SREE VIDYANIKETHAN ENGINEERING COLLEGE
(AUTONOMOUS)
Sree Sainath Nagar, Tirupati

Department of Electrical and Electronics Engineering

Supporting Document for 1.1.2

Syllabus Revision carried out in 2016

Program: B.Tech.- Electrical and Electronics Engineering

Regulations : SVEC-16

This document details the following:

1. Courses where syllabus has been changed 20% and more.
2. Course-wise revised syllabus with changes highlighted.

Note: *For SVEC-16 revised syllabus, SVEC-14 (previous syllabus) is the reference.*

List of Courses where syllabus has been changed (20% and more)

Course Code	Name of the course	Percentage of Syllabus changed	Page Number in which Details are Highlighted
16BT10231	Electric Circuits Lab	30.7	4
16BT10232	Electrical and Electronics Workshop Practice	100	7
16BT30203	Signals, Systems and Networks	21	9
16BT30232	Signals and Networks Lab	100	13
16BT40202	Generation of Electric Power	40	14
16BT50204	Transmission and Distribution	40	16
16BT51041	Sensors and Signal Conditioning	100	21
16BT60202	Power System Analysis	40	23
16BT61001	ARM Processors and PIC Microcontrollers	100	27
16BT61041	Programmable Logic Controllers	100	29
16BT60203	Design and Estimation of Electrical Systems	100	31
16BT60204	Digital Signal Processing for Electrical Engineers	30	33
16BT60206	HVDC Transmission	40	38
16BT60207	Advanced Control Systems	30	42
16BT60209	Instrumentation	30	46
16BT60210	Special Electrical Machines	100	50
16BT60232	Power System – I Lab	50	52
16BT70201	Power System Operation and Control	20	55
16BT70202	Switchgear and Protection	20	57
16BT70203	Energy Conservation and Management	20	62
16BT70204	Flexible AC Transmission systems	60	67
16BT70205	Power System Automation	100	71
16BT70207	Analysis of Power Electronic Converters	100	73
16BT70208	Power Quality	20	75
16BT70209	Smart Grid Technology	100	79
16BT70231	Power System – II Lab	30	81
16BT1HS01	Technical English	20	85
16BT1HS31	English Language Lab	20	89
16BT1BS02	Engineering Physics	20	93
16BT2BS01	Transformation Techniques and Partial Differential Equations	100	99
16BT4HS31	Soft Skills Lab	100	102
16BT6HS05	French Language	100	104
16BT6HS06	German Language	100	106
16BT6HS07	Indian Constitution	100	108

16BT6HS08	Indian Economy	100	110
16BT6HS09	Indian Heritage and Culture	100	112
16BT6HS10	Indian History	100	114
16BT6HS11	Personality Development	100	116
16BT6HS13	Philosophy of Education	100	118
16BT6HS13	Public Administration	100	120
16BT60112	Building Maintenance and Repair	100	123
16BT60115	Environmental Pollution and Control	40	125
16BT70402	Embedded Systems	80	129
16BT70432	Embedded Systems Lab	100	133
16BT20541	Foundations of Data Structures	100	135
16BT20551	Foundations of Data structures Lab	100	137
16BT51041	Sensors and Signal Conditioning	100	139
16BT30451	Analog Electronic Circuits Lab	50	141
16BT70413	Introduction to Nanoscience and Nanotechnology	100	145
16BT60310	Managing Innovation and Entrepreneurship	50	147
	Average	**70.03**	
	Total No. of Courses in the Program	112	
	No. of Courses where syllabus (more than 20%) has been changed	50	
	Percentage of Syllabus changed in the Program	**31.27**	

DEAN(Academics)

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PRINCIPAL

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I B. Tech. - I Semester

(16BT10231) **ELECTRIC CIRCUITS LAB**

Int.Marks	Ext.Marks	TotalMarks	L	T	P	C
50	*50*	*100*	*-*	*-*	*3*	*2*

PREREQUISITES: - COURSE

DESCRIPTION:

Verification of Ohm's law, KVL, KCL and network theorems; analysis of AC and DC circuits; determination of resonant frequency in series and parallel RLC circuits; determination of self and mutual inductances in coupled circuits;

COURSE OUTCOMES: Aftersuccessfulcompletionofthecourse,studentwillbeable to:

CO1. demonstrate knowledge on
- identification of various circuit elements and their values.
- concepts of electrical and magneticcircuits.

CO2. analyzeand relate physical observations and measurementsinelectriccircuitstotheoreticalprinciples andtheorems.

CO3. design circuit parameters to meet the required specifications

CO4. demonstrate skills in
- obtainingthecurrentlocusdiagrams.
- determiningtheparametersofmagneticallycoupled circuits.
- measuringofactiveandreactivepowers.

CO5. function effectively as an individual and as a member in ateam

CO6. communicate effectively both oral and prepare laboratoryreports.

DETAILED SYLLABUS:

LIST OF EXPERIMENTS:

1. VerificationofOhm'sLawandKirchhoff'sLaws
2. VariationofResistanceofConductorwithtemperature
3. PhasoranalysisofRL,RCandRLCcircuits
4. AnalyzingtheseriesRL,RCandRLCcircuitsforvarious excitationsystems
5. CurrentlocusdiagramofRLandRCseriescircuits
6. Series and Parallel resonance
7. Verification of Superposition and Reciprocity theorems
8. Verification of Thevenin's and Norton's theorem
9. Verification of Millmann's and Compensation theorems
10. Verification of Maximum Power transfer theorem for DC & AC excitations
11. Measurement of active and reactive power in three phase circuits
12. Determination of self and mutual inductance and coefficient of coupling
13. Determination of equivalent inductance for aiding and opposing fluxes.

II B.Tech. ISemester

14BT30221: **ELECTRIC CIRCUITS LAB**

InternalMarks	ExternalMarks	TotalMarks	L	T	P	C25
	50	75	--	--	3	2

PREREQUISITE: Electric circuits

COURSE DESCRIPTION: Verification of network theorems; Determination of Two port network parameters; analysis of AC and DC circuits using PSPICE; determination of resonant frequency in series and parallel RLC circuits.

COURSE OUTCOMES:

On successful completion of the course, student will be able to

1. demonstrate knowledgeon
   - identification of various circuit elements and theirvalues.
   - concepts of electrical and magneticcircuits.
2. analyzeandrelatephysicalobservationsandmeasuremen tsinelectric circuits to theoretical principles andtheorems.
3. design electric circuits and magneticcircuits.
4. demonstrate skillsin
   - obtaining the current locusdiagrams.
   - determining the parameters of magnetically coupledcircuits.
   - measuring of active and reactivepowers.
5. apply PSPICE simulation tool to analyze electricalcircuits.
6. function effectively as individual and as member in ateam.
7. communicate effectively both oral andwritten.

LIST OF EXPERIMENTS:

Any EIGHT experiments are to be conducted from Part A Part-A:ELECTRIC CIRCUITS

1. Verification of KVL andKCL.
2. Mesh and Nodalanalysis.
3. Series and Parallelresonance.
4. Current locus diagram of R-L and R-Cseries circuits.
5. Determinationofselfandmutualinductanceandcoefficientofcoupling.
6. Measurement of three phase active power and reactive power for balancedloads.
7. Verification of Superposition and Reciprocity theorems.
8. Verification of Thevenin's and Norton's theorem.
9. Verification of Maximum Power transfer theorem for DC and AC excitations. 10.Verification of Millman's and Compensation theorems.

9.11.Verification of Tellegen's theorem.

Part-B:PSPICE SIMULATION

1. Simulation of DC circuits
2. Mesh analysis
3. Nodal Analysis
4. Simulation of AC circuits

I B. Tech. - I Semester

(16BT10232) **ELECTRICAL ANDELECTRONICS** WORKSHOP PRACTICE

(Common to EEE, ECE & EIE)

Int. Marks	Ext.Marks	TotalMarks	L	T	P	C
50	*50*	*100*	*0*	*0*	*3*	*2*

PREREQUISITES: --

COURSE DESCRIPTION: Identification and specifications of various Electric and Electronic devices; analysis of various series, parallel and series-parallel electrical circuits; develop variouselectricalcircuitsfordomesticandindustrialapplications.

COURSE OUTCOMES: After successful completion of the course, student will be able to

CO1.demonstrate knowledge on various Electrical and ElectronicDevices.
CO2.analyzevariousseriesandparallelelectricalcircuits.
CO3.designanddevelopvariouselectricalcircuitsfordomestic and industrialapplications.
CO4.functioneffectivelyasindividualandasamemberina team.
CO5.communicateeffectivelybothoralandwrittenforms

DETAILED SYLLABUS:

PART A:(Demonstration)

1. Identification and Specifications of R, L, C Components (ColourCodes),Potentiometers,Switches(SPST,DPSTand DPI),GangCondensers,Relays,BreadBoards,PCBs,Fuses, MCBs,EarthingandElectricalWiringaccessories.
2. IdentificationandSpecificationsofActiveDevices:Diodes, BJTs,Low-powerJFETs,MOSFETs,PowerTransistors,LEDs, LCDs, Optoelectronic Devices, SCR, UJT, DIACs, TRIACs, LinearandDigitalICs.
3. Study the operationof

- Multimeter(AnalogandDigital)
- FunctionGenerator
- Regulated PowerSupplies
- CRO.

PART-B:

1. Measurement of Electrical Quantities (AC & DC) using: Voltmeter, Ammeter andWattmeter.
2. MeasurementofResistivityofaconductingwire.
3. Circuitwithonelampcontrolledbyoneswitchandprovision of 2-pin or 3-pin socket PVC surface conduitsystem.
4. Circuit with two lamps controlled by two switches with PVC surface conduitsystem.
5. CircuitforStaircasewiringandGodownwiring.
6. Circuit connection for a Fluorescenttube
7. Solder simple electroniccircuits.
8. B-HcurveofaMagneticmaterial

9. I-V and P-V characteristics of a Solarpanel
10. Design and Fabrication of a single-phase transformer
11. PCB preparation and design of a circuit on a PCB

II B.Tech. - I Semester

(16BT30203) SIGNALS, SYSTEMS AND NET- WORKS

Int. Marks	Ext.Marks	Total Marks	L	T	PC
30	70	100	3	1	--3

PREREQUISITES:

Courses on Multi-variable calculus and Differential equations, Transformation Techniques & Partial Differential Equationsand Electriccircuits.

COURSE DESCRIPTION:

Signals and systems in continuous-time domain; Transforma- tions on signals; Transient analysis of DC and AC circuits;Two Port networks;Filters.

COURSEOUTCOMES: Onsuccessfulcompletionofthecourse, students will be ableto

CO 1. demonstrate knowledge on
- signals andsystems
- transformationofsignalsintimeandfrequency domain
- transientbehaviorofvariouscircuits
- two port networkparameters
- various filters

CO 2. analyze
- continuoussignalsandlineartimeinvariantsystems
- signalstransformedintimeandfrequencydomain
- transientresponseforvariouscircuits
- networkparametersforvariousnetworks
- various filtercircuits

CO3.design
- different types of filters based on frequency and impedance.
- Two-portnetworkforthegivenparameters.

CO4. evaluate the response of various LTI systems & signal transformations, transient response and different parameters of two port networks & filters to provide viable solutions.

CO5.applyappropriatetransformationtechniquesforanalyz ing the signals and networks in time and frequency domains.

CO6. apply the conceptual knowledge of signals, transients, filters and two port network models in relevance to industry and society.

DETAILED SYLLABUS:

UNIT-I:CONTINUOUSTIMESIGNALSANDSYSTEMS

(08 periods) Signals: Definition, test signals - Unit step, ramp, parabolic, unitimpulseandexponentialsignals.Basicoperationonsignals, oddandevencomponents,Energyandpowersignals.
Systems:Definition,classification,linearity,timevariance,causalityandstability.ResponseofLTIsystems.ConvolutionofLTI systems.

UNIT-II: TRANSFORMATIONOFSIGNALS (12Periods)

Fouriertransforms:ReviewofFourierseries,propertiesofFourierseries.Fouriertransforms-definition,propertiesofFourier transforms.Fouriertransformofperiodicsignals,inverseFouriertransform.Applications-Circuitanalysis.
Laplacetransforms:ReviewofLaplacetransform,propertiesof the Laplace transform, Inverse Laplace transform, theorems-initialandfinalvalue(withoutproof).Laplacetransformofpe- riodic signals. Applications - Circuit analysis. Comparison between FourierandLaplacetransforms.

UNIT-III:TRANSIENTANALYSIS (10periods)

DC Transients: Transient response of RL, RC and RLC circuits, initial conditions, solution methods using differential equation and

Laplacetransforms.
AC Transients: Transient response of RL, RC and RLC circuits, initial conditions, solution methods using differential equation and Laplacetransforms.

UNIT-IV: TWOPORTNETWORKS (08periods)

Network Functions - Driving point and transfer functions. Z- parameters, Y-parameters, ABCD parameters andh-parameters. Symmetryandreciprocitypropertyintwoportnetwork.Inter- relationships of different parameters. Inter-connection of two portnetworks.

UNIT-V:FILTERS (07periods)

Classification of filters, filter networks, analysis of prototype filter networks - attenuation, phase shift, characteristic im- pedance in pass band and stop band, constant K low pass & highpassfilters,m-derivedfilters,bandpass&bandelimination filters.Designofprototypefilters.

Total Periods: 45

TEXT BOOKS:

1. Lathi,BhagwandasPannalal,*PrinciplesofLinearSystems andSignals,*OxfordUniversityPress,2nd edition,2009.
2. Charles K. Alexander and Matthew N. O. Sadiku, *Funda- mentals of Electric Circuits,* McGraw-Hill educationPrivate Limited,NewDelhi,5th edition,2013.

REFERENCE BOOKS:

1. Matthew N Sadiku, and Warsame Hassan Ali, *Signals and Systems:APrimerwithMATLAB,*CRCPress,2016.
2. AChakrabarthi,*NetworkAnalysisandSynthesis,*DhanpatRai &Co.,NewDelhi,2nd revisededition,2016.

II B.Tech. IISemester

14BT40201: **SIGNALS AND NETWORKS**

Internal Marks	ExternalMarks	TotalMarks	L	T	P C30
	70	100	3	1	-3

PREREQUISITE(S): Electric circuits

COURSE DESCRIPTION: Overview of signals and linear systems with continuous-time and discrete-time emphasis; different passive filters; transient analysis of DC and AC circuits; two-port networks and network synthesis.

COURSE OUTCOMES: On successful completion of the course, students will be able to

1. demonstrate knowledgeon
   - different types of signal andsystems.
   - parameters of two-portnetworks·
   - transient behavior of variouscircuits.
   - synthesis of networkfunctions.
2. analyze
   - time variant & time invariant signals andsystems.
   - a Two-port network for various networkparameters.
   - the transient behavior of thecircuits.
3. design
   - different types of filters based on frequency andimpedance.
   - two-port network for the givenparameters.
4. demonstrate skillsto
   - evaluate the response of various linear time invariantsignals.
   - evaluate the transient response of a circuit for differentexcitations.
   - evaluate different synthesisfunctions.

DETAILED SYLLABUS:

UNIT - I: SIGNALS AND SYSTEMS

Signals: Definition, classification and representation, test signals - unit step,unitimpulse,unitrampandunitexponential.Operationonsignals- shifting, scaling and time reversal. Sampling theorem - problems.

Systems: Definition, classification based on linearity, time variance, causalityandstability.Responseofcontinuoustimesystemusingdifferential equation method -problems.

UNIT - II: FILTERS

Classification of filters, filter networks, equations of filter networks, classificationofpassband&stopbandfilters,characteristicimpedancein passband&stopbandfilters,constantk-lowpassfilter,k-highpassfilter, m-derived T-section, band pass filter and band eliminationfilter.

UNIT - III: TRANSIENT ANALYSIS

DC Transients: Transient response of R-L, R-C and R-L-C series circuits, initialconditions,solutionmethodusingdifferentialequationandLaplace transformsresponseofR-L,R-CandR-L-Cnetworkstounitstepexcitation - problems.

AC Transients: Transient response of R-L, R-C and R-L-C series circuits, initialconditions,solutionmethodusingdifferentialequationandLaplace transforms response of R-L, R-C and R-L-C networks to sinusoidal excitation -problems.

UNIT - IV: TWO-PORT NETWORKS

Z-parameters, Y-parameters, ABCD parameters and h-parameters, symmetry and reciprocity property in two-port networks, inter- relationships of different parameters, inter-connection of Two-port networks - problems.

UNIT - V: NETWORK SYNTHESIS

NetworkFunctions,Hurwitzpolynomials,positiverealfunction,frequency responseofreactiveoneport,synthesisofreactiveoneportbyFoster's and Cauer method, synthesis of R-L and R-C networks by Foster's and Cauer method -problems.

TEXT BOOKS:

1. AChakrabarthi,*CircuitTheory(AnalysisandSynthesis)*,Dhanpat Rai &Co., New Delhi, 1st edition,2014.
2. A Sudhakar, Shyammohan S Palli, *Circuits and Networks (Analysis and Synthesis)*, McGraw-Hill education Private Limited, New Delhi, 4th edition,2010.

REFERENCE BOOKS:

1. A. Anand Kumar, signals and systems, *PHI Learning Private Limited*, New Delhi,2011.
2. SimonHaykinandBarryVanVeen,*SignalsandSystems*,JohnWiley& Sons Private Limited, New Delhi, 2nd edition,2008.

II B.Tech. - I Semester

16BT30232:**SIGNALSANDNETWORKSLAB**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	--	- -	3	2

PREREQUISITES:
CoursesonMulti-variablecalculus&Differentialequations,Trans- formation Techniques & Partial Differential Equations, Electric circuits and Electric CircuitsLab.

COURSE DESCRIPTION:
Experimentation on Signals and systems; Transient analysis; Twoport network parameters and passive filters.

COURSEOUTCOMES: Onsuccessfulcompletionofthecourse, students will be ableto

CO1. demonstrateknowledgeonsignals,transients,twoport networks & filters and their experimental implementa tion.
CO2. analyzeandrelatetheexperimentalobservations&mea surements forvalidation.
CO3. designasuitableexperimental/simulationprocedurefor practical investigations on signals, systems and net works.
CO4. demonstrateskillsinevaluatingvariousparametersand interprettheobservationstoprovidefeasiblesolutions.
CO5. selectappropriatetechniqueforexperimentalinvestiga tions, analysis and interpretation of signals and net works.
CO6. applytheconceptualknowledgeofsignals,transients, filters and twoport network models in relevance to in dustry andsociety.
CO7.commit to ethical principles and standards while exer cising the practical investigations on signals and net works.
CO8. workindividuallyorinagroupinthefieldofsignalsand networks.
CO9. communicateeffectivelyinverbalandwrittenformin signalsandnetworksdomain.

LIST OF EXPERIMENTS:
Conduct any **TEN** experiments using appropriate Software Tools / Hardware

1. Generationofcontinuoustimesignals.
2. Basic operationson the signals.
3. Systems and theirproperties.
4. Convolution ofsignals.
5. Transformationofsignalsintotimeandfrequencydo mains.
6. TransientresponseofRLcircuitandapplications.
7. Transient response of RC circuitandapplications.
8. TransientresponseofRLCcircuitandapplications.
9. Determination of Open circuit and Short circuit param- etersinisolatedandinterconnectednetworks.
10. DeterminationofABCDandHybridparametersinisolated and interconnectednetworks.
11. Design, analysis and application of Low pass and High passfilters.
12. Design, analysis and application of Band Pass and Band stopfilters.

II B.Tech - II Semester

(16BT40202) **GENERATION OF ELECTRIC POWER**

Int. Marks	Ext. Marks	Total Marks	L	T	PC
30	70	100	3	1	-- 3

PREREQUISITES:
Courses on EngineeringPhysics, EngineeringChemistry, Electronic Devices and Circuits.

COURSE DESCRIPTION:
Generationofelectricpowerusinghydro,thermal,nuclear,gas and renewable energy sources;Cogeneration;Economicaspects ofpowergenerationandpowerfactorimprovement.

COURSE OUTCOMES: On successful completion of the course, students will be able to
CO1. demonstrate knowledgeon
- layoutofvariouspowerplantsandtheiroperation.
- differenttypesofturbinesandtheirapplicationsin power generatingstations.
- non-conventional energysources.
- aspects ofcogeneration.
- economic aspects of powergeneration.
- powerfactorimprovemen tmethods. CO2. analyze
- loadfactor, loss factor and theirrelations.
- powerfactorimprovementmethodsandeconomicas pects of powergeneration.

CO3. design capacitors for most economic power factor.
CO4. evaluatevariousparametersandeconomicaspectsof powergenerationtoprovideaviablesolution.
CO5. select feasible geographical sites for erectingdifferent powerplants.
CO6. apply the conceptual knowledge of electric powergen eration through conventional and non-conventional sources to substantiate the societalneeds.
CO7. realizeconstraints and impacts of conventional & non-conventionalpowergenerationtechnologyonenviron ment andsociety.
CO8.adhere environmental regulations for eco-friendly op eration of power plants.

DETAILED SYLLABUS:

UNIT-I: HYDRO POWER STATIONS AND STEAM POWER STATIONS (09periods)

Hierarchy of power system.Environmental regulations on power plants.

Hydro power plant: Selection of site for hydroelectric power station, layout and classification of hydroelectric power sta- tion,conceptofpumpedstorageplants,availablehydropower and masscurve.
Steam power plant: Layout of steam power plant -fuel han- dling, combustion equipment for steam boilers, fluidized bed combustion, ash handling, dust collectors, boilers, condenser, chimney and cooling towers.
Turbines: Classification,descriptionandworkingprincipleofvari- ous turbines-impulse and reaction turbines, comparison be-tweenimpulseandreactionturbine,Peltonwheel,Francistur-bineandKaplanturbine.

UNIT-II:NUCLEAR AND PEAK LOAD POWER PLANTS (09 periods)
Nuclearpowerstations: Nuclearfission,chainreaction,site selection, layout of nuclear power station, nuclear reactors-classification,components,PWR,BWRandbreederreactor.

Peak load plants:
Dieselenginepowerplant: Introduction,applications,sitese- lection, classification of internal combustion engines,essential components and operationof dieselpowerplant.**Gas turbine power plant:**Gas turbines, site selection, simple gas turbine plant, energy cycle, layout and essential components of gas turbine powerplant.

UNIT-III:RENEWABLEENERGYRESOURCES(08periods)
Introductiontomicrogrid,applicationsofrenewablesourcesas distributed generation.Siteselection - solar and wind. **Solar power**-performanceofPVcellbysinglediodemodel,PVmod- ule,terminologyandapplications.**WindPower**-Windpowerex- tractedbyturbine,horizontalandverticalaxiswindmills.**Fuel cells**-working, Performance characteristics, types-Phosphoric and alkaline fuel cells only. **Biogas**-Biogas generation from Biomass.Impacts of renewable energy generation on environ- ment.

UNIT-IV:ECONOMICASPECTSOFPOWERGENERATIONAND TARIFF **(09periods)**

Introduction,termsanddefinitions-connectedload,maximum demand, load factor, demandfactor, diversityfactor, plant capacityfactor, utilization factor, Plant use factor, loss factor, coincidence factor and contribution factor. Relation between loss factor and load factor. Cost analysis - initial cost, interest and methods of depreciation. Tariffs - simple, flat rate, block rate,maximumdemand,two-part,three-partandpowerfactor tariffs.

UNIT-V:COGENERATIONANDPOWERFACTORCORRECTION (10 periods)
Cogeneration-Electricitygeneratingsystems,Economicben- efits,Environmentalbenefits.Operationmodesofcogeneration systems,Factorstoconsider,projectrisks,cogenerationusage in different places, Practical aspects of installing a cogenera- tionplant.
Power factor correction: Causes of low power factor, meth- ods of improving power factor -power capacitors, series and shunt capacitors for power factor correction. Most economical power factor.

TEXT BOOKS: Total Periods: 45

1. S.N.Singh, *Electrical Power Generation, Transmission and Distribution*,PHIlearningprivatelimited,2nd edition,2015.
2. S. K. Dubey, Dr. S. K. Bhargava, *Non-Conventional Energy Resources*,Dhanpathrai&Co.,2011.

REFERENCE BOOKS:

1. R.K.Rajput, A textbook of power system engineering, Laxmi Publications (P) Ltd, 2006.
2. A S Pabla, Electric Power Distribution, McGraw Hill Educa- tion, 6th edition, 2014.
3. V.K.Mehta and Rohith Mehta, Principles of Power Systems, S Chand & Company Ltd, New Delhi, 4th Multi-color illustrative edition, 2006.
4. David Flin, Cogeneration: A User's Guide. Renewable energy series, Vol. 11. IET, 2010.
5. TuranGonen, Electric Power Distribution System Engineer- ing, Mc Graw-Hill Book Company, 2nd edition, 2007.

III B.Tech.-I Semester

(16BT50204)**TRANSMISSIONANDDISTRIBUTION**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	--	3

PREREQUISITES: CoursesonGenerationofElectric Power,Electromagnetic FieldsandSignals,Systems&Networks.

COURSE DESCRIPTION:

Parameters of overhead transmission lines and underground cables;Performanceoftransmissionlines,travellingwavephe- nomenon; Types of insulators; Sag and corona; Distribution systemsclassification,analysisanditsplanning.

COURSEOUTCOMES: Onsuccessfulcompletionofthecourse, students will be ableto

CO1.demonstrate knowledgeon
- classificationoftransmissionanddistributionsystems
- parametersandconfigurationsoftransmissionanddis tributionsystems
- transients, corona andsaginsulationsystemforcablesandtransmissionlines

CO2. analyze
the electrical and mechanical aspects of cables and transmissionlines
- variousdistributionfeederconfigurations
- voltagedropandpowerlossindistributionsystem CO3.design
- parametersfortransmissionlinesandunderground cables.
- substationfeeders.

CO4. evaluatetheparameters,performance&mechanicalas pectsoftransmissionlines,undergroundcablesanddis tributionsystemstoprovidefeasiblesolutions.

CO5. selectappropriate model for transmission and distribu tionsystemswhileexercisingmodelingandplanningof powersystem.

CO6. applytheconceptualknowledgeoftransmissionanddis tributionsystemsinrelevancetoindustryandsociety.

CO7. followprofessionalnormsforvoltageregulationintrans missionanddistributionsystems.

DETAILED SYLLABUS:

UNIT-I: OVERHEAD TRANSMISSION LINE AND UNDER-

GROUNDCABLES (10 periods)

TRANSMISSIONLINES: Overheadline&undergroundcables and their types, Parameters - resistance, inductance and ca- pacitance calculations in single and three phase transmission lines,singleanddoublecircuits,symmetricalandunsymmetrical spacing, concepts of GMR and GMD, effect of earth oncapaci- tance.

Underground cables:Construction, types of insulating materi- als, classification of cables, laying of cables, insulation resis- tance, capacitance of single and 3-core belted cables.Grading of cables - capacitance and inter sheath grading.

UNIT-II: ANALYSIS OF TRANSMISSION LINES(10 periods)

Transmission lines:Classification - short line, medium lineand long line.Equivalent circuits -end condenser, Nominal-T, Nomi- nal-pie models. ABCD constants, voltage regulation and effi- ciency of transmissionlines.

Travellingwavesontransmissionlines:Travellingwaves-open endline,shortcircuitedline,lineterminatedthrougharesistor, line connected to a cable, T-junction.Beweley's Lattice dia- gram.

UNIT-III:MECHANICALASPECTSOFOVERHEADLINEAND CORONA (09periods)

Overheadtransmissionline:Linesupports,overheadlineinsula- tors, types of insulators, string efficiency and methods forim- provement.

Sag in overhead line:Sag and tension calculations with equal and unequal heights of towers, effect of wind and ice on sag, stringing chart.

Corona: Corona phenomenon - factors affecting corona, criti- cal voltages and

power loss, advantages and disadvantages.

UNIT-IV:DISTRIBUTIONSYSTEMS (08periods)

ClassificationandCharacteristics-residential,commercial,ag- ricultural and industrialloads.
VoltagedropcalculationsinDCdistributors-radialDCdistribu- torfedatoneend,atboththeends(equal/unequalvoltages)andring maindistributor.
Voltage drop calculations in AC distributors - power factors referredtoreceivingendvoltageandrespectiveloadvoltages.

UNIT-V:SUBSTATIONSANDDISTRIBUTIONSYSTEMPLAN-NING (08periods)

Classification of substations:Indoor and outdoor, gas and air insulated substations. Substation layout, different bus bar schemes, location of substations-rating of distributionsubsta- tions,serviceareawith'n'primaryfeeders.
Distribution System Planning:Factorsaffectingsystem planning, substation expansion, distribution system planning models, present distribution system planning techniques.

Total Periods: 45

TEXT BOOKS:

1. C.L.Wadhwa, *Electrical power systems*, New Age Interna- tional Publishers, 6th edition,2010.
2. TuranGonen, *Electric Power Distribution System Engineer ing*,McGrawHillBookCompany,2nd edition,2012.

REFERENCE BOOKS:

1. U.A.BakshiandM.V.Bakshi,*TransmissionandDistributionof ElectricalPower*,1st edition,TechnicalPublications,2009.
2. B.Gupta, *A Course in Electrical Power,* S.K.Kataria & sons, NewDelhi,11th edition,2009.
3. V.Kamaraju, *Electrical Power Distribution Systems*, McGraw HillEducationPrivateLimited,1st edition,2009.
4. V.K.MehtaandRohithMehta,*PrinciplesofPowerSystems*,S Chand&CompanyLtd,NewDelhi,4th Multicolourillustrative edition,2006.

II B.Tech. IISemester

14BT40202: GENERATION OF ELECTRIC POWER

Internal Marks	ExternalMarks	TotalMarks	L	T	P C30
	70	100	3	1	-3

PREREQUISITE(S): DC Machines

COURSE DESCRIPTION: Generation of electric power using hydro, thermal,nuclear,gas,dieselandcombinedoperationofdifferentpower stations; economic aspects of powergeneration.

COURSEOUTCOMES: Oncompletionofthecourse,studentwillbeable to

1. demonstrate knowledgeon
   - layout of various power plants and theiroperation.
   - combined operation of powerstations.
   - conceptofdifferenttypesofturbinesandtheirusageindifferent types of power generation stations.
   - economical aspects of powergeneration.
   - Nonconventional energysources.
2. analyze
   - the water powerequation.
   - load sharing between powerstations.
3. develop skillsto
   - evaluateTariffs by differentmethods.
   - calculatereservecapacityofhydelpowerplantusingmass curve.

DETAILED SYLLABUS:

UNIT - I: HYDRO POWER STATIONS

Selectionofsiteforhydroelectricpowerstation,layout,classificationof hydroelectricpowerstations- conceptofpumpedstorageplants,available hydro power, mass curve - numericalproblems.
Hydraulicturbines-classification,descriptionofvariousturbines- impulse andreactionturbines,Peltonwheel,FrancisturbineandKaplanturbine - working principles, specific speed, efficiency - numericalproblems.

UNIT - II: STEAM POWER STATIONS

Layoutofsteampowerplant-fuelhandling,combustionequipmentfor steam boilers, fluidized bed combustion, ash handling, dust collectors, boilers, condenser, chimney and coolingtowers.
Steam turbines - classification of steam turbines, simple impulse turbine, reaction turbine, comparison between impulse and reaction turbine.

UNIT-III:NUCLEARPOWERSTATIONS&COMBINEDOPERATION OF DIFFERENT POWERPLANTS

Nuclear power stations - Nuclear fission, chain reaction, site selection, layoutofnuclearpowerstation,nuclearreactors-classification,essential components and power, PWR, BWR and breederreactor.

Combined operation of different power plants - Advantage of combined powerplants,loaddivisionbetweenpowerstations,hydroelectricplant withsteampowerplant,run-of-riverplantwithsteampowerplant,pumped storageplantwithsteampowerplantornuclearpowerplant,coordination ofhydroelectricandgasturbinestations,coordinationofdifferenttypes of powerplants.

UNIT - IV: PEAK LOAD POWER PLANTS & RENEWABLE ENERGY RESOURCES

Diesel engine power plant - introduction, applications, site selection, classification of internal combustion engines, essential components, operation of diesel power plant.

GasturbinePowerplants-Gasturbines,siteselection,simplegasturbine plant, energy cycle, Layout and essential components of gas turbine powerplant.

RENEWABLE ENERGY RESOURCES: Solar, wind, ocean and Biomass (Qualitative treatment only). Impacts of renewable energy generation on environment.

UNIT - V: ECONOMIC ASPECTS OF POWER GENERATION AND TARIFF

Introduction,termsanddefinitions-connectedload,maximumdemand, loadfactor,demandfactor,diversityfactor,plantcapacityfactor,utilization factor and Plant use factor. Types of loads, load curve, load duration curve,dumppower,firmpower,primepower,coldreserve,hotreserve, spinning reserve, cost analysis - initial cost, interest and methods of depreciation. Tariffs - simple, flat rate, block rate, maximum demand, two-part, three-part and power factor tariffs - numericalproblems.

TEXT BOOKS:

1. Wadhwa C. L., Generation, *Distribution and Utilization of Electrical Energy*, New Age International,2005.
2. R.K.Rajput,*Atextbookofpowersystemengineering*,LaxmiPublications (P) Ltd, 1st edition, 2006.

REFERENCE BOOKS:

1. V.K.Mehta and Rohith Mehta, *Principles of Power Systems*, Schand& Company Ltd, New Delhi2013.
2. Dr.P. N.Modi,Dr.S.M.Seth,*HydraulicsAndFluidMechanicsIncluding Hydraulics Machines*, Standard Book House, 18th edition,2011.

III B.Tech. - I Semester

(16BT51041)**SENSORSANDSIGNALCONDI**TIONING

(Interdisciplinary Elective-1)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	--	3

PREREQUISITES: Courses onElectrical Measurements andLin- ear & DigitalICs.

COURSE DESCRIPTION:
Principleofoperation,construction,advantages,limitationsand applicationsofresistive,inductive,capacitive,self-generating, digitalandothersensors;Signalconditioningcircuitsandtheir operations.

COURSE OUTCOMES: On completion of the course, the stu- dents will be able to

CO1.demonstrate knowledgeon
- varioussensors.
- signalconditioningcircuits.

CO2.analyze

- various sensors for measuring physicalquantities.
- signalconditioningcircuits.

CO3. designanappropriateinstrumentationamplifiersforcom mercialapplications.
CO4. evaluatephysicalquantitiesusingsensorsandsignal conditioningcircuitstoprovidefeasiblesolutions.
CO5. select&useappropriatesensorsforthemeasurementof physical quantities in domestic and industrial applica tions.
CO6. applytheconceptualknowledgeofsensorsandsignal conditioning circuits in relevance to industry and soci ety.

DETAILED SYLLABUS:

UNIT-I:RESISTIVESENSORS (09Periods)

Principle of transducers, classification, Factors influencing the choiceoftransducers.Potentiometers,Metalandsemiconduc- tor strain gauges-principle of operation, gauge factor, gauge sensitivity; Resistance temperature detectors, Thermistors,Light dependentresistors,resistivehygrometer.

UNIT-II: CAPACITIVE AND INDUCTIVE SENSORS

(09 Periods) Capacitor sensors: Variation in overlapping area, variation in dielectric constant, variation in distance between the platesof variable and differential capacitor. Frequency response ofcapacitive sensors.
Inductive sensors: Variable reluctance sensors, Eddy current sensors,Linearvariabledifferentialtransformers,Synchros,Re- solvers, Electromagnetic sensors based on Faraday's law, Hall effectsensors.

UNIT-III:SELF-GENERATINGSENSORS

(09Periods)
Thermoelectricsensors:Thermoelectriceffects,Thermocouple laws,Coldjunctioncompensation,commonthermocouples.Pi- ezoelectric sensors-Piezoelectric effect, deformation modes, equivalent circuit, materials; Pyro electric Sensors-Pyro elec- tric effect, materials; Photoelectric sensors- photovoltaic ef- fect, materials; Magneto-strictivesensors.

UNIT-IV:DIGITALANDOTHERSENSORS

(09Periods)
Digital transducers: Tachometer encoder, incrementalencoder, absolute encoder. Semiconductor sensors- principle of opera- tionandtechniques;Filmsensors-Thinfilmsensors,Thickfilm sensors;Fiberopticsensors-principleofoperation,sensortech- nology;Ultrasonicsensors-

principleofoperation,sensingmeth- ods; Basics of SMARTsensors.

UNIT-V:SIGNALCONDITIONING **(09Periods)**

Blockdiagramofsignalconditioning,balanceanddeflectionmea- surement in Wheatstone bridge, measurement of reactance; Push-pullbridgeandBlumeinbridge;Carrieramplifier,chopper amplifier,lowdriftamplifierandchargeamplifier,Instrumenta- tionamplifier.

Total Periods: 45

TEXT BOOKS:

1. RamonPallas-ArenyandJohnG.Webster,*SensorsandSig-nalConditioning*,JohnWiley&Sons,Inc.,2nd edition,2001.
2. A.K.Sawhney, *A Course in Electrical and Electronic Mea surements and Instrumentation*, Dhanpat Rai &Co., 19th edition,2015.

REFERENCE BOOKS:

1. D.V.SMurty,*TransducersandInstrumentation*,PHILearn-ingPrivateLimited,2nd edition,2010.
2. D. Patranabis, *Sensors and Transducers*, PHI Learning Pri vateLimited,2nd edition,2003.
3. JohnP.Bentley,*PrinciplesofMeasurementSystems*,Pearson Education, 4th edition,2005.

III B.Tech.-II Semester

(16BT60202) **POWER SYSTEMANALYSIS**

Int.Marks	Ext.Mark s	Total Marks	L	T	P	C
30	70	100	3	1	--	3

PREREQUISITES: Courses on Matrices & Numerical Methods, Electric Circuits and Transmission and Distribution.

COURSE DESCRIPTION:

Per unit representation; Symmetrical component theory; Se- quence networks for power system networks; Formulation of busimpedanceandadmittancematrices;Computationofpower flow using various numerical techniques; Analysis of various faults;Powersystemstabilityanalysis.

COURSEOUTCOMES: Onsuccessfulcompletionofthecourse, students will be ableto

CO1. demonstrate knowledgeon

- perunit representation, symmetrical componenttheory and sequence network representation of powersyste- mnetworks.
- formationofpowersystemnetworkmatrices.
- load flowstudies.
- variousfaults.

power system stability.

CO2.analyze

- the power system network for sequence networkrep resentation.
- thepowersystemnetworksfortheformationofbus impedance and admittance matrices.
- theloadflowproblemofapowersystemnetworkfor differentconditions.
- variousfaults.
- the stability of the power system under differentoper atingconditions.

CO3.evaluate

- perunitquantitiesforvariouspowersystemcompo nents andnetworks.
- thepowersystemnetworkforvariousplanningstrate giesandprovideafeasiblesolution.

CO4. apply appropriate techniques/methods to analyzepower system networkoperating under various conditions.

CO5. applythe conceptual knowledge of power system analysis to assess and analyze a power system for various sce- narios.

DETAILED SYLLABUS:

UNIT-I:PERUNITSYSTEMSANDSYMMETRICALCOMPONENT

THEORY **(10periods)**

Per unit system representation, advantages, per unit equivalent reactance representation of power system components. Symmetrical component theory - voltages, currents and impedances.Sequencerepresentationofpowersystemcompo- nents - generators, transformers, transmission line, load and networks.

UNIT-II: POWER SYSTEM NETWORK MATRICES(08 periods)

Bus admittance matrix - Direct inspection method.Busimped- ancematrix-FormationofZbusmatrixforpartialnetwork,al- gorithmforthemodificationofbusimpedancematrix-addition ofelementfromanewbustoreference,newbustoanoldbus, between an old bus & reference and between two oldbuses.

UNIT-III: POWERFLOWSTUDIES **(12periods)**

Introduction,derivationofstaticloadflowequations.Loadflow solutionusingGauss-Seidelmethod,Newton-Raphsonmethod- withandwithoutPVbus,DecoupledandFastdecoupledmeth- ods(maximumof3-

busesforoneiterationonly).Algorithmand flowcharts,Comparisonofdifferentloadflowmethods.

UNIT-IV:FAULTANALYSIS 08periods)

Introduction, Unsymmetrical faults - LG, LL, LLG - with and withoutfaultimpedance.Symmetricalfault-LLL&LLLGfaults. SymmetricalfaultanalysisusingZbus,shortcircuitcurrentand MVAcalculations.

UNIT-V: POWERSYSTEMSTABILITY (07periods)

Elementaryconceptsofstability.Steadystatestability-power limit,transferreactance,poweranglecurve,derivationofswing equation.Transientstability-equalareacriterion,applications - critical clearing angle, critical clearing time. Methods to im- provestability-autore-closureandfastoperatingcircuitbreak- ers.

l Periods: 45

T o t a

1. C. L. Wadhwa, *Electrical Power Systems*, New AgeInterna-tional(P)Limitedpublishers,NewDelhi,6th edition,2010.
2. P.Venkatesh,B.V.Manikandan,S.CharlesRajaandA.Srin- ivasan, *Electrical power systems analysis, Security andde-regulation*,PHIlearningprivatelimited,Delhi,2014.

REFERENCE BOOKS:

1. G.W. StaggandA.H.El-Abiad,*ComputerMethodsinPower SystemAnalysis*,McGraw-Hill,NewDelhi,Internationalstu- dent edition,1968.
2. JohnJ.GraingerandWilliamD.Stevenson,JR,*PowerSystem Analysis*,McGraw-HillEducation(India)Pvt.Limited,1994.
3. HadiSaadat, *Power System Analysis*, Tata Mc Graw-Hill Pub lishingCompanyLimited,NewDelhi,2nd edition,2002.

IV B.Tech. I Semester

14BT70203: **POWER SYSTEM ANALYSIS**

Internal Marks	ExternalMarks	TotalMarks	L	T	P C30
	70	100	3	1	-3

PREREQUISITE(S): Electric Circuits and Transmission of Electric Power

COURSE DESCRIPTION: Review of basic concepts of power system component and their representation; formation of bus admittancematrix;computationofpowerflowsinapowersystemnetwo rkusingvarious numerical techniques; power system stabilityanalysis.

COURSE OUTCOMES: On successful completion of the course, student will be able

1. demonstrate knowledgeon
   - the formation of networkmatrices.
   - load flowstudies.
   - power systemstability.
2. analyze
   - the power flows and losses in the power system network using load flow analysis for differentconditions.
   - thestabilityofthepowersystemfordifferentloadingandfaulted conditions.
3. demonstrate skills inevaluating
   - bus impedance and bus admittancematrices.
   - the load flow solution for a power system network for different conditions.
   - the various stability limits for various operatingconditions.
4. apply the load flow and stability concepts to investigate variouspower systemproblems.

DETAILED SYLLABUS:

UNIT-I: POWER SYSTEM NETWORK MATRICES

Representation of power system elements. Graph theory - formation of incidence matrices, primitive network matrices, numerical problems. Formation of network matrices by singular transformation, numerical problems.

UNIT-II: ALGORITHM FOR BUILDING OF ZBus

Formation of ZBus for partial network, algorithm for the modification of ZBusmatrix,additionofelementfromanewbustoreference,additionof elementfromanewbustoanoldbus,additionofelementbetweenanold bustoreferenceandadditionofelementbetweentwooldbuses- numerical Problems. Representation of transformer - fixed tap settings and phase shifting transformers.Introduction to Clarke's transformation and Park's transformation.

UNIT-III: POWER FLOW STUDIES - I

YBusformationbydirectandsingulartransformationmethods-numerical problems. Power flow studies - Introduction, necessity, classification of buses, derivation of static load flow equations. Load flow solution using Gauss-Seidel method - with and without PV buses, acceleration factor, determinationofbusvoltage,lineflowsandlosses,injectedactive,reactive powers, algorithm and flowchart - numerical problems(maximum of 3- buses for one iterationonly).

UNIT-IV: POWER FLOW STUDIES - II

Newton-Raphsonmethodinrectangularandpolarco-ordinates-derivation ofJacobianelements,loadflowsolutionwithandwithoutPVbusalgorithm andflowchart,decoupledandfastdecoupledmethods-numericalproblems (maximum of 3-buses for one iteration only). Comparison of different load flowmethods.

UNIT-V: POWER SYSTEM STABILITY

Elementary concepts of stability. Steady state stability - description of steady state stability power limit, transfer reactance, power angle curve, Derivation of swing equation. Transient stability - equal area criterion - applications,criticalclearingangle,criticalclearingtime.Solutionofswing equationbypoint-by-pointmethod,methodstoimprovestability-numerical problems.Applicationsofautore-closureandfastoperatingcircuitbreakers

TEXT BOOKS:

1.G. W. Stagg and A.H. El-Abiad, *Computer Methods in Power System Analysis*, Mc Graw-Hill, New Delhi, 1968.

2.C.L.Wadhwa,*ElectricalPowerSystems*,NewAgeInternational(P)Limited publishers, New Delhi, 5th edition,2009.

REFERENCE BOOKS:

1.P. Venkatesh,B.V. Manikandan, S. Charles Raja and A. Srinivasan, *Electricalpowersystemsanalysis,Securityandderegulation*,PHIlearning private limited, Delhi,2014.

2. AbhijitChakrabarthi,Sunitahalder,*PowerSystemanalysisoperationa nd control*, PHI learning private limited, Delhi,2012.

3. Dr.S.Sivanagaraju,B.V.RamiReddy,*ElectricalPowerSystemAnalysis* , Laxmi Publications, revised edition,2011.

III B.Tech.- II Semester (16BT61001)

ARM PROCESSORS & PIC MICROCONTROLLERS

(Common to EEE & EIE) (Interdisciplinary Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	PC
30	70	100	3	1	--3

PREREQUISITES: Course on Switching theory and logic de- sign.

COURSE DESCRIPTION:
ARMProcessorsarchitecture,Programming,PICmicrocontroller architecture, Interrupts and timers of PIC microcontroller, In- terfacing.

COURSEOUTCOMES:Onsuccessfulcompletionofthecourse, students will be ableto

CO1. demonstrateknowledgeinARMProcessorsarchitecture, PIC architecture, Pin out, Instructionset.
CO2. analyzevariousdesignissuesregardingusageofonchip resourcesandLowpowermodes.
CO3. designembeddedsystemsusingARMProcessorsand PICmicrocontrollerstosuitmarketrequirements.
CO4. solveengineeringproblemsandarriveatsolutionsinde signing embeddedSystems.
CO5. useon-chipresourcestodesignembeddedsystemswith anunderstandingoflimitations.
CO6. practiceprofessionalengineeringtodeliverefficientand cost effective microcontroller basedproducts.

DETAILED SYLLABUS:

UNIT-I: PIC MICROCONTROLLER ARCHITECTURE(10 Periods)

Microcontrollers vs general purpose microprocessor, Overview ofPIC18family,WREGregisterinPIC,PICfileregister,Default access bank, PIC status register, Data formats and directives, Program counter and program ROM space, Arithmetic, Logic instructions, Branch, call and time delay instructions, I/Oport programming,PIC18pindescription,Bitaddressabilityofdata RAM,bankswitching,Macrosandmodules.

UNIT-II: TIMERS, SERIAL PORT AND INTERRUPTS (09 Periods)

Programmingtimers0and1,Counterprogramming,Program- ming timers 2 and 3, Basics of serial communication, PIC18 connectiontoRS232,Serialportprogramminginassembly,PIC18interrupts,Programmingti merinterrupts,Programmingserialin- terrupts.

UNIT-III: PERIPHERALSANDINTERFACING (07Periods)

7 segment LED and LCD interfacing, keyboard interfacing, in- terfacingADC,DAC,Interfacingsteppermotor,DCmotorinter- facing andPWM.

UNIT-IV: INTRODUCTION TO ARM PROCESSORS(09 Periods)

Introduction to ARM Cortex M3 processor, Background of ARM and ARM architecture, Cortex M3 Processor applications, Cor- texM3fundamentals,registers,Operationmodes,Memorysys- tem, memory map, Memory system attributes, ARM Pipeline, Exceptiontypes.

UNIT-V:ARMPROGRAMMING (10Periods)

Data transfer instructions, Pseudo Instructions, Data Process-

ingInstructions,Call&unconditionalBranchInstructions,Decisions&conditionalBranchinstructions,SeverausefulinstructionsinCortexM3,ARMAssemblyLanguageProgramming,Thumb InstructionSet,ARMMode&ThumbmodeProgramming,ARM Programming inC.

Total Periods: 45

TEXT BOOKS:

1. MuhammadAliMazidi,RolinD.McKinlay,Dannycausey,*PIC MicrocontrollerandEmbeddedSystems*:UsingCandPIC18, Pearson Education,2008.
2. JosephYiu,TheDefinitiveGuidetothe*ARMCortex-M3&M4*, Elsevier, 3rd edition,2013.

REFERENCE BOOKS:

1. Andrew Sloss, Dominic Symes, Chris Wright, ARM System Developer's Guide: *Designing and Optimizing SystemSoft- ware (The Morgan Kaufmann Series in Computer Architec- ture and Design)*,2004.
2. John.B. Peatman, *Design with PIC Microcontroller*, Pearson education,1988.

III B.Tech.- II Semester

(16BT61041) PROGRAMMABLE LOGIC CONTROLLERS

(Interdisciplinary Elective-2)

Int. Marks	Ext. Marks	Total Marks	L T P C
30	70	100	3 1 - 3

PREREQUISITES: Course on Switching Theory and Logic De- sign.

COURSE DESCRIPTION:
Introduction to PLC; PLC ladder diagrams; programming PLC; timers, counters and sequences used in PLC; data handling functions; Bit Patterns; advanced PLC functions.

COURSE OUTCOMES:On successful completion of the course, students will be able to

CO1. demonstrateknowledgeonprogrammablelogiccontrol- lers,variousfunctionsofPLCs.
CO2. analyzetheprocessofautomationusingPLCs.
CO3. designskillsinautomatingaprocesscontrol.
CO4. solveengineering problems in industries using PLCs.
CO5. selectsuitablePLCwithanunderstandingoflimitations.
CO6. practice professional engineering to deliver efficient and cost effective designs for society and domestic applications.

DETAILED SYLLABUS:

UNIT-I:PLC BASICSANDPROGRAMMING (09periods)

Introduction,PLCadvantages,disadvantages,PLCsystem,CPU, I/Omodulesandinterfacing,powersupplies,Programmingequip- ment, Programming formats, Construction of PLC ladder dia- grams, Devices connected to I/O modules. Input instructions, Outputs,Operationalprocedures,Programmingexamplesusing contactsandcoils,Fail-SafeCircuits,Drillpressoperation.

UNIT-II:LADDERDIAGRAMS,REGISTERSANDTIMERFUNC-TIONS (09periods)

Digitallogicgates,BooleanalgebraPLCprogramming,Conver-sionexamples.LadderDiagramsforprocesscontrol:Ladderdia-grams&sequencelistings,ladderdiagramconstructionandflow- chart for spray process system. Characteristics of Registers, module addressing, holding registers, Input Registers, Output Registers.Timerfunction&Industrialapplications,Counterfunc-tion&industrialapplications.

UNIT-III: INTERMEDIATE AND DATA HANDLING FUNCTIONS (09 periods)

Intermediatefunctions:Arithmeticfunctions,Numbercompari-sonfunctions,Numberconversionfunctions.Skip,Mastercon-trolrelay,Jumpfunctions.PLCdatamovesystems:Movefunc-tion,FIFO,FAL,ONS,CLR&Sweepfunctionsandtheirapplica- tions.

UNIT-IV: PLC FUNCTIONS WORKING WITH BITS(08 periods)

Bit Pattern, Changing a register bit status, Shift registerfunc- tions and applications, Sequencer functions and applications, Controlling of two-axis & three axis Robots with PLC, Matrix functions.

UNIT-V: ADVANCEDPLCFUNCTIONS

(10periods)

Analogmodules&systems,Analogsignalprocessing,Multi-bit DataProcessing,Analogoutputapplicationexamples,PIDprinciple,positionindicatorwithPIDcontrol,PIDModules,PIDtuning, PID functions, Networking of PLCs, Alternative Programminglanguages,PLCauxiliarycommandsandfunctions.

TEXT BOOK:

1. John W. Webb & Ronald A. Reiss, *Programmable Logic Con- trollers Principles and Applications*, PHI, 5th edition, 2002

REFERENCE BOOK:

1. M.Chidambaram, *Computer Control of Process*, Narosa, 2nd edition,2003.

III B.Tech.-II Semester

(16BT60203) **DESIGN AND ESTIMATION OF** ELECTRICAL SYSTEMS

(Program Elective-1)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	--	3

PREREQUISITES:CourseonElectricalandElectronicworkshop practice.

COURSE DESCRIPTION:
Designandestimationofresidential&commercialbuildings,over- head transmission & distribution lines andindustrial buildings; Lightsources,principalsoflight&design,typesoflamps;electric heating,weldingandtheirapplications.

COURSE OUTCOMES:On successful completion of the course,students will be able to

CO1. demonstrate knowledgeon
- electricalwiringofresidential&commercialandindus trialbuildings.
- materialandsizeofconductorsforoverheadtransmis- sion & distributionlines.
- lightsourcesandillumination.
- electric heating &welding. CO2. analyze
- estimationof residential &commercial buildings, over headtransmission&distributionlinesandindustrialbuild- ings.
- properilluminationstrategyforeffectivelighting.
- heatingandweldingschemesforindustrialpurpose.

CO3. design of electrical wiring for residential & commercial buildings and industrial buildings, overheadtransmission &distribution lines and suitable illumination system for effectivelighting.

CO4. solveengineeringproblemspertainingtoutilizationof electricalenergyandprovidefeasiblesolutions.

CO5. apply suitable electric wiring, heating, welding and illu minationtechniquesfordomesticandindustrialapplica- tions.

CO6. applytheconceptualknowledgeofutilizationstrategies and techniques in relevance to industry andsociety.

CO7. adheretheconstraintsandstandardsforapplicationsof electricenergyindifferentfields.

DETAILED SYLLABUS:

UNIT-I:DESIGNANDESTIMATIONOFRESIDENTIALAND COMMERCIALBUILDINGS (11periods)

Introduction to residential wiring system, systems of distribu- tion of electric energy, methods of wiring, systems of wiring, choice of wiring, rating of wires and cables, load calculations andselectionofsizeofconductor,Introductiontoestimation& costing, sequence to be followed for preparing estimate, re- cordingofestimates,determinationofrequiredquantityofma- terial,preparationofdetailedestimatesandcostingofresiden- tialandcommercialbuilding.GeneralideaaboutIErule,Indian electricityactandmajorapplicableI.Erules

UNIT-II:DESIGNANDESTIMATIONOFOVERHEADTRANS- MISSION &DISTRIBUTIONLINES (09periods)

Introduction,typicalACelectricalpowersystem,maincompo- nentsofoverheadlines,conductormaterials,determinationof size of conductor for overhead transmission line, conductors configurationspacingandclearances,spanlengths,testingand commissioning of

overhead distribution lines, some important specifications,preparationofdetailedestimatesandcostingof overheadtransmissionanddistributionlines.

UNIT-III:DESIGNANDESTIMATIONOFINDUSTRIALNET- WORKINSTALLATIONS (09periods)

Introductionandclassificationofindustrialbuildings,designpro- cess, Industries with less than or equal to 1MVA and above 1MVA load, selection of distribution architecture, selection of transformersubstations,selectionofdrives,selectionofswitch gears.

UNIT-IV: PRINCIPLES OF LIGHT AND DESIGN(10 periods)

Light sources, colour characteristics, terms used in illumination,lawsofillumination,polarcurves,photometry-in- tegratingsphere.Typesoflamps,LEDlights,photometricanaly- sis,lightingcalculations,averagelumenmethod,lightlossfac- tor, quality of lighting, design procedures, arrangement of fix- tures,factorylighting,streetlightingandfloodlighting.

UNIT-V: ELECTRIC HEATING AND ELECTRIC WELDING (06 periods)

ELECTRICHEATING:Designofheatingelement,advantages, methodsandapplications- resistance,inductionanddielectric heating.

ELECTRICWELDING:Classification,resistanceandarcweld- ing,electricwelding,comparisonbetweenACandDCwelding.

Total Periods: 45

TEXT BOOKS:

1. J.B.Gupta,ACoursein*ElectricalInstallationEstimatingand Costing*,S.K.KatariaandSons,Reprintedition,2013.
2. M.K.Giridharan,*ElectricalSystemsDesign*,IKInternational PublishingHousePvt.Ltd,3rdedition,2015.

REFERENCE BOOKS:

1. HemantJoshi,Residential-*CommercialandIndustrialElec- tricalSystems:NetworkandInstallation(Volume1)*,McGraw Hill Education, 21st edition,2007.
2. Hemant Joshi, Residential - Commercial and Industrial Elec tricalSystems:NetworkandInstallation(Volume2),McGraw Hill Education, 21st edition,2007.
3. J.B.Gupta,*UtilizationofElectricPowerandElectricTraction*, S.K.Kataria and Sons, 10th edition, 2013.

III B.Tech. - II Semester

(16BT60204)**DIGITALSIGNALPROCESSING**FOR ELECTRICAL ENGINEERS

(Program Elective-1)

Int. Marks	Ext. Marks	TotalMarks	L	T	P	C
30	70	100	3	1	--	3

PREREQUISITES:Courses on Signals, Systems &Networks and Power Electronics.

COURSE DESCRIPTION:
Discrete-timesignalsandsystems;DiscreteFourierseries,Dis-creteFourierTransforms(DFT)andFastFourierTransform(FFT) algorithms for the analysis of discrete time sequences;design andrealizationofDigitalIIRandFIRfilters;DSPbasedcontrol ofsteppermotors;DSPbasedimplementationofDC-DCbuck- boostconverters.

COURSEOUTCOMES:Onsuccessfulcompletionofthecourse, students will be ableto

CO1. demonstrate knowledgeon
- digital signals andsystems
- DFT andFFT
- analog & digitalfilter
- digital filterrealization

CO2. analyzediscretetimesignalsandsystemsusingDFTand FFTtechniques.

CO3. designandrealizeIIRandFIRdigitalfiltersusingdiffer enttechniques.

CO4. evaluate the Discrete Fourier Transform (DFT) of a se quence and use the DFT to compute the convolutionof two sequences and plot the frequency response of lin ear time-invariantsystems.

CO5. userelevantDSPcontrollersandtechniquesforapplica tionsinpowerelectronicsandelectricalmachines.

CO6. applytheconceptualknowledgeofdigitalsignalpro cessing in relevance to industry andsociety.

DETAILED SYLLABUS:

UNIT-I: FUNDAMENTALSOFDSP **(07periods)**

Reviewofdiscretetimesignalsandsystems,Solutionsfordif-ferenceequationofdiscretetimesystems,frequencyresponse ofdiscretetimesignals,A/DandD/Aconversion,Introduction toDSPsystemwithblockdiagram.

UNIT-II:FOURIERTRANSFORMS **(12periods)**
Discrete Fourier series - Introduction to discrete Fourier series and its properties.

Discrete Fourier Transforms - Introduction, relation withother transforms,properties,circularandlinearconvolution.
FastFourierTransforms-Radix-2DecimationintimeandDeci-mationinfrequencyalgorithms.

UNIT-III:DIGITALFILTERS **(10periods)**
DigitalVsAnalogfilters,advantagesanddisadvantagesofdigi- tal filters, Realization of Digital filters using Direct form-I and Direct form-IIstructures.
IIR Digital Filters:
Analog low pass filter design: Butterworth and Chebyshevlow passfilters.DesignofIIRfilterfromanalogfiltersusingImpulse Invariance and Bilinear transformation techniques. Frequency transformation indigital domain.

UNIT-IV:FIRDIGITALFILTERS **(08periods)**
LinearphaseFIRfiltersanditsfrequencyresponse,locationof zerosinlinearphaseFIRfilters,Fourierseriesmethodfordesign ofFIRfilters.DesignofFIRfiltersusingwindows-Rectangular,

Triangular,HammingandBlackmannwindows.

UNIT-V:TMSLF2407DSPCONTROLLERS (08periods)

Introduction to peripherals - types of physical memory - soft- ware used (Preliminary approach). DSP based control ofstep- per motors - principle of hybrid stepper motors - basic opera- tion, stepper motor drive system, implementation of stepper motor control system using LF2407 DSP controller. DSPbased implementationofDC-DCbuckboostconverters-introduction, converter structure, continuous and discontinuous conduction modes, connecting DSP to buck-boost converter, controlling the buck-boost converter.

Total Periods: 45

TEXT BOOKS

1. A.Anandkumar,*Digitalsignalprocessing*,PHILearningPrivate limited, NewDelhi,2013.
2. Hamid A. Toliyat, Steven G. Campbell, DSP based electrome- chanical motion control, CRC Press Special Indian edition, 2012.

REFERENCE BOOKS:

3. John G. Proakis, Dimitris G. Manolakis, Digital Signal Process- ing, Principles, Algorithms and Applications, Pearson Educa- tion/PHI, 4th edition, 2007.
4. Alan.V. Oppenheim, Ronald.W. Schafer, John R Buck, Discrete Time Signal Processing, Prentice Hall, 2nd edition, 2006.

IV B.Tech. I Semester

14BT60401: **DIGITAL SIGNAL PROCESSING**

Internal Marks	External Marks	Total Marks	L	T	PC
30	70	100	3	1	-3

PREREQUISITE(S): SignalsandNetworks

COURSEDESCRIPTION: Continuousanddiscretesignalsandsequences; systems; DFT and FFT algorithms for the analysis of discrete sequences; designandrealizationofDigitalIIRandFIRfilters;Multiratesystemsand some of the Signal processingapplications.

COURSE OUTCOMES: On successful completion of this course, students will be able to

1. demonstrate knowledgein
   - digital signals, sequences andsystems.
   - DFT and FFTtransforms.
   - analog& Digital FilterDesign.
   - digital FilterRealization.
   - DSPProcessors.
2. perform Frequency analysis of discrete time signals in suppressing un necessary frequencycomponents.
3. design and develop digital filters to optimize system performance and theirrealization.
4. solve problems in processing of signals through digital systems and applying them in signalprocessing.

DETAILED SYLLABUS:

UNIT - I: INTRODUCTION TO DIGITAL SIGNAL PROCESSING

ReviewofDiscrete-timesignals,systemsandtheirclassification.Discrete- Time systems described by differenceequations.

Frequency analysis of Discrete Time signals:

Fourier series for DT periodic signal and power density spectrum, the Fourier transform of DT aperiodic signals and energy density spectrum, convergenceofFouriertransforms.ReviewofZ-transforms,Applications, solution for difference equations of digitalfilters.

UNIT - II: DISCRETE AND FAST FOURIER TRANSFORMS

DFS representation of periodic sequences, properties of Discrete Fourier Series.

DiscreteFourierTransforms(DFT):PropertiesofDFT,linearfilteringmethods based on DFT, Relationship of FT to Z Transform, frequency analysis of signals usingDFT.

Fast Fourier transforms (FFT): Radix-2 Decimation in time (DIT)

and Decimation in frequency (DIF) FFT algorithms, Inverse FFT.

UNIT - III: IIR DIGITAL FILTERS

Design of IIR digital filters from analog filters - IIR filter design by approximation of derivatives, impulse invariance and bilinear transformation.Characteristicsofcommonlyusedanalogfilters,Frequency transformations.StructuralrealizationofIIRsystems-direct,cascadeand parallel form structures, Transposedform.

UNIT - IV: FIR DIGITAL FILTERS

Symmetricandanti-symmetricFIRfilters,DesignoflinearphaseFIRdigital filters using windowing techniques, Frequency sampling technique, Comparison of IIR and FIR filters. Structural realization of FIR filters- direct, cascade-form structures and linear phasestructures.

UNIT - V: INTRODUCTION TO DSP PROCESSORS

IntroductiontoprogrammableDSPs:MultiplierandMultiplierAccumulator (MAC), Modified Bus Structures and Memory Access schemes in P-DSPs, Multipleaccessmemory,multiportedmemory,VLIWArchitecture,Pipelining, Special addressing modes, On-ChipPeripherals.

Architecture of TMS 320C6X: Introduction, Features of 'C6X Processors, InternalArchitecture,CPU,General-PurposeRegisterFiles,FunctionalUnits and Operation, Data Paths, Control RegisterFile.

TEXT BOOKS:

1. John G. Proakis, Dimitris G. Manolakis, *Digital Signal Processing, Principles, Algorithmsand Applications*, Pearson Education/PHI, 4th edition,2007.
2. Alan.V. Oppenheim, Ronald.W. Schafer, John R Buck, *Discrete Time Signal Processing*, Prentice Hall, 2nd edition,2006.
3. B.Venkataramani,M.Bhaskar,*DigitalSignalProcessors-Architecture, Programming and Applications*, TATA McGraw Hill, 2nd edition,2010

REFERENCE BOOKS:

1.TarunKumarRawat,*DigitalSignalProcessing*,OxfordUniversityPress, 1st edition,2015.

III B.Tech. - II Semester

(16BT60206)**HVDCTRANSMISSION**

(Program Elective-1)

Int. Marks	Ext.Marks	TotalMarks	L	T	P	C
30	70	100	3	1	--	3

PREREQUISITES:CoursesonPowerElectronicsandTransmis- sion &Distribution.

COURSE DESCRIPTION:
NeedforHVDCTransmission,planningandmoderntrends;Analy- sis and control of power converters; Harmonics; Characteris- tics and design of filters; Faults and protection ofconverters.

COURSEOUTCOMES:Onsuccessfulcompletionofthecourse, students will be ableto
CO1. demonstrate knowledgeon

- differenttypesofHVDCtransmissionsystem,various converter configurations and theircontrol.
- effectsofharmonics,faultsandtheircontrolmethods. CO2. analyze
- differentconverterconfigurations.
- differentcontrolandprotectionstrategiesinHVDCsys- tem.
- powerflowinHVDCtransmissionsystem.

CO3. demonstrateskillsindesigningfiltercircuitsforminimiz ingharmonics.
CO4. solveproblemsinHVDCtransmissiontoprovideviable solutions.
CO5. selectandapplyappropriatedevices,schemesandtech niquesforrealtimeapplicationsinHVDCtransmission.
CO6. applytheconceptualknowledgeofHVDCtransmissionin relevance to industry andsociety.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO HVDC TRANSMISSION(08 periods)

NeedforHVDCtransmission,apparatusrequiredforHVDCtrans- mission system, types of DC links, comparison of EHVAC and HVDC transmission systems, applications of HVDC transmission system,planningandmoderntrendsinHVDCtransmissionsys- tem.

UNIT-II: STATIC POWER CONVERTER ANALYSIS(10 periods)
Introduction,analysisofGraetzcircuit,characteristicsof6pulse & 12 pulse converters, commutation process, rectifier and in- verteroperation,equivalentcircuitforconverters,specialfea- tures of convertertransformers.

UNIT-III: CONTROL OF HVDC CONVERTER AND SYSTEMS (10 periods)
Principle of DC link control, constant current, constant extinc- tionangleandconstantignitionanglecontrol,individualphase controlandequidistantfiringanglecontrol.Effectofsourcein- ductanceonthesystem.StartingandstoppingofDClink.Power flowcontrol.

UNIT-IV: HARMONICSANDFILTERS (09periods)
HARMONICS: Generation of harmonics, characteristicharmon- ics,calculationofACharmonics,non-characteristicharmonics, effects of harmonics,

calculation of voltage and current har- monics,effectofpulsenumberonharmonics.
FILTERS: Types of AC filters,filter characteristics, design of single tuned filters, design of high pass filters, DC filters.

UNIT-V: CONVERTER FAULTS AND PROTECTION (08 periods)
Converter faults, over voltages in converter station, protection against over current and over voltage in converter station, surge arresters, protection of DC line, DC breakers.

Total Periods: 45

TEXT BOOKS:

1. K.R. Padiyar,HVDCPower Transmission Systems,New Aca- demic Science, 2nd edition,2011.
2. Sunil S Rao, EHV-AC, HVDC Transmission and Distribution Engineering,KhannaPublishers,3rdedition,2001.

REFERENCE BOOKS:

1. E.Uhlman,*PowerTransmissionbyDirectCurrent*,Springer Verlag, Berrlin/Heedelberg1975.
2. Jos Arillaga, *High Voltage Direct Current Transmission, The Institute of Electrical Engineers*, London, United Kingdom, 2nd edition,1998.
3. E. W. Kimbark, *Direct current Transmission*, John Wiely & Sons, NewYork.

IV B.Tech. IISemester

14BT80202: **HVDCAND FACTS**

Internal Marks	External Marks	Total Marks	L	T	PC
30	70	100	3	1	-3

PREREQUISITE(S): Power Electronics, Transmission of electric power, Power system operation and control.

COURSE DESCRIPTION: Introduction to high voltage transmission; converterandHVDCsystemcontrol;harmonicsandfilters;FACTSconcepts; static shunt, series compensators and combinedcompensators.

COURSE OUTCOMES: On successful completion of the course, student will be able to

1. demonstrate knowledgeon
   - differentconventionalandmodernmethodsforrealandreactivepower control in transmissionsystem.
   - importance and operation of various HVDC and FACTS controllers in transmissionsystem.
   - Various transformer and converter configurations used for HVDCand FACTScontrollers.
2. analyze different converters and compensators for improving overall performance of the transmissionsystem.
3. extend the applications of HVDC and FACTS devices to improve the overall performance of the transmissionsystem.

DETAILED SYLLABUS:

UNIT - I: INTRODUCTION TO HIGH VOLTAGE DC TRANSMISSION

HVDC transmission system - Introduction, comparison of AC and DC transmission systems, application of DC transmission, types of DC links, typicallayoutofaHVDCconverterstation,introductiontoHVDCconverters, effect of pulse number, analysis of phase bridge circuit with and without overlap, converter bridge characteristics, equivalent circuit for rectifier and inverter configurations. Twelve pulseconverters.

UNIT - II: CONVERTER AND HVDC SYSTEM CONTROL

Principles of DC link control, converter control characteristics, system controlhierarchy.Firinganglecontrol-currentandextinctionanglecontrol, startingandstoppingofDClink.Harmonics-Introduction,generation.AC and DC filters, reactive power

requirements at steady state. Sources of reactive power, static VARsystems.

UNIT - III: FACTS CONCEPTS

Reactive power control in electrical power transmission, principles of conventional reactive power compensators. Introduction to FACTS, flow of power in AC parallel paths, meshed systems, basic types of FACTS controllers, definitions of FACTS controllers, brief description of FACTS controllers.

UNIT - IV: STATIC SHUNT AND SERIES COMPENSATORS

Shunt compensation - objectives of shunt compensation, methods of controllable VAR generation, static VAR compensators - SVC, STATCOM, SVCandSTATCOMcomparison.Seriescompensation-objectivesofseries compensation, thyristor switched series capacitors (TCSC), static series synchronous compensator (SSSC), power angle characteristics, basic operating controlschemes.

UNIT - V: COMBINED COMPENSATORS

Unified power flow controller (UPFC) - Introduction, operating principle, independentrealandreactivepowerflowcontrollerandcontrolstructure. Interline power flow controller (IPFC), generalized and multidimensional FACTScontroller.

TEXT BOOKS:

1. K.R.Padiyar,*HighVoltagePowerTransmissionSystemsTechnologyandSystemInteractions*,NewageinternationalPublishers,NewDelhi,2005.
2. Narain G.Hingorani, LasziGyugyi, Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems, IEEE press, Delhi, 2001.

REFERENCE BOOKS:

1. S Rao, EHVAC, HVDC Transmission & Distribution Engineering, Khanna Publishers, Delhi, 3rd edition, 2006.
2. Mohan Mathur, Rajiv K.Varma, Thyristor - based FACTS controllers for Electrical Transmission Systems, A John Wiley and Sons Publications, 2002.

III B.Tech.- II Semester

(16BT60207) **ADVANCED CONTROL SYSTEMS**

(Common to EEE & EIE) (Program Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	--	3

PREREQUISITES:Course on Control systems

COURSE DESCRIPTION:
Designofcompensatorsandcontrollers,statespace,canonical forms,controllabilityandobservability,describingfunction,phase planeanalysis,Lyapunov'sstabilityanalysis,Fullorderobserver and reduced orderobserver.

COURSEOUTCOMES:Onsuccessfulcompletionofthecourse, students will be ableto

CO1. demonstrateknowledgeon
- state spaceanalysis.
- various compensators andcontrollers.
- stability in the sense ofLyapunov.
- fullandreducedorderobserversinstatespaceanalysis.

CO2. analyze the stability of nonlinear system using
- describing functionapproach.
- phase planeanalysis.
- Lyapunov'smethod.

CO3. designsuitablecompensatorandcontrollersusingroot locus and Bodeplot.

CO4. evaluate stability of systems using pole placementand Lyopunovmethodtoprovidevalidsolutions.

CO5. selectappropriatetechniquesforanalyzingthestability of thesystem.

CO6. applythe conceptual knowledge of advanced control systems in relevance to industry andsociety.

DETAILED SYLLABUS:

UNIT-I:LINEARCONTROLSYSTEMDESIGN **(10periods)**

Introductiontocontrolsystemdesign,typesofcompensators, design of compensators using root locus technique. Types of controllers,designofPI,PDandPIDcontrollersusingBodeplot and root locustechnique.

UNIT-II: STATESPACEANALYSIS **(08periods)**

Review of state space analysis. Canonical forms -Controllable canonical form, observable canonical form, Jordan canonical form. Tests for controllability and observability for continuous timesystems-Timevaryingcase,timeinvariantcase,principle ofduality,controllabilityandobservabilityformJordancanonical form.

UNIT-III: ANALYSIS OF NONLINEAR SYSTEMS

(13 periods) Introduction to non-linear systems, different types of physical nonlinearities,describingfunctions,derivationofdescribingfunc-tionsfordeadzone,saturation,backlash,relayandhysteresis. Stabilityanalysisofnonlinearsystemsthroughdescribingfunc- tions, phase-plane analysis, singular points, methods for con- structingtrajectories-Isoclines'method,deltamethod.

UNIT-IV:STABILITYANALYSIS **(06periods)**

Stability in the sense of Lyapunov.Lyapunov's stability and Lypanov'sinstabilitytheorems.DirectmethodofLypanovforthe l inear and nonlinear

continuous time autonomous systems.Generation of Lyapunov functions - Variable gradient method,Krasooviski'smethodandPopov'scriterion.

UNIT-V:DESIGN OF CONTROL SYSTEMS IN STATE SPACE (08periods)

Necessityofpoleplacement,designbypoleplacement,neces- saryandsufficientconditionsforarbitrarypoleplacement.De- termination of feedback gain matrix using direct substitution methodandAckermann'sformula.Fullorderobserverandre- duced orderobserver.

Total Periods: 45

TEXT BOOKS:

1. M.Gopal,*ModernControlSystemTheory*,NewAgeInterna- tional (P) Ltd., 2nd edition,2000.
2. K.Ogata,*ModernControlEngineering*,PrenticeHallofIndia, 4th edition,2006.

REFERENCE BOOKS:

1. A. Nagoorkani, Advanced control theory, RBA publications, 2nd edition,1999.
2. I.J.NagrathandM.Gopal,*ControlSystemsEngineering*,New Age International (P) Ltd.,2007.

III B.Tech. II Semester

14BT60206: **ADVANCED CONTROL SYSTEMS**

(PROFESSIONAL ELECTIVE -I)

Internal Marks	ExternalMarks	TotalMarks	L	T	P	C
	70	100	3	1	-3	3

PREREQUISITE(S): Control Systems

COURSE DESCRIPTION: Linear control system design;design of compensators and controllers; non-linear systems; describing function; phase plane and stability analysis; design of controllers and observers; formulationofvariousoptimalcontrolproblems;minimizationoffunctional.

COURSE OUTCOMES: On successful completion of this course, student will be able to

1. gain knowledgeon
   - need for control system design, tuning of PID controller and Two- degrees-of-Freedomcontrol.
   - non-linear systemstability.
   - modal and optimalcontrol.
2. analyze
   - stabilityof a non-linear system using describing functions and phase planeanalysis.
   - non-linear system stability using Lyapunov's stabilitycriterion.
   - Minimization of functional with differentcases.
3. demonstrate design skillsin
   - compensators and controllers using Root locus and Bodeplot
   - controllers,observer and regulators using statespace.
4. demonstrate problem solving skillsin
   - evaluatingstabilityofsystemsusingdescribingfunctionsandliapunov stability
   - application of calculus ofvariations

UNIT – I: LINEAR CONTROL SYSTEM DESIGN

Introduction to control system design, types of compensators, design of compensatorsusingbodeplotandrootlocustechnique.Typesofcontrollers, design of PI, PD and PID controllers using bode plot and root locus technique. Tuning rules for PID controllers, two-degrees-of-freedom control.

UNIT - II: ANALYSIS OF NONLINEAR SYSTEMS

Introductiontonon-linearsystems,differenttypesofphysicalnonlinearities, describing functions, derivation of describing functions for dead zone,

saturation,backlash,relayandhysteresis.Stabilityanalysisofnonlinear systemsthroughdescribingfunctions,Phase-Planeanalysis,singularpoints, methods for constructing trajectories - Isoclines' method, deltamethod.

UNIT- III: STABILITY ANALYSIS

StabilityinthesenseofLyapunov.Lyapunov'sstabilitytheorems.Stability analysis of linear time invariant systems by Lyapunov second method. Generation of Lyapunov functions, variable gradient method,Krasovskii's method.

UNIT - IV: DESIGN OF CONTROL SYSTEMS IN STATE SPACE

Necessity of pole placement, design by pole placement, necessary and sufficientconditionsforarbitrarypoleplacement.Determinationoffeedback gain matrix using direct substitution method and Ackermann's formula.
Fullorderobserverandreducedorderobserver,quadraticoptimalregulator systems.

UNIT - V: OPTIMAL CONTROL

Introduction to optimal control, formulation of optimal control problems, calculusofvariations,minimizationoffunctionalofsinglefunction,functional involving n independent functions, constrainedminimization.

TEXT BOOKS:

1. M. Gopal, *Modern Control System Theory*, New Age International (P) Ltd., 2nd edition,2000.
2. K.Ogata,*ModernControlEngineering*,PrenticeHallofIndia,4thedition, 2006.

REFERENCE BOOKS:

1. A. Nagoorkani, *Advanced control theory*, RBA publications, 2nd edition, 1999.
2. I.J. Nagrath and M.Gopal, *Control Systems Engineering*, New Age International (P) Ltd.,2007.

III B.Tech.- II Semester

(16BT60209) **INSTRUMENTATION**

(Program Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	--	3

PREREQUISITES:Courseson Analog Electronic Circuits, Elec- trical Measurements, Computer Architecture and Organization.

COURSE DESCRIPTION:
Principle of operation, advantages and limitations of various typesofelectronicanddigitalinstrumentsformeasurementof electrical quantities; Storage oscilloscopes, Data acquisition,displaydevicesandrecorders.

COURSE OUTCOMES:On successful completion of the course, students will be able to

CO1. demonstration knowledgeon
- varioustypesofelectronicanddigitalinstruments.
- signalanalyzersandstorageoscilloscopes.
- data acquisition systems, display devices andrecord- ers.

CO2. analyze
- varioustypesofelectronicanddigitalinstruments.
- signalanalyzersandstorageoscilloscopes.
- displaydevices,recordersandvariousdataacquisition systems.

CO3. designanappropriatedisplaysystemforindustrialand commercialapplications.

CO4. estimate the magnitude, phase, frequency and spec trumofsignalwithoscilloscopetoprovidefeasiblesolu- tion.

CO5. selectanappropriateinstrumentationprinciplesandtech niquestosubstantiatetheindustrialrequirements.

CO6. apply the conceptual knowledge of various instrumen tationprinciplesandtechniquesinrelevancetoindus- try.

DETAILED SYLLABUS:

UNIT-I:ELECTRONICINSTRUMENTS **(10periods)**

Electronic voltmeter using rectifiers, AC voltmeter - Average, Peak and true RMS voltmeters; Electronic multi meters-elec- tronicohmmeter;Vectorimpedancemeter,Vectorvoltmeters, Qmeter-measurementoflow,highimpedanceandbandwidth, errors.

UNIT-II:DIGITALINSTRUMENTS **(09periods)**

Basicdigitalinstrument.Digitalfrequencymeter-Periodand Timeintervalmeasurement;Digitalphasemeter,Capacitancemeter,DigitalTachometer,Di gitalLCRmeter,LCRBridge,Char- acteristicsofdigitalmeters,specificationofDVM,Digitalmulti meter.Microprocessorbasedramptype DVM.

UNIT-III: SIGNAL ANALYZERS & STORAGE OSCILLOSCOPES **(10 periods)** Analyzers-Resonantwaveanalyzers,Frequency-selectiveana- lyzers, Heterodyne analyzers, Application of wave analyzers; Harmonic distortion analyzers, Total Harmonic distortion ana- lyzers,logicanalyzers,Poweranalyzers.
Spectrum analyzers-basic spectrum analyzers, spectra of dif- ferent signal.
Storageoscilloscope-Samplingoscilloscope,digitalstorageos- cilloscope, electronic switch, oscilloscopeprobes.

UNIT-IV: DATAACQUISITIONSYSTEMS **(09periods)**

Generalizeddataacquisitionsystemanditscomponents,Types of multiplexing systems - time division and frequency division multiplexing;Digitaldataacquisitionsystem,useofdataacquisitionsystemsandrecordersindigitalsystems,Digitalrecordingsystems-blockdiagramanditsworking;moderndigitalDAS- Analog Multiplexer operation, Operation of Sample- Hold circuits.

UNIT-V: DISPLAY DEVICES AND RECORDERS (07 periods)

Displaydevices-LED,LCD,LVD,VDU;Recorders-graphic,ultravioletandmagnetictaperecorders,digitaltaperecorders,bio- medicalrecorders.

TEXT BOOKS: **Total Periods: 45**

1. A.K.Sawhney, A course on *Electrical and Electronics Measurements&Instrumentation*,DhanpatRaiandCo.Publishers,19th edition,2015.
2. J.B. Gupta, A course on *Electrical and Electronics Measurements&Instrumentation*,S.K.Katariapublishers,14th edition,2015.

REFERENCE BOOKS:

1. H.S.Kalsi,*ElectronicInstrumentation*-byTataMCGrawHill Company, 3rd edition,2010.
2. D.V.S Murthy, *Transducers and Instrumentation*, Prentice HallofIndia,NewDelhi,2nd edition,2010.

III B.Tech. II Semester

14BT60205: **INSTRUMENTATION**

(PROFESSIONAL ELECTIVE -I)

Internal Marks	ExternalMarks	TotalMarks	L	T	P C30
	70	100	3	1	-3

PREREQUISITE(S): Engineering Mathematics, Electrical Circuits and Electrical and Electronic Measurements.

COURSEDESCRIPTION: Variousinstrumentationsystems,performance characteristics; resistive, capacitive and inductive transducers; digital voltmeters, oscilloscopes and storage oscilloscopes data acquisition systems.

COURSE OUTCOMES: On successful completion of the course, student will be able to

1. gain knowledgeon
   - characteristic parameters of various measuringinstruments.
   - varioustypes of digital voltmeters, transducers, signal analyzers, oscilloscopes, storage oscilloscopes and data acquisitionsystems.
2. analyze
   - the performance characteristics of various measuringinstruments
   - variousdigitalvoltmeters,transducers,signalanalyzers,oscilloscopes, storage oscilloscopes and data acquisitionsystems.
3. develop skills toevaluate
   - various non electrical quantities, performance characteristics of measuringinstruments
   - magnitude,phaseandfrequencyofsignalorspectralwithoscilloscopes
4. select a suitable instruments to meet the requirements of industrial applications.

DETAILED SYLLABUS:

UNIT - I: CHARACTERISTICS OF MEASURING SYSTEMS

Classification of instruments, elements of a generalized measurement system. Measurement system performance - static and dynamic characteristics. Limiting and relative limiting errors - combination of quantities with limiting errors, types of errors - numerical problems

UNIT - II: DIGITAL METERS Digital voltmeters and it types. Ramp type DVM and its types, micro processor based ramp type DVM. Digital frequency meter. Time and period measurement. Phase meter, digital phase meter. Q-meter. Vector impedance meter. Peak responding and true RMS voltmeters.

UNIT - III: SIGNAL ANALYZERS & CRO

Analyzers: wave analyzers- frequency selective, logic, heterodyneanalyzers, application of wave analyzers and harmonic distortion,spectrumanalyzers,basicspectrumanalyzers,spectraldisplays. Oscilloscopes: cathode ray oscilloscope, cathode ray tube, time base generator, horizontal and vertical amplifiers, measurement of phase and frequency, lissajous patterns-numerical problems. Storage oscilloscope: sampling oscilloscope-digital storageoscilloscope.

UNIT - IV: TRANSDUCERS

Definition of transducer, classification of transducers, advantages of electricaltransducers,characteristicsandchoiceoftransducers-principle operation of resistor, inductor, LVDT and capacitor transducer, LVDT Applications, RVDT. Strain gauge and its principle of operation, gauge sensitivity, gauge factor. Thermistors, thermocouples, Synchros, piezo electric transducers, photo diodes, phototransistors.

UNIT - V: DATA ACQUISITION SYSTEMS

Generalized data acquisition system and its components. Types of multiplexing systems - time division and frequency divisionmultiplexing. Digital data acquisition system, use of data acquisition systems and recorders in digital systems. Digital recording systems -block diagram and its working, modern digital DAS (only blockdiagram)

TEXT BOOKS:

1. A.K.Sawhney,*AcourseinElectricalandElectronicMeasurementsand Instrumentation*,DhanpatRai&Co.(Pvt.)limited,NewDelhi,2014.
2. H.S. Kalsi,*ElectronicInstrumentation*-byTata MCGrawHillCompany, 3rd edition,2010.

REFERENCE BOOKS:

1. D. Helfrick and W. D. Cooper, *Modern Electronic Instrumentation and Measurement Techniques* by Prentice Hall of India, 2nd edition,India.
2. D.V.SMurthy,*TransducersandInstrumentation*,PrenticeHallofIndia, New Delhi, 2nd edition,2010.

III B.Tech.-II Semester

(16BT60210)**SPECIALELECTRICALMACHINES**

(Program Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	--	3

PREREQUISITES: Course on Synchronous Machines

COURSE DESCRIPTION:
Construction,operation,types,characteristicsandapplications of Stepper Motors, Switched Reluctance Motor, PM Brushless DC Motor, Synchronous Reluctance, Linear Induction and syn- chronousMotors.

COURSEOUTCOMES: On successful completion of the course, students will be able to

CO1. demonstrate knowledgeon

- construction and operation of various types ofspecial electricalmachines.
- characteristics of special electricalmachines.
- openloopandclosedloopoperationofspecialelectri- calmachines.

CO2. analyzetheoperationandperformanceofspecialelec tricalmachinesforvariousoperatingconditions.

CO3. designsuitableaccessories/controllersfordesiredop erationandcontrolofspecialelectricalmachines.

CO4. solveengineeringproblemspertainingtospecialelectri calmachinestoprovidefeasiblesolutions.

CO5. selectandapplyappropriatetechniqueandtoolsforcon trol and operation of special electrical machines in do mesticandindustrialapplications.

CO6. apply the conceptual knowledge of specialelectrical machinesinrelevancetoindustryandsociety.

DETAILED SYLLABUS:

UNIT-I:STEPPERMOTOR (09periods)

Types of construction and working principle of stepping motor.Variousconfigurationsforswitchingthephasewindings, torqueequationandcharacteristics.Openloopandclosedloop controlofsteppermotor,applications.

UNIT-II:SWITCHEDRELUCTANCEMOTOR (09periods)
Construction details, Principle of operation - Design of stator androtorpolearcs-torqueequationandcharacteristics,power converter for switched reluctance motor, control of switched reluctancemotor,rotorsensingmechanism.

UNIT-III: SYCHRONOUS RELUCTANCE MOTOR (09 periods)

Constructional features, Types – Axial and Radial flux motors.

Principle of operation, torque-speed characteristics, Phasor diagram, Characteristics, control of SyRM, advantages and applications.

UNIT-IV:PERMANENT MAGNET BRUSHLESS DC MOTOR (09 periods) Permanent magnet materials-hysteresis loop, analysis of magneticcircuits.Constructionaldetails,principleofoperation, BLDC square wave motor, types of BLDC motor, sensing and switching logic schemes, sensorless and sensor based control of BLDCmotors.

UNIT-V:LINEARMOTORS (09periods)

Linear Induction Motor (LIM): Construction, principle of operation-singlesidedanddouble-sidedLIM,thrustequations and performance equations based on current sheet concept, equivalentcircuitofLIM,applications.
Linear Synchronous Motor (LSM): Construction, types, principleofoperation,thrustequation,controlandapplications.

Total Periods: 45

TEXT BOOKS:

1. K. VenkataRatnam, *Special electrical machines*, University press,NewDelhi,2009.
2. E.G.Janardhanan,*Specialelectricalmachines*,PHIlearning private limited,2014.

REFERENCE BOOKS:

1. Takashi Kenjo, *Stepping Motors and their Microprocessor controls*,clarendenpress,Oxford,1984.
2. T. KenjoandS.Nagamori,*Permanent-MagnetandBrushless DCMotors*,clarendenpress,Oxford,1984.
3. T.J.E. Miller, *Brushless Permanent Magnet and Reluctance MotorDrives*,clarendenpress,Oxford1989.
4. R. Krishnan, *Switched Reluctance Motor Drives - Modeling, Simulation,analysis,DesignandApplications*,CRCpress,Special Indian Edition, 2015.

III B.Tech.- II Semester

(16BT60232) **POWER SYSTEM - I LAB**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	--	--	3	2

PREREQUISITES:Course on Transmission &Distribution and Power System Analysis.

COURSE DESCRIPTION:
Experimentation on Transmission and distributionsystems; Load flow, Fault and Stability analysis.

COURSEOUTCOMES:Onsuccessfulcompletionofthecourse, students will be ableto

CO1. demonstrateknowledge on transmission &distribution systemsandvarioustypesofpowersystemanalysisfor experimentalimplementation.
CO2. analyze,evaluateandrelateexperimentalobservations andmeasurements for validation.
CO3. designasuitablemeasuringandtestingsetupforex perimentationonpowersystems.
CO4. interpretthedataobtainedfromexperimentationtopro vide validconclusions
CO5. selectandapplyappropriatetechniqueforsolvingcom plexproblemsinthepowersystems.
CO6. applytheconceptualknowledgeofpowersystemsin relevance to industry andsociety
CO7. committoethicalprinciplesandstandardswhileexer cisingthepracticalinvestigationsonpowersystem.
CO8. workindividuallyorinagroupwhileexercisingpractical investigationsinthefieldofpowersystemanalysis.
CO9. communicateeffectivelyinverbalandwrittenformin relevance to powersystem.

DETAILED SYLLABUS:
Conduct any **TEN** exercises from the following

1. Determination of transmissionlineparameters.
2. Performance of a transmission line for different load condi- tions.
3. Coronacharacteristics.
4. Determinationofefficiencyofstringinsulator.
5. Power angle characteristicof salient polesynchronous machine.
6. Performancecharacteristicsofdistributionsystem.
7. Formation ofYbus.
8. Formation ofZbus
9. Load flowanalysis.
10. Fault analysis.
11. Rotor dynamics using swing equation.
12. Transient stability analysis.

IV B.Tech. I Semester

14BT70222: POWER SYSTEMS AND SIMULATION LAB

InternalMarks	ExternalMarks	TotalMarks	L	T	P	C25
	50	75	--	--	3	2

PREREQUISITE(S): Electric circuits lab, Electrical Systems and Simulation

lab, Power System Operation and Control and Power System Analysis

COURSE DESCRIPTION: Relay testing; fault analysis; determination of sub-transient reactance; sequence impedances; sequence components and power angle characteristics of synchronous machine; determination of load flows, simulation of synchronous machine and load frequency problem using MATLAB software

COURSE OUTCOMES: On successful completion of the course, student will be able to

CO 1. demonstrate knowledgeon
- determination of sequence parameters for synchronous machineand transformer.
- power system protection and testing ofrelays.
- The usage ofMATLAB/SIMULINK.
- various load flow methods and load frequency

problem 2.analyze
- faults on synchronousgenerator
- thepowerflowinpowersystemnetworkusingvariousloadflowmethods
- protective schemes and testing of

relays. 3.demonstrate skillsin
- obtaining the power angle characteristics of salient polemachine
- obtaining various relaycharacteristics
- determining phase sequence components of salient pole machine synchronous machine andtransformer
- identifying, selecting and developing suitable protection schemes for reliable operation of powersystem.

4. applyMATLAB
- to determine Y-bus, Z-bus and power flow in power systemnetwork
- to investigate load frequency problem usingSIMULINK

5. execute real time projects in the field of power system operation and control.
6. function effectively as individual and as member in a team 7.communicate effectively both oral andwritten

LIST OF EXPERIMENTS:

PART A

Conduct any 6 experiments from thefollowing:

1. Determination of sub-transient reactance's for salient pole synchronous machine.
2. Determination of sequence impedances for cylindrical rotor synchronous machine.
3. Fault analysis for LG, LL and LLG faults.
4. Reactive power compensation using tap changing transformer.
5. Power angle characteristic of three-phase salient pole synchronous machine.
6. Determination of sequence components for three phase transformer.
7. Characteristics of over current relay.
8. Characteristics of over voltage relay.
9. Testing of frequency relay.
10. Testing of reverse power relay.

PART B

Conduct any 6 experiments from thefollowing:

1. Formationofbusadmittancematrixwithandwithoutoff-nominalratios of transformer of a power system network usingMATLAB
2. Formationofbusimpedancematrixwithandwithoutmutualcouplingof a power system network usingMATLAB
3. Load flow solution by using MATLAB
4. 4.Transient stability analysis usingMATLAB
5. 5.Economic dispatch usingMATLAB
6. Modelingofstandardtestsystemwithgeneratorexcitationandgovernor action usingSIMULINK
7. Modelingandanalysisofautomaticloadfrequencycontrolofmulti-area power system usingSIMULINK
8. Analysis of Transmission line parameters using PSCAD
9. 9.Simulation of Capacitor switching transient using PSCAD 10.Transformer inrush currents measurement usingPSCAD

III B.Tech - ISemester

(16BT70201) **POWER SYSTEM OPERATION AND CONTROL**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	--	3

PREREQUISITES:CoursesonTransmission&Distributionand ControlSystems.

COURSE DESCRIPTION:
Load forecasting; Optimal operation of generators in thermal powerstation;Optimalschedulingofhydrothermalsystem;Unit commitment;ModelingofPowersystemcomponents;Reactive powerandVoltagecontrol;Loadfrequencycontrol.

COURSEOUTCOMES: Onsuccessfulcompletionofthecourse, students will be ableto

CO1. demonstrate knowledgeon:
- load forecastingmethods.
- characteristics,schedulingandoptimaloperationof thermalandhydropowerplants
- unitcommitment.
- modelingofpowersystemcomponentsforLFCand AVRstudies.
- concepts of reactive power and voltagecontrol.
- load frequency control in single - and two-area sys tems.

CO2. analyze
- thecriteriaforoptimaloperationofthermalandhydro thermalplantswithandwithouttransmissionlosses.
- unitcommitmentofthermalunits.
- compensation and tap settings requiredfor reactive power and voltagecontrol
- LFC parameters in single - andtwo-area power sys tem.

CO3. design suitable strategy to control reactive power, volt ageandLFCdynamicsinpowersystem.

CO4. evaluatevariousoperationalparametersforscheduling & economic operation and control of power system to provide viablesolution.

CO5. applyappropriatetoolsandtechniquesforsecuredop erationandcontrolofpowersystem.

CO6. apply the conceptual knowledge of power system op erationandcontrolinrelevancetoindustryandsociety.

DETAILED SYLLABUS:

UNIT-I: PLANNING AND ECONOMIC OPERATION OF THERMALPOWERSYSTEM (12Periods)

Planning: Load curves, importance of load forecasting, quadratic,simpleregressionandexponentialcurvefittingtechniques of forecasting.

Economic Operation of thermal plants: Characteristics of thermalplants.Optimumallocationwithandwithouttransmissionlosses,losscoefficients,generaltransmissionlinelossfor- mula.

UNIT-II:HYDROTHERMALSCHEDULING (07Periods)

Introduction,classificationofhydroplants,schedulingofhydro plants - long-term, short-term, schedulingenergy.Hydrothermal scheduling - problem formulation, objective function, opera- tional constraints. Short term scheduling - Lagrange function, iteration method, penaltyfactor.

UNIT-III:UNITCOMMITMENT

(07Periods)

UnitcommitmentVsEconomicdispatch.Constraintsinunitcom- mitment - start-up and shut-down costs, up time and down time.Unitcommitmentsolutionmethods-prioritylistmethod, dynamicProgrammingmethod(maximumofthreeplantsforthree operating hoursonly).

UNIT-IV: REACTIVE POWER AND VOLTAGE CONTROL

(08 Periods) Introduction, reactive power and voltage control in transmis- sion lines - Line compensation, Load compensation and Static compensation.Voltagecontrolmethods-Excitationsystems- AC, DC and Static types. Tap-changing transformers. Compo-nentsandblockdiagramrepresentationofIEEEtype-1excita- tionsystem,AVRmodel.

UNIT-V: LOAD FREQUENCY CONTROL IN POWER SYSTEM

(12 Periods) Load frequency control of single area system: Necessity of keeping frequency constant, LFC Model - speed governor, tur- bine - reheat and non-reheat, generator-load model. steady state response - uncontrolled and controlled case, dynamic response. Load frequency control and economic dispatch con- trol.
Loadfrequencycontroloftwoareasystem:Blockdiagramrep-resentation,uncontrolledandcontrolledcase,tie-linebiascon-trol.Statespacerepresentationandoptimalcontroller.

Total Periods: 45

TEXT BOOKS:

1. K. Uma Rao, *Power system operation and control*, Wiley India Pvt. Ltd, 1st edition,2013.
2. A. Chakravarthi and S. Halder, *Power System Analysis Op-erationandControl*,PrenticeHallIndia,3rdedition,2006.

REFERENCE BOOKS:

1. C.L.Wadhwa, *Electrical Power Systems*, New age Interna tional,NewDelhi,5thedition,2009.
2. Wood, Allen J., and Bruce F. Wollenberg, *Power generation, operationandcontrol*,JohnWiley&Sons,3rdedition,2013.
3. PrabhaKundur,P*owersystemstabilityandcontrol*,McGraw- hill, 1st edition,2006.
4. T.J.E.Miller,*ReactivePowercontrolinelectricsystems*,Wiley, 1982.

IV B.Tech. - I Semester

(16BT70202) **SWITCHGEAR ANDPROTECTION**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	--	3

PREREQUISITES:CoursesonTransformersandInductionMachines,SynchronousMachinesandTransmission&Distribution.

COURSE DESCRIPTION:
Overview of protection schemes; Fuses and circuit breakers; Electromagnetic, static and microprocessor based relays;Protectionschemesforvariouscomponentsundervariousoperatingconditions;Neutralgrounding.

COURSEOUTCOMES:Onsuccessfulcompletionofthecourse, students will be ableto

CO1. demonstrate knowledgeon
- operation of various protective devices andschemes.
- protectionprinciplesforpowersystemcomponents.
- neutralgrounding.

CO2. analyzedifferent protective devices and protectionsch- emes under various operatingconditions.

CO3. designproperprotectionschemefordifferentpowersys temcomponents.

CO4. evaluateoperating parameters and settings of protec tive devices in different protection schemes toprovide feasiblesolutions.

CO5. select and apply appropriate protective deviceand scheme for differentscenarios.

CO6. applyvariousgroundingmethodsforsafetyofpower systemcomponentsandpersonnel.

DETAILED SYLLABUS:

UNIT-I:RELAYS **(11periods)**

Electromagnetic relays: Introduction, types of relays, con- struction, operation and torque equation of induction type re- lays, differential relays and biased differential relays. Charac- teristics of over current, directional and distance relays (R-X). **Static relays**: Advantages and disadvantages, blockdiagram of a basic static relay, definite time, inverse and inverse defi- niteminimumtime(IDMT)staticrelays.Comparators-ampli- tude and phasecomparators.
Microprocessorbasedrelays: Advantagesanddisadvantages, block diagram with flow chart - distance relays and over cur- rentrelays-definite,inverse&IDMT.

UNIT-II:FUSESANDCIRCUITBREAKERS **(09periods)**
Fuses - types of fuses & characteristics. Circuit breakers - elementaryprinciplesofarcinterruption,recoveryvoltage,re-strikingvoltage,RRV,averageandmaximumrateofriseofre- striking voltage, current chopping and resistance switching. Construction and principle of operation - minimum oil circuit breaker, air blast circuit breaker, vacuum circuit breaker and SF_6 circuit breaker.Isolators.

UNIT-III:PROTECTIONOFGENERATORSANDTRANSFORMERS **(08periods)**

Protection of generators: Differential protection, restricted earthfaultprotectionandinterturnfaultprotection,rotorfault protection, calculation of percentage windingunprotected.

Transformer protection: Differential protection,percentage differential protection, design of CT's ratio. Protection against internalfaults-buchholtzrelay.

UNIT-IV:PROTECTIONOFFEEDERSANDTRANSMISSION LINES **(10periods)**

Protectionoftransmissionlines:Three-zonedistancepro- tection using distance relays, carrier current protection using over currentrelays.

Protectionoffeeders:Protectionofradialandringmainfeed-ersusingovercurrentrelays.Protectionofbusbars.
ProtectionagainstOverVoltages:Causesofovervoltages in power systems, protection against lightning over voltages- non-linear(valvetype)andmetaloxide(zinc-oxide)surgear- resters,surgeabsorbers.Insulationcoordination,basicimpulse insulation level(BIIL).

UNIT-V:NEUTRALGROUNDING (07periods)
Groundedandungroundedsystems.Effectsofungroundedneu- tral on system performance. Methods of neutral grounding - solid,resistance,reactance,arcsuppressioncoil(Petersoncoil), groundingpractices.

Total Periods: 45

TEXT BOOKS:

1. Sunil S. Rao, *Switchgear Protection and Power Systems (Theory,practiceandSolvedProblems)*,KhannaPublishers, New Delhi, 13th edition,2013.
2. BadriRam,D.N.Viswakarma,*PowersystemProtectionand Switchgear*, Mc Graw Hill education (India) PrivateLimited, New Delhi, 2nd edition,2011.

REFERENCE BOOKS:

1. C. L. Wadhwa, *Electrical Power systems*, New Age Interna-tional(P)Limited,Publishers,NewDelhi,5thedition,2009.
2. T. S. Madhava Rao, *Power System Protection: Static Relays withMicroprocessorApplications*,TataMcGraw-HillPublish-ingCompanyLimited,NewDelhi,2ndedition,2004.

III B.Tech. II Semester

14BT60203: **SWITCHGEAR AND PROTECTION**

Internal Marks	External Marks	Total Marks	L	T	PC
30	70	100	3	1	-3

PREREQUISITE(S): Transformers and Induction Machines, Transmission of Electric Power and SynchronousMachines

COURSE DESCRIPTION: Short circuit studies; Fuses and their ratings;
circuitbreakers;relays;staticandmicroprocessorbasedrelays;protection schemes for various equipment and over voltageprotection.

COURSEOUTCOMES:onsuccessfulcompletionofthecourse,studentwill be ableto

1. demonstrate knowledgeon
   - symmetrical component theory and sequencenetworks
   - operation of various protectivedevices.
   - protection principles for power systemcomponents.
2. analyze
   - fault levels for differentfaults
   - operating aspects of protectivedevices
3. designproperprotectionschemefordifferentpowersystemcomponents.
4. demonstrate skills inevaluating
   - operating parameters of various protectingdevices
   - settings of protection devices in different protectionschemes.

DETAILED SYLLABUS:

UNIT-I: FAULT ANALYSIS

Symmetrical component theory - voltages, currents, power, symmetrical componenttransformationmatrix.Sequencenetworks-positive,negative and zero sequence networks. Fault analysis - LG, LL, LLG, LLL &LLLG faults with and without fault impedance, short circuit current and MVA calculations, application of reactors - numericalproblems.

UNIT - II: RELAYS

Introduction - types of relays, electromagnetic Relays - construction,
operationandtorqueequationofinductiontyperelays,differentialrelays and biased differential relays. Characteristics of over current, directional and distance relays(R-X).
Static relays - advantages and disadvantages, block diagram of a basic
staticrelay,definitetime,inverseandinversedefiniteminimumtime(IDM

T) static relays. Comparators - amplitude and phase comparators. Microprocessor based relays - advantages and disadvantages, block diagramforovercurrent(definite,inverseandIDMT)anddistancerelays with flow charts.

UNIT - III: PROTECTION OF GENERATORS AND TRANSFORMERS

Protection of generators - differential protection, restricted earth fault protectionandinterturnfaultprotection,rotorfaultprotection,numerical problems on % windingunprotected.

Transformer protection - differential protection, percentage differential protection, protection against internal faults, Buchholtz relay, numerical problems on design of CT'sratio.

UNIT- IV: PROTECTION OF FEEDERS AND TRANSMISSION LINES

Protection of feeders (Radial and Ring main) using over current relays. Protection of transmission lines - three-zone protection using distance relays, carrier current protection. Protection of busbars.

Protection against Over Voltages: Generation of over voltages in power systems, protection against lightning over voltages - Non-Linear (Valve type)andMetalOxide(Zinc-Oxide)surgearresters.Insulationcoordination, basic impulse insulation level(BIIL).

UNIT - V: CIRCUIT BREAKERS

Fuses - Types, characteristics and their ratings. Isolators. Circuit Breakers - elementary principles of arc interruption, recovery, restriking voltage, restriking phenomenon, average and maximum rate of rise of restriking voltage, current chopping and resistance switching. Construction and principle of minimum oil circuit breaker, air blast circuit breaker, vacuum circuit breaker and SF6 circuitbreaker.

TEXT BOOKS:

1. BadriRam,D.N.Viswakarma,*PowersystemProtectionandSwitchgear*, McGrawHilleducation(India)PrivateLimited,NewDelhi,2nd edition, 2011.
2. SunilS.Rao,*SwitchgearProtectionandPowerSystems(Theory,practice andSolvedProblems)*,KhannaPublishers,NewDelhi,11thedition,2005.

REFERENCE BOOKS:

1. C.L.Wadhwa, *Electrical Power systems*, New Age International (P) Limited, Publishers, New Delhi, 5th edition,2009.
2. T.S.Madhava Rao, *Power System Protection: Static Relays with Microprocessor Applications*, TATA McGraw-Hill Publishing Company Limited, NewDelhi, 2nd edition,2004.

IV B.Tech. - I Semester

(16BT70203) **ENERGY CONSERVATIONAND** MANAGEMENT

(Program Elective-3)

Int. Marks	Ext. Marks	TotalMarks	L	T	P	C
30	70	100	3	1	--	3

PREREQUISITES: Courses on Electrical Measurements and Transmission & Distribution.

COURSE DESCRIPTION:
Principlesofenergyconservation,auditandmanagement;En- ergyefficientmotors,lighting,instrumentsandsignificanceof energyeconomics.

COURSEOUTCOMES:Onsuccessfulcompletionofthecourse, students will be ableto

CO1. demonstrate knowledgeon

- energy auditingpractices.
- energy conservationschemes.
- energyeconomicsandmanagement.

CO2. analyze

- energy conservationmeasures.
- energy auditingpractices.
- energyeconomicsandmanagement.

CO3. designanappropriateenergyconservationschemefor commercial and industrialapplications.

CO4. explorerelevantmethodsofenergyauditinginvarious industries and provide feasible solutions to conserve energy.

CO5. selectandapplyappropriatetechniqueforenergyau diting andconservation.

DETAILED SYLLABUS:

UNIT-I: ENERGY AUDIT AND MANAGEMENT PRINCIPLES

(10 periods)

Energy audit - definitions, concept, types of audit, energy in- dex, cost index, pie charts, Sankey diagrams, load profiles, energy conservation schemes - energy audit of industries - energysavingpotential,energyauditofprocessindustry,ther- malpowerstation,buildingenergyaudit.
Energymanagement-Principlesofenergymanagement,orga- nizingenergymanagementprogram,initiating,planning,con- trolling,promoting,monitoring,reporting.

UNIT-II: ENERGY CONSERVATION PRINCIPLES (08 periods)
Rules for efficient energy conservation - technologies fornenergy conservation - Energy scenario, principles of energy conservation,resourceavailability,energysavings,currenten- ergyconsumptioninIndia,rolesandresponsibilitiesofenergy managers inindustries.

UNIT-III: ENERGY EFFICIENT MOTORS AND LIGHTING

(09 periods) Energy efficient motors - factors affecting efficiency, loss distribution,constructionaldetails,characteristics,variablespeed, variabledutycyclesystems,motorenergyaudit.
Lighting:Goodlightingsystemdesignandpractice,lightingcontrol,lightingenergyaudit.

UNIT-IV: ENERGY INSTRUMENTS AND ECONOMICANALYSIS

(08 periods)

EnergyInstruments-wattmeter,dataloggers,thermocouples, pyrometers,luxmeters,tonguetesters.PLCsandapplications.
EnergyEconomicAnalysis-Thetimevalueofmoneyconcept. Cash flow models, payback analysis, depreciation, taxes and taxcreditnumericalproblems.

UNIT-V:DEMANDSIDEMANAGEMENT (10periods)

Introduction to DSM, concept of DSM, benefits of DSM, differenttechniquesofDSM-timeofdaypricing,multi-utilitypower exchange model, and time of day models for planning. Load management,loadpriorityteчnique,peakclipping,peakshifting,valleyfilling,strategicconservation,energyefficientequipment. Management and organization of energy conservation awarenessprograms.

Total Periods: 45

REFERENCE BOOKS:

1. W.R.Murphy&G.MckayButterworth,*Energymanagement*, Butterworth-Heinemannpublications,2nd edition,2016.
2. AlbertThumann,WilliamJ.Younger,*Handbookofenergyaudits*, Taylor & Francis Ltd, 7th edition,2008.
3. UmeshRathore, *Energy management*, S.K. Kataria & Sons, 2nd edition,2014.
4. W.C.Turner,Stevedoty,*Energymanagementhandbook*,CRC press, 6th edition,2006.
5. D.P. Sen, K.R. Padiyar, IndraneSen, M.A. Pai, *Recent Ad vances in Control and Management of Energy Systems*, Interline Publisher,Bangalore,1993.
6. Ashok V. Desai, Wiley Eastern, *Energy Demand - Analysis, ManagementandConservationHandbookonenergyaudit-ing-TERI(TataEnergyResearchInstitute)*,2005.
7. CraigB.Smith,KellyE.Parmenter,*Energymanagementprinciplesapplications*,benefits,Savings,ElsevierInc(Pergamon Press), 1st edition,2016.

IV B.Tech. IISemester

14BT80207:**ENERGYAUDITANDDEMANDSIDE MANAGEMENT**

(PROFESSIONAL ELECTIVE -IV)

Internal Marks	External Marks	Total Marks	L	T	PC
30	70	100	3	1	-3

PREREQUISITE(S): DistributionofElectricPower,ElectricalandElectronic Measurements, Transmission of Electric Power, Utilization of Electrical Energy, Power System Operation andControl.

COURSEDESCRIPTION: EnergyAuditandenergymanagement;energy efficient motors; lighting and energy instruments; demand side management and significance of energyeconomics.

COURSE OUTCOMES: On successful completion of the course, student will be able to

1. demonstrate knowledgeon
   - energy auditing practices, energy conservationschemes
   - energy indices, graphicalrepresentations
   - energy managementconcepts
   - characteristics of energy efficient motors,

goodlighting 2.analyze
   - various energy instruments such as wattmeter, data loggers, thermocouples, pyrometers, lux meters, tonguetesters
   - payback analysis, depreciation, taxes and tax

credit 3.demonstrate skills in design for good lighting system 4.familiarize demand side managementpractices

DETAILED SYLLABUS:

UNIT - I: PRINCIPLES OF ENERGY AUDIT

Energyaudit-
definitions,concept,typesofaudit,energyindex,costindex, piecharts,Sankeydiagrams,loadprofiles,energyconservationschemes
- energy audit of industries - energy saving potential, energy audit of process industry, thermal power station, building energyaudit.

UNIT - II: ENERGY MANAGEMENT

Principles of energy management, organizing energy management
program,initiating,planning,controlling,promoting,monitoring,reporting. Energy manger, Qualities and functions, language, Questionnaire -check list for topmanagement.

UNIT - III: ENERGY EFFICIENT MOTORS AND LIGHTING

Energy efficient motors - factors affecting efficiency, loss distribution, constructional details, characteristics, variable speed, variable dutycycle systems, motor energyaudit.
Lighting:Goodlightingsystemdesignandpractice,lightingcontrol,lighting energyaudit.

UNIT - IV: ENERGY INSTRUMENTS AND ECONOMIC ANALYSIS

EnergyInstruments-
wattmeter,dataloggers,thermocouples,pyrometers, lux meters, tongue testers. PLCs andapplications.
Energy Economic Analysis - The time value of money concept.cash flow models, payback analysis, depreciation, taxes and tax credit - numerical problems.

UNIT - V: DEMAND SIDE MANAGEMENT

IntroductiontoDSM,conceptofDSM,benefitsofDSM,differenttechniques of DSM - time of day pricing, multi-utility power exchange model, and timeofdaymodelsforplanning.Loadmanagement,loadprioritytechnique, peak clipping, peak shifting, valley filling, strategic conservation, energy
efficientequipment.Managementandorganizationofenergyconservation awarenessprograms.

TEXT BOOKS:

1.W.R.Murphy&G.MckayButterworth,*Energymanagement*,Heineman n publications,2001

2.A S. Pabla, *Electrical Power distribution*,TMH, 5th edition, 2004. 3.Umesh Rathore, *Energy management*, S.K.Kataria& Sons, 2nd edition, 2014.

REFERENCES:

1.W.C.Turner, *Energy management hand book*, John wiley and sons.

2.D.P.Sen, K.R.Padiyar, IndraneSen, M.A.Pai, *Recent Advances in Control andManagementofEnergySystems*,InterlinePublisher,Bangalore,1993.

3.AshokV.Desai,WileyEastern,E*nergyDemand-Analysis,Management and Conservation Hand book on energy auditing - TERI* (Tata Energy Research Institute), 2005

IV B.Tech. - I Semester

(16BT70204)**FLEXIBLEACTRANSMISSION**

SYSTEMS

(Program Elective-3)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	--	3

PREREQUISITES:CoursesonPowerElectronicsandTransmis- sion&Distribution.

COURSE DESCRIPTION:
Conventional AC Power Transmission System; Real and Reac- tivePowerTransmission;loadandlinecompensation;Concepts ofFACTS;CompensationusingFACTSDevicesandControllers; ShuntCompensation,SeriesCompensation,PhaseangleRegu- lationandCombinedcompensation.

COURSEOUTCOMES:Onsuccessfulcompletionofthecourse, students will be ableto
CO1. demonstrate knowledgeon

- realandreactivepowerflowinconventionalsystem.
- concept of FACTS devices andcontrollers.
- shuntandseriescompensationusingFACTSdevices.
- phaseangleregulationandcombinedcompensation. CO2. analyze
- stabilityandvoltageprofileofacompensatedandun compensated transmissionlines.
- Voltageregulation,improvementoftransientstability, prevention of voltage instability, power oscillation damp ingwithvariousFACTSdevicesandcontrollers.

CO3. designsuitablecompensationstrategyforbettervolt ageprofileandsecuredoperationofpowersystem.
CO4. solveproblemsoftransmissionsystemtoprovidefea siblesolutions.
CO5. selectandapplyappropriatedevices,schemesandtech niquesforrealtimeapplicationsinACpowertransmis- sion.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO AC TRANSMISSION SYSTEMS

(10 Periods) Overview of interconnected power system. Power flow in AC systems-Expressionforrealandreactivepowerflowbetween two nodes of a power system, controllable parameters, con- ventionalcontrollersforrealandreactivepowerflows-merits anddemerits.
FACTS - benefits - types of FACTS controllers.

UNIT-II: REACTIVEPOWERCONTROL

(09Periods)
Reactivepower-it'ssignificanceandcontrolinElectricalPower Transmission-Differenttypesofreactivepowercompensation equipmentfortransmissionsystems.Loadcompensation-speci- ficationofloadcompensator.Uncompensatedandcompensated transmissionlines:shuntandseriescompensation.

UNIT-III: STATICSHUNTCOMPENSATION

(11Periods)
Operating characteristics and control schemes of static VAR generators-variableimpedancetype:TCR,TSR,TSC,Switch- ing converter type - STATCOM;

Hybrid VAR generators. Appli- cations of static shunt compensators - Voltage regulation,im- provementintransientstability,preventionofvoltageinstabil- ity,poweroscillationdamping.Comparisonofstaticshuntcom- pensators.

UNIT-IV: STATICSERIESCOMPENSATION **(08Periods)**

Operating characteristics and control schemes of static VAR generators - variable impedance type: GCSC, TSSC, TCSC, Switching converter type: SSSC. Applications of static series compensators- improvementintransientstability,poweroscil- lationdamping.Comparisonofstaticseriescompensators.

UNIT-V:STATICPHASEANGLEREGULATORSANDCOMBINED COMPENSATORS **(07Periods)**

Power flow control by phase angle regulators - operation and control of TCPAR, objectives of TCPAR: improvement of tran- sient stability, power oscillation damping. Principle of UPFC - comparison of UPFC to series compensators and phase angle regulators, control schemes of UPFC, operating principle and characteristics of IPFC.

Total Periods: 45

TEXT BOOKS:

1. T.J.E.Miller,*ReactivePowercontrolinelectricsystems*,Wiley, 1982.
2. NarainG.Hingorani,LasziGyugyi,*UnderstandingFACTS:Con- ceptsandTechnologyofFlexibleACTransmissionSystems*, Wiley-IEEE Press,1999.

REFERENCE BOOKS:

1. Xiao-Ping,Rehtanz,Christian,Pal,Bikash,*FlexibleACTrans- missionSystems:ModelingandControl,SpringerPowerSys- tems Series*,2006.
2. R.MohanMathurandRajivK.Varma,*ThyristorbasedFACTS controllers for Electrical Transmission Systems*, Wiley-IEEE Press,2002.

IV B.Tech. IISemester

14BT80202: **HVDCAND FACTS**

Internal Marks	External Marks	Total Marks	L	T	PC
30	70	100	3	1	-3

PREREQUISITE(S): Power Electronics, Transmission of electric power, Power system operation and control.

COURSE DESCRIPTION: Introduction to high voltage transmission; converterandHVDCsystemcontrol;harmonicsandfilters;FACTSconcepts; static shunt, series compensators and combinedcompensators.

COURSE OUTCOMES: On successful completion of the course, student will be able to

4. demonstrate knowledgeon
   - differentconventionalandmodernmethodsforrealandreactivepower control in transmissionsystem.
   - importance and operation of various HVDC and FACTS controllers in transmissionsystem.
   - Various transformer and converter configurations used for HVDCand FACTScontrollers.
5. analyze different converters and compensators for improving overall performance of the transmissionsystem.
6. extend the applications of HVDC and FACTS devices to improve the overall performance of the transmissionsystem.

DETAILED SYLLABUS:

UNIT - I: INTRODUCTION TO HIGH VOLTAGE DC TRANSMISSION

HVDC transmission system - Introduction, comparison of AC and DC transmission systems, application of DC transmission, types of DC links, typicallayoutofaHVDCconverterstation,introductiontoHVDCconverters, effect of pulse number, analysis of phase bridge circuit with and without overlap, converter bridge characteristics, equivalent circuit for rectifier and inverter configurations. Twelve pulseconverters.

UNIT - II: CONVERTER AND HVDC SYSTEM CONTROL

Principles of DC link control, converter control characteristics, system controlhierarchy.Firinganglecontrol-currentandextinctionanglecontrol, startingandstoppingofDClink.Harmonics-Introduction,generation.AC and DC filters, reactive power

requirements at steady state. Sources of reactive power, static VARsystems.

UNIT - III: FACTS CONCEPTS

Reactive power control in electrical power transmission, principles of conventional reactive power compensators. Introduction to FACTS, flow of power in AC parallel paths, meshed systems, basic types of FACTS controllers, definitions of FACTS controllers, brief description of FACTS controllers.

UNIT - IV: STATIC SHUNT AND SERIES COMPENSATORS

Shunt compensation - objectives of shunt compensation, methods of controllable VAR generation, static VAR compensators - SVC, STATCOM, SVCandSTATCOMcomparison.Seriescompensation-objectivesofseries compensation, thyristor switched series capacitors (TCSC), static series synchronous compensator (SSSC), power angle characteristics, basic operating controlschemes.

UNIT - V: COMBINED COMPENSATORS

Unified power flow controller (UPFC) - Introduction, operating principle, independentrealandreactivepowerflowcontrollerandcontrolstructure . Interline power flow controller (IPFC), generalized and multidimensional FACTScontroller.

TEXT BOOKS:

1.K.R.Padiyar,*HighVoltagePowerTransmissionSystemsTechnologyandSystemInteractions*,NewageinternationalPublishers,NewDelhi,2005.2.Narain G.Hingorani, LasziGyugyi, *Understanding FACTS:ConceptsandTechnologyofFlexibleACTransmissionSystems*,IEEEpress,Delhi,2001.

REFERENCE BOOKS:

1.S Rao, EHVAC, H*VDC Transmission & Distribution Engineering,*Khanna Publishers, Delhi, 3rd edition,2006.

2.Mohan Mathur, Rajiv K.Varma, *Thyristor - based FACTS controllers for Electrical Transmission Systems*, A John Wiley and Sons Publications, 2002.

IV B.Tech. - I Semester

(16BT70205) **POWER SYSTEM AUTOMATION**

(Program Elective-3)

Int. Marks Ext.Marks Total Marks L T P C 30 70

PREREQUISITES: Course on Switchgear and Protection.

COURSE DESCRIPTION:
Power system operation and control, Substation and Distribu- tionautomation;DeregulationandRestructuringofpowersys- tem.

COURSEOUTCOMES:Onsuccessfulcompletionofthecourse, students will be ableto

CO1. demonstrate knowledgeon

- realtimeoperationandcontrolofpowersystem.
- substationanddistributionautomation.
- restructuring of powersystem.

CO2.analyze

- various automationdevices.
- technicalissues.
- restructuredmodelofpowersystem.

CO3. designasuitablearchitectureforsubstationautoma tion.

CO4. examineoperationalandtechnicalissuestoprovidefea sible solutions for substation and distribution automa tion.

CO5. applyprinciplesofDMSframeworktointegratewithreal time powersystem.

CO6. applytheconceptualknowledgeofrealtimeoperation and control of power system in relevance to industry andsociety.

DETAILED SYLLABUS:

UNIT-I:POWERSYSTEMCONTROL (08periods)

Introduction,Decomposition,Operationofpowersystems,or- ganization and operator activities, Investment factor, Control centre,elementsofcomputercontrolsystem.

UNIT-II:POWERSYSTEMAUTOMATION (10periods)

Evolutionofautomationsystems,SCADAinpowersystem,Build- ingblocksofSCADAsystem,Remoteterminalunit,Intelligent electronicdevices,Dataconcentratorsandmergingunits,SCADA communication systems, Master station, Human-machineinter- face, Classification of SCADAsystems.

UNIT-III:SUBSTATIONAUTOMATION (09periods)

Substation automation, conventional automation, New smart devicesforsubstationautomation,newintegrateddigitalsub- station,technicalissues,newdigitalsimulation.Substationau- tomationarchitectures,Substationautomationapplicationsfunc- tions,Benefitsofdatawarehousing.

UNIT-IV:DISTRIBUTIONAUTOMATION (08periods)

IntroductiontoDistributionautomation-Customer,Feederand substation automation, Subsystems in a distribution control center, Distributed Management System(DMS) frameworkinte- gration with subsystems, Advanced real-time DMSapplications, advanced analytical DMS applications, DMS coordination with othersystems.

UNIT-V: POWERSYSTEMRESTRUCTURING (10periods)

Deregulation- need for deregulation, Advantages of deregula- tioninpowersystem;RestructuringModels-PoolCoModel,Bi- lateralModel,HybridModel;Independentsystemoperator(ISO) -RoleofISO;Powerexchange,Marketoperations,Marketpower, Standardcost,Transmissionpricing,Congestionpricing-man- agement ofcongestion.

Total Periods: 45

TEXT BOOKS:

1. Torstencegrell, *Power systems control Technology*,Prentice Hall,1986.
2. MiniSThomasandJohnDMcdonald,*PowerSystemSCADA andSmartGrids*,CRCPress,2015.
3. MShahidehpour,MuwaffaqAlomoush,*Restructuredelectrical powersystemsoperation*,tradingandvolatility,CRCPress, 2001.

REFERENCE BOOKS:

1. JamesNorthcote-GreenandRobertWilson,*ControlandAutomationofElectricalPowerDistributionSystems*,CRCPress, 2013.
2. EdmundHandschin,*RealtimecontrolofElectricPowerSystem*,ElsevierPublishingcompany,1972.

IV B.Tech. - I Semester

(16BT70207) **ANALYSIS OF POWER ELEC**TRONIC CONVERTERS

(Program Elective-4)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	--	3

PREREQUISITES:CoursesonElectricalCircuits,ElectronicDe- vices & Circuits, Analog Electronics Circuits, Linear andDigital ICs and PowerElectronics.

COURSE DESCRIPTION:
Advanced Power semiconductor devices; MOSFET and IGBT- Gate and base drive circuits; 3-, 6- and 12- pulse converters; Switching Regulators; Advanced PWM Techniques.

COURSEOUTCOMES:Onsuccessfulcompletionofthecourse, students will be ableto

CO1. demonstrate knowledge on the characteristics of vari ousspecialpowerswitchingdevices&varioustriggering methodsforMOSFETandIGBT.
CO2. analyzetheperformanceofdifferentpowerconverters subjected to variousloads.
CO3. designthesuitableswitchingregulatorsforappropriate power electronicapplications.
CO4. examinevariousconfigurationsofpowerelectroniccir cuitstoprovidefeasiblesolutions.
CO5. selectanappropriatepowersemiconductordeviceand/ orcircuitforrealtimeapplications.
CO6. applytheconceptualknowledgeofpowersemiconduc tordevicesand/orcircuitsinrelevancetoindustry.

DETAILED SYLLABUS:

UNIT-I: SPECIAL POWER SWITCHING DEVICES

(10 periods) Thyristors:GTOs-Construction,operation,steadystatechar- acteristics and switching characteristics. Construction and op- erationofBCTs,FET-CTHs,ETOs,IGCTs,MCTs,SITHs,ASCR, RCT, SCS and light activated thyristor. Comparison of various thyristors. Transistors:ConstructionandoperationofCOOLMOSandSITs.

UNIT-II:GATE&BASEDRIVECIRCUITS

(10periods)

MOSFETandBJTgatedrivecircuits.Isolationofgateandbase drives - pulse transformer, opto-couplers. Thyristor firing cir- cuits - R, RC firing circuits, photo - SCR isolator, pulse trans-formerisolation,1:6isolationtransformerforinvertergatebiascircuitsandthyristorconvertergatingcircuits.GatedriveICs- MOSFETs and IGBTs. Drive ICs for converters - MOS Gated Driver.

UNIT-III: ANALYSIS OF MULTIPULSE CONVERTERS
(09 periods)

Operation of 3-, 6-, and 12- pulse converters. Performance analysis of 3-, 6-, and 12- pulse converters - Low Order Har- monics (LOH), Total Harmonic Distortion(THD), Power Factor, Ripple Factor, Form Factor, Distortion Factor.

UNIT-IV:SWITCHINGREGULATORS

(08periods)

Design and analysis of buck, boost, buck-boost and cuk converters.ResonantConverters-ZeroVoltageSwitching(ZVS)

andZeroCurrentSwitching(ZCS)converters.

UNIT-V: ADVANCEDPWMTECHNIQUES (08periods)

ModifiedSinusoidalPulseWidthModulation,PhaseDisplacement Control, Trapezoidal Modulation Technique, Staircase Modulation,SteppedModulation,HarmonicInjectionModulation,DeltaModulation.SelectiveHarmonicsElimination(SHE)Technique.

Total Periods: 45

TEXT BOOKS:

1. Muhammad H. Rashid, *Power Electronics: Circuits, Devices andApplications*,PearsonEducation,4th Edition,2013.
2. Ned Mohan, T. M. Undeland, W.P. Robbins, *Power Electron- ics: Converters, Applications and Design*, Wiley, 3rd Edition, 2007.

REFERENCE BOOKS:

1. PCSen,*ModernPowerElectronics*,WheelerpublishingCo, 1st Edition,NewDelhi,1998.
2. BimalKBose,*ModernPowerElectronicsandDrives*,Pearson Education, 2nd Edition,2003.

IV B.Tech. - I Semester

(16BT70208) **POWER QUALITY**

(Program Elective-4)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	--	3

PREREQUISITES: Course on Transmission and Distribution

COURSE DESCRIPTION:

Powerqualityterminology,powerqualityissues,classification; Differentsourcesofpowerqualitydisturbances;Harmonicdis- tortion;Principlesforcontrollingharmonics;Powerqualitymea- suringequipment;Powerqualitymonitoringstandards;Impact ofdistributedgenerationonpowerquality.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. demonstrate knowledgeon

- sourcesofpowerqualitydisturbancesandissues.
- powerqualitymonitoringandmeasuringinstruments.
- power qualitystandards.
- effect of distributed generation on powerquality.

CO2. analyze various power quality issues.

CO3. designasuitableharmonicfilterforcommercialandin dustrialloads.

CO4. investigatevariouspowerqualityissuesandprovidefea siblesolutionsforimprovementofpowerquality.

CO5. selectanduseanappropriateequipmentformonitoring andmeasurementofpowerquality.

CO6. applytheconceptualknowledgeofpowerqualityinrel evance to industry and society.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO POWER QUALITY (08 periods)

Power Quality- definition, terminology, issues, evaluationpro- cedure, responsibilities of the suppliers and users of electric power,powerqualitystandards,CBEMAandITIcurves.

UNIT-II: POWERQUALITYDISTURBANCES (10periods)

Generalclassesofpowerqualityproblems-Impulsiveandoscil- latory transients. Long duration voltage variations - overvolt- age,undervoltage,sustainedinterruption.Shortdurationvolt- age variations- interruption, sag, swell and outage. Sources of sags and interruptions, estimating voltage sag performance - overviewofmitigationmethods.

UNIT-III: FUNDAMENTALSOFHARMONICS (10periods)

Harmonic distortion, voltage versus current distortion,harmon- icsversustransients,powersystemquantitiesundernon-sinu- soidalconditions,harmonicindices.Harmonicsourcesfromcom- mercialandindustrialloads.Effectsofharmonicdistortion.Ap- plied harmonics - harmonic distortion evaluation, principlesof controllingharmonics,devicesforcontrollingharmonicdistor- tion.Harmonicfilterdesignandstandardsonharmonics.

UNIT-IV:POWERQUALITYMONITORING (09periods)

Power quality benchmarking, monitoring considerations,choos- ing monitoring locations, permanent power qualitymonitoring equipment, historical perspective of

power quality measuring instruments. Power quality measurement equipment-types of instruments, assessment of power quality measurementdata, power qualitymonitoring standards.

UNIT-V:DISTRIBUTEDGENERATIONANDGRIDINTERCONNECTION (08periods)

Distributed generation -connection requirements and impacts on the network.Interaction and optimal location of DG-Eigen analysisandvoltageinteraction.PowerqualityinDG-Mitigation of voltage dip during motor start, harmonic effects with DG, voltageflickerandfluctuation.Islandingissues,distributionline compensation-heavy Load and Light load condition, real generation,protectionissuesfordistributedgeneration,technolo- gies for distributed generation, power quality impact fromdif- ferent DGtypes.

Total Periods: 45

TEXT BOOKS:

1. Roger C. Dugan, Mark F. Mc Granaghan, Surya Santoso, H. Wayne Beaty, *Electrical Power Systems Quality*, 3rd edition, TMH Education Pvt. Ltd.,2012.
2. ArindamGhosh,GerardLedwich,*Powerqualityenhancement using custom power devices*, Kluwer academic publishers, 2002.

REFERENCE BOOKS:

1. G.T. Heydt, *Electric Power Quality*, Stars in a circle Publica- tions, 1991.USA.
2. Surajit Chattopadhyaya, Madhuchhanda Mitra, Samarjit Senugupta, *Electrical Power Quality*, Springer Dordrecht Heidelberg London NewYork.
3. Math H. J. Bollen, *Understanding Power qualityproblems,* IEEE Press, 2007.

IV B.Tech. IISemester

14BT80203: **POWER QUALITY**

(PROFESSIONAL ELECTIVE - III)

Internal Marks	External Marks	Total Marks	L	T	PC
30	70	100	3	1	-3

PREREQUISITE(S): Transmission of Electric Power

COURSEDESCRIPTION: Powerqualityterminology,powerqualityissues, classification;interruptions;differentsourcesofpowerqualitydisturbances; harmonicdistortion;harmonicindices;principlesforcontrollingharmonics; powerqualitymeasuringequipment;powerqualitymonitoringstandards; power quality enhancementdevices.

COURSEOUTCOMES: Onsuccessfulcompletionofthiscourse,thestudent will be ableto

1. gainknowledgeonvarioussourcesofpowerqualitydisturbances,power quality issues, standards, measuring equipment and power quality enhancementdevices.
2. analyze the voltage sag, harmonic distortion due to commercial and industrialloads
3. design a suitable harmonic filter for industrialapplication.
4. applysuitablecustompowerdevicesforenhancementofpowerquality
5. practicethepowerqualitystandardsforenhancementofefficiencyand life of electric systems.

DETAILED SYLLABUS:

UNIT- I: INTRODUCTION TO POWER QUALITY

Power Quality - definition, terminology, issues, evaluation procedure, responsibilitiesofthesuppliersandusersofelectricpower,powerquality standards, CBEMA and ITICcurves.

UNIT- II: POWER QUALITY DISTURBANCES

General classes of power quality problems - Impulsive and oscillatory transients,longdurationvoltagevariations-overvoltage,undervoltage, sustainedinterruption,shortdurationvoltagevariations-interruption,sag, swell andoutage. Sources of sags and interruptions, estimating voltage sag performance - overview of mitigationmethods.

UNIT -III: FUNDAMENTALS OF HARMONICS

Harmonicdistortion,voltageVscurrentdistortion,harmonicsVstransients,

powersystemquantitiesundernon-sinusoidalconditions,harmonicindices. Harmonicsourcesfromcommercialandindustrialloads.Effectsofharmonic distortion. Applied harmonics - harmonic distortion evaluation, principles of controlling harmonics, devicesfor controlling harmonic distortion. Harmonic filter design and standards onharmonics.

UNIT -IV: POWER QUALITY MONITORING

Power quality benchmarking, monitoring considerations, choosingmonitoring locations, permanent power quality monitoring equipment, historicalperspectiveofpowerqualitymeasuringinstruments,powerquality measurement equipment - types of instruments, assessment of power quality measurement data, power quality monitoringstandards.

UNIT-V:POWERQUALITYENHANCEMENTUSINGCUSTOMPOWER DEVICES

Custompowerdevices(principleofoperationonly)-introduction,network reconfiguring type - solid state current limiter(SSCL), solid state breaker(SSB), solid state transfer switch(SSTS). Compensating type - distribution static compensator (DSTATCOM), dynamic voltage restorer (DVR), unified power qualityconditioner(UPQC).

TEXT BOOKS:

1.RogerC.Dugan,MarkF.McGranaghan,SuryaSantoso,H.WayneBeaty, *Electrical Power Systems Quality,* 3rd edition, TMH Education Pvt. Ltd., 2012.

2.C. Sankaran, *Power quality,* CRC Press, 2002.

REFERENCE BOOKS:

1. MathH.J.Bollen,*UnderstandingPowerqualityproblems*,IEEEPress, 2007.
2. Arindam Ghosh, Gerard Ledwich, *Power quality enhancementusing custom power devices*, Kluwer academic publishers,2002.

IV B.Tech. - I Semester

(16BT70209) **SMART GRID TECHNOLOGY**

(Program Elective-4)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	--	3

PREREQUISITES: Course on Transmission and Distribution

COURSE DESCRIPTION:

Smartgridbenefitsandrequirements;Distributionmanagement systems,smartsubstations,energymanagementsystems;Smart metersandAMI;Powerqualityinsmartgrids;Communication channels andnetworks.

COURSEOUTCOMES: Onsuccessfulcompletionofthecourse, students will be ableto

CO1. demonstrate knowledgeon
- smartgridinitiativesandtechnologies
- communicationtechnologiesforthesmartgrid
- sensing,measurement,controlandautomation.

CO2. analyzedifferentcommunicationchannelsandnetworks in smartgrid.

CO3. usemoderntechniques/toolstoconvertconventional gridtosmartgrid.

CO4. applyprinciplesofenergymanagementsystemstoin dustrialapplications.

CO5. followtheprotocolsandstandardsforcommunication technologies.

DETAILED SYLLABUS:

UNIT-I:INTRODUCTIONTOSMARTGRID (07periods)

SmartGrid-Keyrequirements,operations,keyfeatures,chal- lenges-technicalandnon-technical,comparisonbetweensmart grid and conventional grid. Concept of smart grid, need for smart grid and smart grid drivers. Functions and benefits of smartgrid.SmartgriddeploymentinIndia.Functionalmodelofa smartgrid.

UNIT-II:TECHNOLOGIESFORTRANSMISSIONANDDISTRI- BUTIONSYSTEMS (12periods)

Distribution system topology. Distribution system tools - Re-moteterminalunit(RTU)anditsarchitecture;DistributionMan- agementSystem(DMS)-functions,featuresandapplications; Voltage/VAR control - devices, fault detection, isolation and servicerestoration;Outagemanagementsystems. Smartsubstation-functions,features,substationautomation, wideareamonitoringsystem(WAMS);Feederautomation- functions. Energy management systems - benefits, functions, duality between DMS and EMS.

UNIT-III:SMARTMETERSANDADVANCEDMETERINGINFRA-STRUCTURE (09periods)

Smartelectricitymeters-evolution,needforsmartmeter,ben-efits,differencesbetweenconventionalandsmartmeter,hard-wareused;Advancedmeteringinfrastructure(AMI)-benefits, drivers,systemmodel,securityrequirements,AMIVsAMR;Com- munication infrastructure and protocols for smart metering - Homeareanetwork(HAN),Neighbourhoodareanetwork(NAN) - protocols and standards for communication; IntelligentElec-tronicDevices(IEDs)-functions,Smartmeterissues.

UNIT-IV: POWER QUALITY MANAGEMENT IN SMART GRID (07 periods) Introduction to power

quality, Electromagnetic compatibility (EMC)insmartgrid,Gridconnectedrenewableenergysources - equipment required, power quality conditioner; Web based powerqualitymonitoring-hardwareandsoftware.Powerqual- ityaudit.

UNIT-V:HIGHPERFORMANCECOMPUTINGFORSMARTGRID APPLICATIONS (10periods)

Introduction,communicationchannels-wiredandwireless,wired Vswireless;Networksusedincommunication-LAN,WAN,HAN, FAN, NAN, IAN, BAN; Communication technologies - Internet protocol,introductiontocloudcomputingandproperties.

Total Periods: 45

TEXT BOOKS:

1. Bharat Modi, AnuPrakash and Yogesh Kumar,*Fundamentals ofSmartGridTechnology*,S.K.Kataria&Sons,2016.
2. JanakaEkanayake, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, Nick Jenkins, *Smart Grid Technology and Appli- cations*,WileyPublications,2012.

REFERENCE BOOKS:

1. JamesMomoh,SmartGrid:*FundamentalsofDesignandAnal sis*,Wiley,IEEEPress,2012.

IV B.Tech. - I Semester

(16BT70231) **POWER SYSTEM - II LAB**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	--	--	3	2

PREREQUISITES: Courses on Matrices and Numerical Methods, Electric Circuits and Transmission & Distribution.

COURSEOUTCOMES:onsuccessfulcompletionofthecourse, students will be ableto

CO1. demonstrateknowledgeon
- • formation of network matrices and parameters of powersystem.
- variousloadflowmethodsandfaults.
- load frequency control and stability of power system.

CO2. analyze
- theformationofpowersystemnetworkmatrices.
- thepowerflowsolutionsusingvariousloadflow techniques.
- various types of power systemfaults.
- load frequencyproblem.
- stabilityfor the stable operation of power system.

CO3. designasuitableoperatingandcontrolstrategytomeet the required specifications of powersystem.

CO4. developprogrammingskillstosolveandsimulatepower systemproblemstoprovideviablesolution.

CO5. selectandapplyappropriatetechniqueforsolvingcomplex problemsinthepowersystems.

CO6. applythe conceptual knowledge of power systems in relevance to industry andsociety.

CO7. committo ethical principles and standards while exercisingthepracticalinvestigationsonpowersystem.

CO8. work individually or in a group in the field of power systems.

CO9. communicate effectively in verbal and written form in power systemdomain.

LIST OF EXPERIMENTS:

Conduct any **TEN** experiments using MATLAB/SIMULINK/PSCAD/ MiPower/PSIM.

1. Determinationofloadparametersfromloadcurve.
2. Determinationoftransmissionlineparameters.
3. Formation ofYbus.
4. Formation ofZbus.
5. Load flowanalysis.
6. Faultanalysis.
7. Rotordynamicsusingswingequation.

8. Transient stabilityanalysis.
9. Economic dispatchproblem.
10. Modeling,simulationandanalysisofAVR.
11. Modeling,simulationandanalysisofLFCinan interconnected powersystem.
12. Power qualityproblems.
13. Determinationoftransformerinrushcurrent.
14. Simulationofcapacitorswitchingtransients.
15. Demonstrationofsoftcomputingtechniquestoolboxes(ANN, FUZZY, GA).

IV B.Tech. I Semester

14BT70222: **POWER SYSTEMSAND**SIMULATION LAB

InternalMarks	ExternalMarks	TotalMarks	L	T	P	C25
	50	75	--	--	3	2

PREREQUISITE(S): Electric circuits lab, Electrical Systems and Simulation

lab, Power System Operation and Control and Power System Analysis

COURSE DESCRIPTION: Relay testing; fault analysis; determination of sub-transient reactance; sequence impedances; sequence components and power angle characteristics of synchronous machine; determination of load flows, simulation of synchronous machine and load frequency problem using MATLAB software

COURSE OUTCOMES: On successful completion of the course, student will be able to

CO 1. demonstrate knowledgeon
- determination of sequence parameters for synchronous machineand transformer.
- power system protection and testing ofrelays.
- The usage ofMATLAB/SIMULINK.
- various load flow methods and load frequency problem

CO 2. analyze
- faults on synchronousgenerator
- thepowerflowinpowersystemnetworkusingvariousloadflowmethods
- protective schemes and testing of relays

CO 3. demonstrate skillsin
- obtaining the power angle characteristics of salient polemachine
- obtaining various relaycharacteristics
- determining phase sequence components of salient pole machine synchronous machine andtransformer
- identifying, selecting and developing suitable protection schemes for reliable operation of power system.

CO 4. applyMATLAB
- to determine Y-bus, Z-bus and power flow in power system network
- to investigate load frequency problem using SIMULINK

CO 5. execute real time projects in the field of power system operation and control.

CO 6. function effectively as individual and as member in a team

CO 7. communicate effectively both oral andwritten

LIST OF EXPERIMENTS:

PART A

Conduct any 6 experiments from thefollowing:

1. Determinationofsub-transientreactance'sforsalientpolesynchronous machine.
2. Determinationofsequenceimpedancesforcylindricalrotorsynchronous machine.
3. Fault analysis for LG, LL and LLGfaults.
4. Reactive power compensation using tap changing transformer.
5. Power angle characteristic of three-phase salient polesynchronous machine.
6. Determination of sequence components for three phase transformer
7. Characteristics of over current relay.
8. Characteristics of over voltage relay
9. Testing of frequency relay.
10. Testing of reverse powerrelay.

PART B

Conduct any 6 experiments from thefollowing:

11. Formationofbusadmittancematrixwithandwithoutoff-nominalratios of transformer of a power system network usingMATLAB
12. Formationofbusimpedancematrixwithandwithoutmutualcouplingof a power system network usingMATLAB
13. Load flow solution by using MATLAB 4.Transient stability analysis usingMATLAB 5.Economic dispatch usingMATLAB

10. Modelingofstandardtestsystemwithgeneratorexcitationandgovernor action usingSIMULINK
11. Modelingandanalysisofautomaticloadfrequencycontrolofmulti-area power system usingSIMULINK
12. Analysis of Transmission line parameters using PSCAD 9.Simulation of Capacitor switching transient using PSCAD 10.Transformer inrush currents measurement usingPSCAD

I B. Tech. – I Semester [CSE, CSSE, IT, CE & ME]

I B. Tech. – II Semester [ECE, EEE & EIE]

(16BT1HS01) TECHNICAL ENGLISH

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	--	3

PRE-REQUISITES: ***English at Intermediate level***

COURSE DESCRIPTION: Introduction to Communication; Active Listening; Effective Speaking; Reading; and Writing.

COURSE OBJECTIVES:

CEO1. To impart knowledge of the nuances of communication.
CEO2. To develop Listening, Speaking, Reading and Writing skills in order to use language effectively in distinct situations.
CEO3. To imbibe an attitude of assimilating language skills in the sequence of locating, retrieving, reporting, evaluating, integrating, and accurately citing in the required context.

COURSE OUTCOMES: On successful completion of this course, the students will be able to

CO1: Demonstrate knowledge in

- Process of communication
- Modes of listening
- Paralinguistic features
- Skimming and Scanning
- Elements of style in writing

CO2: Analyze the possibilities and limitations of language, understanding
- Barriers to Communication
- Barriers to Effective Listening
- Barriers to Speaking
- Formal and metaphorical language

CO3: Design and develop functional skills for professional practice**.**

CO4: Apply writing skills in preparing and presenting documents

CO5: Function effectively as an individual and as a member in diverse teams.

CO6*:* Communicate effectively with the engineering community and society in formal and informal situations**.**

DETAILED SYLLABUS:

UNIT I - **INTRODUCTION TO COMMUNICATION:** **(9 periods)**

Introduction –Language as a Tool of Communication – Communicative Skills (Listening, Speaking, Reading and Writing) – Effective Communication – Modes of Communication – Barriers to Communication (classification)

UNIT II - **ACTIVE LISTENING:** **(9 periods)**

Introduction – Reasons for poor Listening – Traits of a Good Listener – Listening Modes – Types of Listening – Barriers to Effective Listening – Listening for General Content and Specific Information

UNIT III - **EFFECTIVE SPEAKING:** **(9 periods)**

Introduction – Achieving Confidence, Clarity and Fluency – Paralinguistic Features – Barriers to Speaking – Types of Speaking – Persuasive Speaking

UNIT IV - **READING**: **(9 periods)**

Introduction and Reading Rates – Reading and Interpretation – Intensive and Extensive Reading – Critical Reading – Reading for Different Purposes – SQ3R Reading Technique – Study Skills

UNIT V – **WRITING**: **(9 periods)**

Introduction – Language – Elements of Style – Techniques for Good Technical Writing – Referencing and Styling – Right Words and Phrases – Sentences

Total Periods: *45*

TEXT BOOKS:

1. Meenakshi Raman & Sangeetha Sharma, *Technical Communication*, Oxford University Press, New Delhi, 2012.

REFERENCE BOOKS:

1. Ashraf Rizvi*, Effective Technical Communication*, McGraw-Hill Education (India) Pvt.Ltd., New Delhi, 2015.
2. Sanjay Kumar & Pushp Lata, *Communication Skills*, Oxford University Press, New Delhi, 2013.
3. Teri Kwal Gamble and Michael Gamble, *Communication Works*, Tata Mc Graw-Hill, New Delhi, 2010.
4. Rajendra Pal and J.S. Korlahalli, *Essentials of Business Communication*, Sultan Chand and Son, New Delhi, 2010.

14BT1HS01: **TECHNICAL ENGLISH**

I -Year B.Tech.

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100				

COURSE OBJECTIVES:

1. To lay basic foundation and impart knowledge of English language, grammar and communication skills.
2. To develop listening, speaking, reading and writing skills among students needed in their personal, academic and professional pursuits.
3. To train students apply the nuances of English for various communication needs.
4. To build confidence in effective usage of English language.

COURSE OUTCOMES : After completion of the course the students will be able to

1. Acquire fundamental and functional knowledge of English language, grammar and communication skills.
2. Identify and analyze productive skills (speaking and writing) and receptive skills (listening and reading) of English language proficiency for effective communication and practice.
3. Design and develop functional skills for professional practice through English.
4. Communicate effectively with the engineering community and society to comprehend and deliver effective solutions.
5. Inculcate an attitude to upgrade competence of English knowledge and communication to engage in independent and life-long learning.

DETAILED SYLLABUS:

UNIT – I : (10 periods)

My Early Days, **A. P. J. Abdul Kalam** from **Technical English for Engineer**s by Cambridge University Press for India Pvt Ltd. (2014).

Communication: Importance of communication-- Language as a tool of Communication – Communicative Skills (Listening, Speaking, Reading and Writing) – Effective Communication – Verbal and Non-verbal Communication

UNIT – II : (10 periods)

A Speech by N. R. Narayana Murthy from **Technical English for Engineer**s by Cambridge University Press for India Pvt Ltd. (2014).

Listening: Meaning and Art of Listening – Importance of Listening– Traits of a Good Listener - Reasons for poor Listening –Types of Listening – Barriers to Effective Listening

UNIT – III : (10 periods)

The Town by the Sea by Amitav Ghosh from **Technical English for Engineer**s by Cambridge University Press for India Pvt Ltd. (2014).

Speaking: Achieving Confidence, Clarity, and Fluency – Paralinguistic Features – Types of Speaking – Barriers to Speaking.

UNIT – IV : (10 periods)

Dr. C. V. Raman: The Celebrated Genius from **Technical English for Engineer**s by Cambridge University Press for India Pvt. Ltd., (2014).

Reading: Reading and Interpretation—Intensive and Extensive Reading—Critical Reading-- Reading Comprehension-– Techniques for Good Comprehension – SQ3R Reading Technique

UNIT – V : (10 periods)

Lesson Entitled **The Model Millionaire** from **Technical English for Engineer**s by Cambridge University Press for India Pvt. Ltd. (2014).

Writing: Characteristics –– Language –Elements of Style – Techniques for Good Technical Writing – Avoiding Plagiarism and Referencing and Styling.

Total periods: 50

TEXT BOOKS:

1. **Technical English for Engineers***,* Cambridge University Press for India Pvt. Ltd., First Edition, (2014),
2. Meenakshi Raman & Sangeetha Sharma, **Technical Communication**, Oxford University Press, New Delhi, 2012.

REFERENCE BOOKS:

1. M. Ashraf Rizvi, **Effective Technical Communication**, Tata McGraw–Hill, Publishing Company Limited, First Edition, 2005.

2. Martin Hewings, **Advanced English Grammar: A Self Study Reference and Practice Book for Advanced South Asian Students,** Cambridge University press, First South Asian Edition, 1999, New Delhi.

I B. Tech. – I Semester (CSE, CSSE, IT, CE & ME)

I B. Tech. – II Semester (ECE, EEE & EIE)

(16BT1HS31) ENGLISH LANGUAGE LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	0	0	3	2

PRE-REQUISITES: English at intermediate or equivalent level.

COURSE DESCRIPTION: Phonetics; Vocabulary Building; Functional Grammar; Just a Minute; Elocution/Impromptu; Giving Directions/Conversation Starters; Role Play; Public Speaking; Describing People, Places, Objects and Events; Reading Comprehension; Listening Comprehension; Information Transfer.

COURSE OBJECTIVES:

CEO1: To impart the knowledge of native pronunciation through Phonetics.

CEO2: To enhance Listening, Speaking, Reading and Writing skills for effective usage of language in formal and informal situations.

CEO3: To imbibe a positive attitude of learning the language through computer-aided multimedia instructions.

COURSE OUTCOMES: On successful completion of this course the students will be able to

CO1: Demonstrate knowledge in
- Phonetics
- Information Transfer

CO2: Analyze the situations in professional context by using
- Vocabulary
- Grammar

CO3: Design and develop functional skills for professional practice.

CO4: Apply the techniques of Listening and Reading skills to comprehend Listening and Reading comprehension.

CO5: Function effectively as an individual and as a member in diverse teams through
- Extempore talk and
- Role Play

CO6: Communicate effectively in public speaking in formal and informal situations.

CO7: Recognize the need to engage in lifelong learning to upgrade competence of knowledge and communication.

LIST OF EXERCISES:

1. Phonetics
2. Vocabulary Building
3. Functional Grammar
4. Just a Minute
5. Elocution/Impromptu
6. Giving Directions/Conversation Starters
7. Role Play
8. Public Speaking
9. Describing People, Places, Objects and Events.
10. Reading Comprehension
11. Listening Comprehension
12. Information Transfer

Total Lab Slots: 10

TEXT BOOK:

1. Department Lab Manual

REFERENCE BOOKS:

1. D. Sudha Rani, *A Manual for English Language Laboratories*, Pearson, Noida, 2010.
2. D. Sudha Rani, *Advanced Communication Skills Laboratory Manual*, Pearson, Noida, 2012.
3. R. Manivannan and G. Immanuel, *Communication Skills Laboratory*, VK Publications, Sivakasi, 2013
4. Nira Kumar*, English Language Laboratories*, PHI Learning Pvt. Ltd., New Delhi, 2011.

(14BT1HS02) ENGLISH LANGUAGE COMMUNICATION SKILLS LABORATORY

B. Tech. – I year

(Common to All branches of Engineering)

Int. Marks	Ext. Marks	Total Marks	L	T	P
25	50	75	-	-	

COURSE OBJECTIVES:

1. To impart practical knowledge in segmental features, supra-segmental features and Para-linguistic features.
2. To develop language skills for effective communication with clarity and precision in academic, professional and personal situations.
3. To apply the practical knowledge of functional grammar and vocabulary enrichment in effective writing.
4. To develop interest in English language so that the students use it effectively in various formal, informal and neutral situations.

COURSE OUTCOMES:

On the successful completion of the course, the students will / should be able to

1. Gain practical knowledge in
   - English Speech Sounds
   - Stress Patterns in word and sentence
   - Intonation Patterns
   - Paralinguistic Features
   - Vocabulary Enrichment
2. Analyse the functional part of the grammatical elements for writing grammatically correct English in various academic and personal practices.
3. Develop various language functions to fulfil the purpose of speaking and writing in academic, professional and personal contexts
4. Apply the knowledge of the usage of various language software for enhancing the language skills more and more thereby acquiring unconsciously the language functions and elements that are commonly used in various contexts
5. Communicate effectively with engineering community and society in various formal, informal and neutral situations.
6. Demonstrate various language functions by participating in
   - Just A Minute
   - Impromptu Speech
   - Elocution
   - Role Plays
   - Presentations
7. Engage in lifelong learning for the development of the communicative competence for meeting the global challenges.

DETAILED LIST OF EXPERIMENTS / LAB PRACTICE SESSIONS:

1. English Speech Sounds and Phonemic Transcription
2. Word Stress & Sentence Stress
3. Accent, Rhythm and Intonation
4. Paralinguistic Features.
5. Vocabulary Building
   a. Importance of Vocabulary Enrichment in Speaking: Spelling
   b. Synonyms – Antonyms – prefix – Suffixes – One Word Substitutes
      c. Idioms and Phrases – Homophones – Homonyms – Homographs.
6. Functional Grammar
   a. Parts of Speech
   b. Tenses
      c. Change of Speech
      d. Change of Voice
      e. Word Order& Error Correction
      f. Essay Writing
7. Just a Minute, Impromptu Speech & Elocution
8. Role Plays
9. Telephonic Etiquette
10. Listening Skills
11. Describing People, Places and Objects
12. Presentation Skills
13. Information Transfer

REFERENCES :

1. Departmental Lab Manual

I B. Tech. – I/II Semester

(16BT1BS02) ENGINEERING PHYSICS

(Common to all branches)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	- -	3

PRE-REQUISITES: Intermediate / senior secondary Physics

COURSE DESCRIPTION:

Lasers; optical fibers; principles of quantum mechanics; band theory of solids; semiconductors; dielectric properties of materials; acoustics of buildings; superconductors; crystallography and nano materials.

COURSE OBJECTIVES:

CEO1 : To provide the basic knowledge of architectural acoustics, quantum mechanics, lasers, superconductors, optical fibers, semiconductors and nanotechnology.

CEO2 : To develop skills in using semiconductor devices, lasers, and optical fibers.

COURSE OUTCOMES: After completion of the course, a successful student will be able to:

CO1: Acquire basic knowledge of lasers, optical fibers, quantum mechanics, dielectrics, semiconductors, and superconductors, acoustic of buildings, crystallography and nano materials.

CO2: Analyze the construction and working of various laser systems, semiconductor devices, various types of optical fibers and its communication system and nano materials properties.

CO3: Gain skills in designing of lasers, optical fiber cable, semiconductor devices, acoustically good halls and nanomaterials.

CO4: Develop problem solving skills in engineering context.

CO5: Use relevant techniques for assessing ball milling, pulsed laser deposition, pn-junction, Laser

DETAILED SYLLABUS:

UNIT I – LASERS AND FIBER OPTICS (11 periods)

Lasers: Introduction, characteristics of lasers, spontaneous and stimulated emission of radiation, Einstein's coefficients – condition for amplification, population inversion, Nd:YAG laser, Helium-Neon laser, semiconductor laser and applications of lasers.

Fiber optics: Introduction, principle of optical fiber, acceptance angle, acceptance cone and numerical aperture, classification of optical fibers optical fiber communication system and applications of optical fibers.

UNIT II – PRINCIPLES OF QUANTUM MECHANICS AND BAND THEORY OF SOLIDS (07 periods)

Principles of Quantum Mechanics: Introduction, de-Broglie's hypothesis, Schrödinger's one dimensional wave equation (time independent), significance of wave function, particle in a one dimensional potential box, Fermi-Dirac distribution and effect of temperature (qualitative treatment).

Band Theory of Solids: Electron in a periodic potential, Kronig-Penney model (qualitative treatment), origin of energy bands formation in solids, distinction between conductors, semiconductors and insulators based on band theory.

UNIT III – SEMICONDUCTORS AND DIELECTRIC PROPERTIES OF MATERIALS (13 periods)

Semiconductors: Introduction, types of semiconductors, intrinsic carrier concentration, electrical conductivity in semiconductors, drift and diffusion currents, Einstein's relation, Hall effect and its applications, direct and indirect band gap semiconductors, p-n junction, energy band diagram of p-n diode, LED, photo diode and Solar cell.

Dielectric Properties of Materials: Introduction, dielectric constant, electronic, ionic and orientation polarizations (qualitative treatment), local field, frequency dependence of polarizability (qualitative treatment), ferroelectricity.

UNIT IV – ACOUSTICS OF BUILDINGS AND SUPERCONDUCTIVITY (07 periods)

Acoustics of Buildings: Introduction, basic requirement of acoustically good hall, reverberation and time of reverberation, Sabine's formula for reverberation time (qualitative treatment), absorption coefficient of sound and its measurement, factors affecting the architectural acoustics and their remedies.

Superconductivity: Introduction, General properties - Meissner effect, penetration depth, Type-I and Type-II superconductors, flux quantization, Josephson effects, BCS theory (qualitative treatment), applications of superconductors.

UNIT V – CRYSTALLOGRAPHY AND NANOMATERIALS (07 periods)

Crystallography: Introduction, crystal planes, crystal directions and Miller indices, separation between successive (hkl) planes, X-ray diffraction by crystal planes, Bragg's law-powder method.

Nanomaterials: Introduction, principles of nanomaterials, properties of nanomaterials, synthesis of nanomaterials by ball milling and pulsed laser deposition and applications of nanomaterials.

Total Periods: 45

TEXT BOOKS:

1. P. K. Palaniswamy, ***Engineering Physics***, Scitech Publications India Private Limited, 2nd Edition, 2009

REFERENCE BOOKS:

1. Dr. S. Mani Naidu, ***Engineering Physics***, Pearson Education, 1st Edition, 2013.
2. M.N. Avadhanulu, P.G.Kshirsagar, ***A textbook of Engineering Physics***, S.Chand & Company Ltd. Revised edition 2014.
3. K. Thyagarajan, ***Engineering Physics-I***, McGraw-Hill Education (India) Pvt.Ltd. 2015

(14BT1BS01) ENGINEERING PHYSICS
(Common to All Branches of Engineering)

I Year B. Tech.

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	2	1	- -	4

Pre requisite: --
COURSE OBJECTIVES:

1. To provide the basic knowledge of space & time, acoustics principles, quantum mechanics, laser concepts, nanotechnology, superconductors, principles of optical fibers and its communication systems, p-n Junction based devices and zero resistance concepts.
2. To develop skills in using semiconductor devices, lasers, magnetic field intensity and fiber optics.
3. To apply laser techniques and optical fibers in communication technology.

COURSE OUTCOMES:

After completion of the course, a successful student will be able to:

1. Apply the knowledge of lasers and optical fiber technology in communication systems.
2. Analyze and provide basic information to design acoustically good halls, theatres, sound recording rooms, etc.
3. Gain knowledge of crystal directions and planes and for analyzing the complex crystal structure behavior for engineering and medical applications.
4. Use magnetic materials, lasers and superconductors for the benefit of society.
5. Recognize the importance of lasers, optical fibers and superconductors for effective use in engineering applications.

DETAILED SYLLABI:

UNIT-I: LASERS, FIBER OPTICS AND HOLOGRAPHY (18 periods)

Lasers: Introduction, characteristics of laser, principles of lasing action, spontaneous and stimulated emission of radiation, Einstein's coefficients, population inversion, ruby laser, Helium-Neon laser, semiconductor laser, applications of lasers.

Fiber optics: Introduction, construction and working principle of optical fiber, acceptance angle, acceptance cone and numerical aperture, types of optical fibers and refractive index profiles, Attenuation and losses in fibers, optical fiber communication system, applications of optical fibers in sensors and medicine.

Holography: Introduction, construction of a hologram, reconstruction of image from hologram, applications.

UNIT-II: SPECIAL THEORY OF RELATIVITY, ACOUSTICS OF BUILDINGS AND CRYSTALLOGRAPHY (16 periods)

Special Theory of Relativity: Introduction, absolute frame of reference, time dilation, length contraction, addition of velocities, mass-energy equivalence, energy-momentum relation.

Acoustics of Buildings: Introduction, basic requirement of acoustically good hall, reverberation and time of reverberation, Sabine's formula for reverberation time (qualitative treatment), absorption coefficient of Sound and its measurement, factors affecting the architectural acoustics and their remedies.

Crystallography: Introduction, crystal planes, crystal directions and Miller indices, separation between successive (hkl) planes, X-ray diffraction by crystal planes, Bragg's law, Laue and powder methods.

UNIT-III :PRINCIPLES OF QUANTUM MECHANICAS AND BAND THEORY OF SOLIDS (17 periods)

Principles of Quantum Mechanics: Black body radiation – Wien's law, Rayleigh-Jeans law and Planck's law (qualitative), waves and particles, matter waves, de-Broglie's hypothesis, G.P. Thomson experiment, Heisenberg's uncertainty principle, Schrödinger's one dimensional wave equation (time independent), significance of wave function, particle in a one dimensional potential box, Fermi-Dirac distribution and effect of temperature (qualitative treatment only), scattering-source of electrical resistance.

Band Theory of Solids: Electron in a periodic potential, Kronig-Penney model (qualitative treatment), origin of energy band formation in solids, effective mass of electron, distinction between metals, semiconductors and insulators based on band theory.

UNIT-IV: DIELECTRIC PROPERTIES OF MATERIALS AND SEMICONDUCTORS (17 periods)

Dielectric Properties of Materials: Introduction, dielectric constant, electronic, ionic and orientation polarizations (qualitative treatment), local field, Clausius-Mossotti equation, frequency dependence of polarisability (qualitative treatment), ferro and piezo electricity.

Semiconductors: Introduction, intrinsic and extrinsic semiconductors, carrier concentration, electrical conductivity in semiconductors, drift and diffusion, Einstein's relation, Hall effect, direct and indirect band gap semiconductors, p-n junction, energy diagram of p-n diode, diode equation (qualitative), LED, photo diode and solar cell.

UNIT-V :MAGNETIC PROPERTIES OF MATERIALS, SUPERCONDUCTIVITY AND NANOMATERIALS (17 periods)

Magnetic Properties of Materials: Introduction, origin of magnetic moment, classification of magnetic materials into dia, para, ferro, anti-ferro and ferri magnetism, hysteresis, soft and hard magnetic materials.

Superconductivity: General properties, Meissner effect, penetration depth, Type-I and Type-II superconductors, flux quantization, Josephson effects, BCS theory, applications of superconductors.

Nanomaterials: Introduction, surface area to volume ratio, quantum confinement, properties of nanomaterials, synthesis of nanomaterials by ball milling, plasma arcing,

pulsed laser deposition and sol-gel methods, carbon nanotubes-properties and applications, applications of nanomaterials.

Total : 85 periods

TEXT BOOKS :

1. S. Mani Naidu,*Engineering Physics*, Pearson Education, 2013.
2. P. K. Palaniswamy, *Engineering Physics*, Scitech Publications India Private Limited, 2009

REFERENCE BOOKS:

1. R. K. Gaur and S. L. Gupta *, Engineering Physics*, , Dhanpat Rai Publications (P) Ltd., 8th Edition, 2001.
2. M. R. Srinivasan *,Engineering Physics* , New Age International (P) Limited, Publishers, 1st Edition,2010.

I B. Tech. – II Semester

(16BT2BS01) TRANSFORMATION TECHNIQUES AND PARTIAL DIFFERENTIAL EQUATIONS

(Common to all Branches of Engineering)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	--	3

PRE REQUISITE: Intermediate /Senior secondary mathematics

COURSE DESCRIPTION: Fourier series; Fourier integrals and transforms; Laplace transforms; z –transforms; partial differential equations.

COURSE OBJECTIVES:

CEO 1: To impart basic knowledge on Fourier series, Fourier transforms, Laplace transforms, z-transforms and partial differential equations.

CEO 2: To develop skills in analyzing the problems, designing mathematical models, Fourier series, Fourier transforms, Laplace transforms, z-transforms and partial differential equations for the problems in engineering.

COURSE OUTCOMES: After completion of the course a successful student is able to

CO 1 :Acquire basic knowledge in
(a) Fourier series and Fourier transforms
(b) Fourier integrals
(c) Laplace transforms and their applications
(d) z- transforms and their applications
(e) solving partial differential equations
(f) Heat transfer and wave motion

CO 2 : Develop skills in analyzing the
(a) Properties of Fourier series for a given function
(b) Partial differential equations through different evaluation methods
(c) Difference equations through z – transforms
(d) Engineering systems and processes involving wave forms and heat transfer

CO 3 :Develop skills in designing mathematical models for
(a) Problems involving heat transfer and wave forms
(b) Engineering concepts involving, Fourier transforms, Fourier integrals, Laplace transforms, z-transforms and difference equations

CO 4 :Develop analytical skills in solving the problems involving
(a) Fourier series and Fourier transforms
(b) Laplace transforms
(c) Z-transforms and difference equations
(d) Heat transfer and wave motion

CO 5 : Use relevant transformation techniques for
(a) Obtaining Fourier transforms for different types of functions
(b) Laplace transforms
(c) Z- transforms
(d) Partial differential equations

DETAILED SYLLABUS:

UNIT- I : FOURIER SERIES (7 periods)

Fourier series:Determination of Fourier coefficients, convergence of Fourier series (Dirichlet's conditions),Fourier series of even and odd functions, Half-range Fourier sine and cosine expansions.

UNIT- II: FOURIER INTEGRALS AND FOURIER TRANSFORMS (8 periods)

Fourier integral theorem (statement only), Fourier sine and cosine integrals, Fourier transform, Fourier sine and cosine transforms –properties, Inverse transform and finite Fourier transforms.

UNIT-III:LAPLACE TRANSFORMS (12 periods)

Laplace transforms of standard functions. Properties of Laplace transforms. First and second shifting Theorems. Laplace transforms of derivatives and integrals. Inverse transforms. Convolution theorem (without proof), inverse Laplace transforms by convolution theorem. Laplace transform of periodic functions, Applications of Laplace transforms to ordinary differential equations of first and second order with constant coefficients.

UNIT-IV : Z- TRANSFORMS (9 periods)

Z – transforms, inverse Z– transforms, damping rule, shifting rule, initial and final value theorems. Convolution theorem(without proof), solution of difference equations by Z– transforms.

UNIT – V : PARTIAL DIFFERENTIAL EQUATIONS (9 periods)

Formation of Partial differential equations – Solutions of first order linear equations by method of grouping. First and second order equations by method of separation of variables – Solutions of one dimensional Wave equation, Heat equation.

Total no. of periods: 45

TEXT BOOK:

1. T.K.V. Iyengar, B. Krishna Gandhi, S. Ranganatham and M.V.S.S.N. Prasad, ***Engineering Mathematics, vol-1***, S. Chand & Company 13/e,2014.

2. T.K.V. Iyenger, B. Krishna Gandhi, S.Ranganadham and M.V.S.S.N.Prasad, ***Mathematical Methods***, S.Chand and Company, 8/e,2013

REFERENCE BOOKS:

1. Grewal, B.S., ***Higher Engineering Mathematics***, Khanna publishers, Delhi, 42/e,2012
2. Kreyszig, E., ***Advanced Engineering Mathematics***, John Wiley and Sons, Inc., 9/e,2013.

II B. Tech. – II Semester/ III B.Tech – I Semester

(16BT4HS31) SOFT SKILLS LABORATORY

(Common to all Branches)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	0	0	3	2

PRE-REQUISITES:

English Language Laboratory in I B.Tech or English Laboratory at Diploma Level.

COURSE DESCRIPTION:

Body Language; Creative Thinking; Stress Management; Goal Setting; Interpersonal Skills; Leadership Skills; Team Work; Assertiveness; Etiquette; Conflict Management; Report Writing; Group Discussions.

COURSE OBJECTIVES:

CEO1: To impart knowledge of Body Language in order to appreciate non-verbal forms of understanding and expression.

CEO2: To develop the principles in understanding the elements of team, anticipating the problem situation and adopt appropriate steps to remedy.

CEO3: To imbibe an attitude of planning & organizing to set and meet goals.

COURSE OUTCOMES:

On successful completion of this course the students will be able to

CO1: Acquire knowledge in

- Goal Setting
- Creative Thinking
- Leadership Skills
- Team Work

CO2: Analyse the functional knowledge in

- Body Language
- Interpersonal Skills
- Stress Management

CO3: Apply the techniques of soft skills in a problem situation enhanced through multimedia software.

CO4: Function effectively as an individual and as a member in diverse teams.

CO5: Communicate effectively in public speaking in formal and informal situations.

LIST OF EXERCISES:

1. Body Language
2. Creative Thinking
3. Stress Management
4. Goal Setting
5. Interpersonal Skills
6. Leadership Skills
7. Team Work
8. Assertiveness
9. Etiquette
10. Conflict Management
11. Report Writing
12. Group Discussions

Total Lab Slots: 10

TEXT BOOKS:

1. Department Lab Manual.

REFERENCE BOOKS:

1. R. C. Sharma & Krishna Mohan, *Business Correspondence and Report Writing*, Tata McGraw-Hill Publishing Company Limited, Third Edition, New Delhi, 2012.
2. Gopalswamy Ramesh and Mahadevan Ramesh, *The Ace of Soft Skills*, Pearson, Noida, 2010.
3. Jeff Butterfeild, *Soft Skills for Everyone*, Cengage learning, Delhi, 2011.
4. Barun K. Mitra, *Personality Development and Soft Skills*, Oxford University Press, Noida, 2012.

SUGGESTED SOFTWARE:

1. English Language Communication Skills Laboratory Software – SOFTX Technologies Pvt. Ltd., Hyderabad.
2. GEMS – Globarena E- Mentoring System.
3. Speech Solutions.
4. English Pronunciation Dictionary by Daniel Jones.
5. Learning to Speak English 8.1, The Learning Company – 4 CDs.
6. Mastering English: Grammar, Punctuation and Composition.
7. English in Mind, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
8. Dorling Kindersley Series of Grammar.
9. Language in Use 1, 2 & 3.
10. Cambridge Advanced Learner's Dictionary - 3rd Edition.
11. Centronix – Phonetics.
12. Let's Talk English, Regional Institute of English South India.
13. The Ultimate English Tutor.

III B. Tech. – II Semester / IV B. Tech. – I Semester

(16BT6HS05) FRENCH LANGUAGE (La Langue Francais)

(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	- -	3

PRE-REQUISITES

COURSE DESCRIPTION: Oral communications; Basic grmmar; ;advancedgrammar;basic writing; Business French (La Francais Commercial)

COURSE OBJECTIVES:

CEO1. To impart knowledge of the nuances of communication.
CEO2. To develop Speaking and Writing skills in order to use French language effectively in distinct situations.

COURSE OUTCOMES: On successful completion of this course, the students will be able to

CO1: Demonstrate knowledge in

- Process of communication
- Modes of listening
- Paralinguistic features
- Skimming and Scanning
- Elements of style in writing

CO2: Analyze the possibilities and limitations of language, understanding

- Barriers to Communication
- Barriers to Effective Listening
- Barriers to Speaking
- Formal and metaphorical language

CO3: Design and develop language skills for professional practice**.**

CO4: Apply basic writing skills in writing Emails and understanding wide range of technical terminologies.

CO5: Understand French culture and civilization.

CO6*:* Communicate effectively with the native French in day to day situation**.**

DETAILED SYLLABUS

UNIT I –ORAL COMMUNICATION: (9 periods)

Introduction - Language as a Tool of Communication, French alphabets, Phonetics and pronunciation, making contacts, giving information, Arranging things, Expression of feelings.

UNIT II –BASIC GRAMMAR: (9 periods)

Introduction –Articles, -Er ending Verbs, Nouns, Numbers, Gender, Pronouns, Sentence structure – Case study.

UNIT III –ADVANCED GRAMMAR: (9 periods)

Introduction -Adjectives, Prepositions, Introduction to tenses – Present tense, past tense and future tense, Active and Passive voice.

UNIT IV –BASIC WRITING: (9 periods)

Introduction -Introduction to written communication, Pre-writing, Creating context for writing and Data collection, fill in forms, Write greeting cards, Invitations and Short personal announcements, Short text to describe photos and pictures.

UNIT V –BUSINESS FRENCH (La Francais Commercial) (9 periods)

Introduction - E-mail writing, Letter writing, Learning technical vocabulary and its application.

Case study of influential French companies, Learning computer/desktop/new age- media vocabulary, Introduction to how to present a topic, Fixing an Appointment

Total Periods: 45

TEXT BOOKS:

1. Annie Berther, ***Alter Ego*** , Hachette Publications, 2012

REFERENCE BOOKS:

1 Regine Merieux, Yves Loiseau, ***Connexions*** , Goyall Publishers, 2011
2 Delphine Ripaud, ***Saison***, French and Euroean Inc., 2015

III B. Tech. – II Semester / IV B. Tech. – I Semester

(16BT6HS06) GERMAN LANGUAGE

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES

COURSE DESCRIPTION: Oral communication; Basic grammar; Advanced grammar; Basic writing; Business German

COURSE OBJECTIVES:

CEO3. To impart knowledge of the nuances of communication.
CEO4. To develop Speaking and Writing skills in order to use German language effectively in distinct situations.
COURSE OUTCOMES: On successful completion of this course, the students will be able to

CO1: Demonstrate knowledge in

- Process of communication
- Modes of listening
- Paralinguistic features
- Skimming and Scanning
- Elements of style in writing

CO2: Analyze the possibilities and limitations of language, understanding

- Barriers to Communication
- Barriers to Effective Listening
- Barriers to Speaking
- Formal and metaphorical language

CO3: Design and develop language skills for professional practice**.**

CO4: Apply basic writing skills in writing Emails and understanding wide range of technical terminologies.

CO5: Understand German culture and civilization.

CO6: Communicate effectively with the native German in day to day situation**.**

DETAILED SYLLABUS

UNIT I –ORAL COMMUNICATION: (9 periods)

Introduction - Language as a Tool of Communication, German alphabets, Phonetics and pronunciation, making contacts, giving information, Arranging things, Expression of feelings.

UNIT II –BASIC GRAMMAR: (9 periods)

Introduction –Articles, Verbs, Nouns, Numbers, Gender, Pronouns, Sentence structure – Case study.

UNIT III –ADVANCED GRAMMAR: (9 periods)

Introduction -Adjectives, Prepositions, Introduction to tenses – Present tense, past tense and future tense, Active and Passive voice, Introduction to Case- Akkusativ, Nominativ, Dativ&Genetiv Case.

UNIT IV –BASIC WRITING: (9 periods)

Introduction -Introduction to written communication, Pre-writing, Creating context for writing and Data collection, fill in forms, Write greeting cards, Invitations and Short personal announcements, Short text to describe photos and pictures.

UNIT V –BERUFSDEUTCSCH (BUSINESS GERMAN): (9 periods)

Introduction - E-mail writing, Letter writing, Learning technical vocabulary and its application.

Case studies of influential German companies, Learning computer/desktop/new age- media vocabulary, Introduction to how to present a topic, Fixing an Appointment.

Total Periods: 45

TEXT BOOKS:

1. Heuber, ***Tangram Aktuelleins***, Heuber Verlag Publications , 2011.

REFERENCE BOOKS:

1. Anta Kursisa, Gerhard Newner, Sara vicenta, ***Fir fuer Deutsch 1 und Deutsch 2,*** Heuber Verlag Publications, 2005
2. Herman Funk, ***Studio D A1***, Cornelsen GOYAL SAAB Publication, 2011.

III B. Tech. – II Semester / IV B. Tech. – I Semester

(16BT6HS07) INDIAN CONSTITUTION

(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P
30	70	100	3	1	0

PRE-REQUISITES: ---

COURSE DESCRIPTION: Elements, functions and functionaries according to Indian Constitution, understanding for better professional practice and good citizenry

COURSE OBJECTIVES:

CEO1: To familiarize the students with parliamentary proceedings, legislature, and administration federal system and judiciary of India, civil services, Indian and international politics

CEO 2: To imbibe attitude for ethical behavior and attitude within provision of Constitution

COURSE OUTCOMES: After successful completion of the course the students will be able to

CO1: Gain knowledge in

- parliamentary proceedings, laws, legislature, administration and its philosophy
- federal system and judiciary of India
- socials problems and public services like central civil services and state civil services
- Indian and international political aspects and dynamics

CO2 : Develop etiquette and professional behavior in line with the constitution of India for becoming a responsible citizen

DETAILED SYLLABUS :

UNIT- I : PREAMBLE AND ITS PHILOSOPHY (8 periods)

Introduction and Evolution of Indian Constitution, preamble and its Philosophy.

UNIT- II :UNION GOVERNMENT (8 periods)

Powers, Functions and Position of President, Vice-President and Council of Ministers, Composition of parliament, Constitution Amendment Procedure, Financial Legislation in Parliament.

UNIT-III :FEDERAL SYSTEM (14 periods)

Centre-State relations, Directive Principles of State Policy, Fundamental Rights and Duties, Centre-State Relations, Features of Federal System, Administrative Relationship between Union and States, Powers, Functions and Position of Governors, Function of Chief Ministers, Council of Ministers, Composition and powers of the State Legislature.

UNIT-IV :JUDICIARY AND PUBLIC SERVICES (10 periods)

The Union Judiciary - Supreme Court and High Court, All India Services, Central Civil Services, State Services, Local Services and Training of Civil Services.

UNIT-V : INTERNATIONAL POLITICS (5 periods)

Foreign Policy of India, International Institutions like UNO, WTO, SAARC and Environmentalism.

Total periods : 45

TEXT BOOK:

1. Briji Kishore Sharma, ***Introduction to the Constitution of India***, Prentice Hall of India, 2005.

REFERENCE BOOKS:

1. Mahendra Pal Singh,V. N. Shukla's ***Constitution of India***, Eastern Book Company, 2011.
2. Pandey J. N., ***Constitutional Law of India*** - Central Law Agency, 1998

III B. Tech. – II Semester / IV B. Tech. – I Semester

(16BT6HS08) INDIAN ECONOMY

(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	0	3

PRE-REQUISITES: --

COURSE DESCRIPTION:
Introduction; Time Value of Money; Elementary Economic Analysis; Value Analysis/Value Engineering; Economic Planning.

COURSE OBJECTIVES:

CEO1: To familiarize the students with the concept of elementary principles of Indian economy and their operational significance from engineering perspective.
CEO2: To develop skills for effective use of principles of economy in firm/industry/corporation in public or private sector.

COURSE OUTCOMES: On successful completion of this course the students will be able to

CO1: Acquire the knowledge in
- Micro and Macro Economics.
- Traditional and Modern methods of Capital Budgeting.
- Five year plans and NITI Aayog.

CO2: Analyze
- Capital Budgeting.
- Value Analysis and Value Engineering.
- Economic analysis
- Law of supply and demand

CO3 : Ability to understand the nuances of project management and finance

DETAILED SYLLABUS:

UNIT – I: INTRODUCTION (9 Periods)
Economics- Flow in an Economy, Law of Supply and Demand; Micro and Macro Economics; Relationship between Science, Engineering, Technology, and Economic Development; Concept of Engineering Economics-Types of Efficiency, Definition and Scope of Engineering Economics.

UNIT – II: TIME VALUE OF MONEY (12 Periods)
Concepts and Application; Capital Budgeting-Traditional and Modern Methods; Simple and Compound Interest, Cash Flow Diagram, Principle of Economic Equivalence; Evaluation of

Engineering Projects – Present Worth Method, Future Worth Method, Annual Worth Method, Internal Rate of Return Method, Cost-benefit Analysis in Public Projects; Depreciation Policy-Depreciation of Capital Assets, Causes of Depreciation, Straight Line Method and Declining Balance Method.

UNIT – III: ELEMENTARY ECONOMIC ANALYSIS (9 Periods)

Economic Analysis – Meaning, Significance, Simple Economic Analysis; Material Selection for a Product, Substitution of Raw Material; Design Selection for a Product; Material Selection-Process Planning, Process Modification.

UNIT - IV: VALUE ANALYSIS/VALUE ENGINEERING (6 Periods)

Introduction- Value Analysis, Value Engineering, Functions, Aims; Value Analysis vs. Value Engineering; Value Engineering Procedure- Advantages, Application Areas.

UNIT- V: ECONOMIC PLANNING (9 Periods)

Introduction- Need For Planning in India, Five year plans(1951-2012), NITI Aayog (from 2014 onwards); Inclusive Growth-Meaning, Significance, Need for inclusive growth in India, Strategy for more inclusive growth, Challenges and Prospects; Employment and Inclusive Growth in India, Role of engineers in sustaining inclusive growth.

Total Periods: 45

TEXT BOOKS

1. Panneerselvam R. ,***Engineering Economics*** , PHI Learning Private Limited, Delhi , 2/e,2013.
2. Jain T.R., V. K.Ohri, O. P. Khanna. ***Economics for Engineers***. VK Publication, 1/e, 2015.

REFERENCE BOOKS

1. Dutt Rudar & Sundhram K. P. M.***Indian Economy***.S. Chand, New Delhi, 62 revised edition 2010.
2. Misra, S.K. & V. K. Puri. ***Indian Economy*****: Its Development Experience.** Himalaya Publishing House, Mumbai 32/e ,2010.

III - B. Tech. II -Semester./ IV - B. Tech. I - Semester

(16BT6HS09) INDIAN HERITAGE AND CULTURE

(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	0	3

PRE-REQUISITES: ---

COURSE DESCRIPTION: Basic traits of Indian Culture; Humanistic Reforms under Jainism and Buddhism; Culture in the medieval period; Socio Religious reforms in Indian Culture; Reform movements for harmonious relations.

COURSE OBJECTIVES:

CEO1. To impart the knowledge on history of India and process of evaluation of Indian Culture and its importance.

CEO2. To develop analytical mind on the administrative hierarchies through the study of ancestral administration and study its relevance to the existing administrative set up

CEO3. To imbibe an attitude of having harmonious relations within society.

COURSE OUTCOMES: On successful completion of this course, the students will be able to

CO1: Acquaint knowledge in

(a) human aspirations and values in Vedic culture.
(b) cultural aspects of Buddhism and Jainism
(c) unification of our country under Mourya's and Gupta's administrations
(d) socio Religious aspects of Indian culture
(e) reform movements and harmonious relations.

CO2 : Apply ethical principles and reforms as models for the upliftment of the societal \ status in the present cultural contexts

DETAILED SYLLABUS:

UNIT I - : BASIC TRAITS OF INDIAN CULTURE (9 periods)

Meaning and definition and various interpretations of culture. Culture and its features. The Vedic and Upanishadic culture and society. Human aspirations and values in these societies. Chaturvidha purushardhas, Chaturashrma and Chaturvarna theory.

UNIT II - : HUMANISTIC REFORMS UNDER JAINISM AND BUDDHISM (9 periods)

Salient features of Jainism - contributions of Jainism to Indian culture. Contributions of Aachaarya and Mahaapragya. Buddhism as a humanistic culture. The four noble truths of Buddhism. Contributions of Buddhism to Indian culture.

Unit- III : CULTURE IN THE MEDIEVAL PERIOD (9 periods)

Unifications of India under Mouryas and Guptas and their cultural achievements. Cultural conditions under satavahanas. Contributions to pallavas and cholas to art and cultural achievements of vijayanagara rulers.

Unit- IV : SOCIO RELIGIOUS REFORMS IN INDIAN CULTURE (9 periods)

Western impact on India, Introductin of western education, social and cultural awakening and social reform movements of Rajaramohan Roy - Dayanandha Saraswathi- Anne Besant. (theosophical society)

Unit- V : REFORM MOVEMENTS FOR HARMONIOUS RELATIONS (9 periods)

Vivekananda, Eswarchandra vidyasagar and Veeresalingam- emancipation of women and struggle against caste. Rise of Indian nationalism. Mahatma Gandhi- Non violence and satyagraha and eradication of untouchability .

Total Periods: *45*

TEXT BOOKS:

1. Valluru Prabhakaraiah, ***Indian Heritage and Culture***, Neelkamal Publications Pvt. Ltd. Delhi, 1/e , reprint 2015.

REFERENCE BOOKS:

1. L. P. Sharma, ***History of Ancient India***, Konark Publishers, Pvt. Ltd. New Delhi, 2010.
2. L. P. Sharma, ***History of Medieval India***, Konark Publishers, Pvt. Ltd. New Delhi, 2010.
3. L. P. Sharma, ***History of Modern India***, Konark Publishers, Pvt. Ltd. New Delhi, 2010.
4. The Cultural Heritage of India Vol-I, II, III, IV, V, The Ramakrishna Mission Institute of Culture, Calcutta.

III B. Tech. – II Semester / IV B. Tech. – I Semester

(16BT6HS10) INDIAN HISTORY

(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	0	3

PRE-REQUISITES: ----

COURSE DESCRIPTION: Introduction; Ancient India; Classical and Medieval era; Modern India; India after independence.

COURSE OBJECTIVES:

CEO1: To familiarize the students with elements of Indian history by which they could correlate contemporary issues and problems in Indian society.
CEO 2: To develop analytical skills on social processes of civilizations, modernization and social change

CEO 3: To imbibe culture that will enhance them to be better citizens of the nation

COURSE OUTCOMES: After successful completion of the course the students will be able to

CO 1: Gain knowledge on evolution and history of India as a nation

CO2: Analyze social and political situations of past and current periods

CO3: Practice in career or at other social institutions morally and ethically

DETAILED SYLLABUS:

UNIT-I : INTRODUCTION (8 periods)

Elements of Indian History; History Sources: Archaeology, Numismatics, Epigraphy & Archival research; Methods used in History; History & historiography; sociological concepts-structure, system, organization, social institutions, Culture and social stratification (caste, class, gender, power), State& Civil Society.

UNIT-II : ANCIENT INDIA (9 periods)

Mohenjo-Daro civilization; Harappa civilization; Mauryan Empire.

UNIT -III: CLASSICAL & MEDIEVAL ERA (12 periods)

Classic Era (200 BC - 1200 AD); Hindu - Islamic Era (1200 - 1800 AD).

UNIT-IV: MODERN INDIA (6 periods)

Age of Colonialism (17th - 19th centuries); First war of Indian Independence; Freedom Struggle (1857-1947).

UNIT-V :INDIA AFTER INDEPENDENCE (1947 -) (10 periods)

The Evolution of the Constitution and Main Provisions; Consolidation of India as a Nation; Politics in the States; Indian economy; Modernization and globalization, Secularism and communalism, Nature of development, Processes of social exclusion and inclusion, Changing
Nature of work and organization.

Total periods : 45

TEXT BOOK:

1. K. Krishna Reddy, ***Indian History***, Tata McGraw-Hill, 21st reprint,2017

REFERENCE BOOKS:

1. Guha, Ramachandra, ***India after Gandhi***, Pan Macmillan,2007 Thapar, Romila, ***Early India***, Penguin, 2002

III B. Tech. – II Semester (CSE, CSSE, IT, CE & ME)

IV B. Tech. – I Semester (ECE, EEE & EIE)

(16BT6HS11) PERSONALITY DEVELOPMENT

(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	0	3

PRE-REQUISITES: Soft Skills Lab

COURSE DESCRIPTION:

Self-esteem & Self-Management; Developing Positive Attitudes; Self-Motivation & Self-Management; Getting Along with the Supervisor; Workplace Success.

COURSE OBJECTIVES:

CEO1: To make students understand the concept and components of personality and thereby to apply the acquired knowledge to themselves and mould their personality.

CEO2: To impart training for positive thinking, that enables the students to be in a good stead to face the challenges,

CEO3: To imbibe an attitude of planning & organizing to set and meet goals.

COURSE OUTCOMES: On successful completion of this course the students will be able to

CO1: Demonstrate knowledge in

- Self-Management
- Planning Career

CO2: Analyze the situations based on

- Attitudes
- Thinking strategies

CO3: Design and develop the functional skills for professional practice in

CO4: Function effectively as an individual and as a member in diverse teams.

CO5: Communicate effectively in public speaking in formal and informal situations.

DETAILED SYLLABUS:

UNIT – I: SELF-ESTEEM & SELF-IMPROVEMENT (9 Periods)

Know Yourself – Accept Yourself; Self-Improvement: Plan to Improve - Actively Working to Improve Yourself.

Case study: 1

UNIT – II: DEVELOPING POSITIVE ATTITUDES (9 Periods)

How Attitudes Develop – Attitudes are Catching – Improve Your Attitudes.

Case study: 2

UNIT – III: SELF-MOTIVATION & SELF-MANAGEMENT (9 Periods)

Show Initiative – Be Responsible Self-Management; Efficient Work Habits – Stress Management – Employers Want People Who can Think – Thinking Strategies.

Case study: 3

UNIT – IV: GETTING ALONG WITH THE SUPERVISOR (9 Periods)

Know your Supervisor – Communicating with Your Supervisor – Special Communications With Your Supervisor – What Should You Expect of Your Supervisor? – What Your Supervisor Expects of You - Moving Ahead Getting Along with Your Supervisor.

Case study: 4

UNIT - V: WORKPLACE SUCCESS (9 Periods)

First Day on the Job – Keeping Your Job – Planning Your Career – Moving ahead.

Case study: 5

Total Periods: 45

TEXT BOOK:

1. Harold R. Wallace and L. Ann Masters, *Personality Development*, Cengage Learning, Delhi, Sixth Indian Reprint 2011.

REFERENCE BOOKS:

1. Barun K. Mitra, *Personality Development and Soft Skills,* Oxford University Press, New Delhi, 2011.
2. Stephen R. Covey, *The 7 Habits of Highly Effective People*, Free Press, New York, 1989
3. K. Alex, *Soft Skills*, S. Chand & Company Ltd, New Delhi, Second Revised Edition 2011.
4. Stephen P. Robbins and Timothy A. Judge*, Organizational Behaviour*, Prentice Hall, Delhi, 16th Edition 2014.

III B. Tech. – II Semester / IV B. Tech. – I Semester

(16BT6HS12) PHILOSOPHY OF EDUCATION

(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	0	3

PRE-REQUISITES: ---

COURSE DESCRIPTION: Introduction to Philosophy and Engineering Education; Philosophical methods and their implications in engineering; Philosophical education in India; Values and Engineering education; Outcome based education.

COURSE OBJECTIVES:

CEO1: To familiarize the students with the fundamentals of educational philosophical methods.

CEO2: To impart skills in applying the contextual knowledge of Engineering education and responsibilities.

CEO3: To imbibe an attitude to inculcate and implement values of engineering education.

COURSE OUTCOMES: On successful completion of this course the students will be able to

CO1: Acquire knowledge in

- Philosophy of Engineering education.
- Philosophical Methods.
- Knowledge acquiring methods.
- Engineering education and responsibilities.

CO2: Understand the impact of Outcome Based Education for effective educational outcomes

CO3: Apply reasoning to assess societal issues with the contextual knowledge of engineering education and responsibilities.

DETAILED SYLLABUS :

Unit- I:INTRODUCTION TO PHILOSOPHY ANDENGINNERING EDUCATION (9 periods)

Concept , Significance, and Scope of Philosophy in Engineering – Aims of Engineering Education – relationship between philosophy and engineering education – speculative, normative and critical approaches of philosophy in engineering.

Unit- II :PHILOSOPHICAL METHODS AND THEIR IMPLICATIONS IN ENGINEE RING (9 periods)

Introduction to Philosophical approaches: Idealism, Naturalism, Pragmatism, Realism and Existentialism; Significance and Scope in Engineering Education.

Unit: III :PHILOSOPHICAL EDUCATION IN INDIA (9 periods)

Different branches of philosophy- meaning, Epistemology: nature and scope; Knowledge acquiring methods; Kinds and instruments of knowledge; Re-shaping of educational thoughts by Indian thinkers: Rabindranath Tagore, Sri Aurobindo Gosh, Mahatma Gandhi, Jiddu Krishnamurthy and Swamy Vivekananda.

Unit- IV:VALUES AND ENGINEERING EDUCATION (9 periods)

Introduction; Engineering education and responsibilities: health, social, moral, ethics aesthetic; Value: crisis and strategies for inculcation;
Case study: Engineering Solutions given by Mokshagundam Visvesvaraya

Unit-V :OUTCOME- BASED EDUCATION (9 periods)

Institutional visioning ;educational objectives ; programme outcomes , curriculum, stakeholders, infrastructure and learning resources ; governance and management, quality in education.

Total periods: 45

TEXT BOOKS :

1. Ganta Ramesh, ***Philosophical Foundations of Education***, Neelkamal Publications, 1/e,2013
2. Carl Micham, ***Thinking through technology(The Paths between Engineering and Philosophy)***.University of Chicago Press, 1/e,1994.
3. Louis L Bucciarelli, ***Engineering Philosophy,*** Delft University Press,1/e, 2003.
4. NBA/ABET Manuals.

REFERENCE BOOKS :

1. Louis L Bucciarelli, ***Philosophy of Technology and Engineering Sciences***, North Holland, 1/e, 2009 (e-book).
2. Samuel Florman, ***Existential pleasures of education***. Martins's Griffin S.T. publication, 1/e, 1992.

III B. Tech. – II Semester / IV B. Tech. – I Semester

(16BT6HS13) PUBLIC ADMINISTRATION

(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	0	3

PRE-REQUISITES: Nil

COURSE DESCRIPTION:
Introduction; Public Policy; Good Governance; E-Governance; Development Administration.

COURSE OBJECTIVES:

CEO1: To familiarize the students with the theories, concepts and practices of public administration from engineering perspective.

CEO2: To develop critical thinking and problem solving skills for effective practice of Good Governance and Administrative Development that are applied in the chosen domain.

CEO3: To imbibe an attitude of understanding and implementing administration policies for sustainable development in distinguished sectors.

COURSE OUTCOMES: On successful completion of this course the students will be able to

CO1: Acquireknowledge in

- Public Policy.
- Good Governance.
- E-governance.
- Development Administration.
-

CO2: Analyze the possibilities and limitations of existing policies through Good Governance perspective.

CO3: Design and develop solutions in e-governance models to find and provide opportunities in e-governance.

CO4: Adopt principles of e-governance in addressing the existing issues and challenges in e-governance sector.

CO5: Understand the significance of Administrative Development in finding professional engineering solutions by probing

- Bureaucracy.
- Role of civil society.

DETAILED SYLLABUS :

UNIT – I: INTRODUCTION (9 Periods)

Public and Private Administration- Differences and Similarities, Meaning, Scope; Importance of Public Administration in Modern Era; Public Administration and its implications in the field of Engineering.

Case Study: Unique Identification Authority of India (UIDAI):Aadhaar Project: Challenges Ahead

UNIT – II: PUBLIC POLICY (9 Periods)

Meaning and Scope; Policy Formulation in India; Policy making process; Policy Implementation

Engineering and Public Policy, Social, ethical, Monetary and fiscal policies; policy implications of engineering; The engineer's role in Public Policy.

Case Study: NITI Aayog: Demonetization and Aftermath of Demonetization – Cashless transactions.

UNIT – III: GOOD GOVERNANCE (9 Periods)

Significance; Objectives; Concepts; Reforms; Organization and its basic problems Administrative and Governance reforms in India; Sustainable and Inclusive growth in India; Engineering and Sustainable Environment-Role of Engineers; Right to information Act

Case Study: Strategies in Good Governance: A Case Study of Karnataka, Kerala and Orissa.

UNIT – IV: E-GOVERNANCE (9 Periods)

Meaning, Significance, Issues in E-governance; E-governance Models, Problems and Opportunities; Application of Data Warehousing and Data Mining in Governance; Engineers role in re-engineering E-governance.

Case Study: e-Housing System for Bhavana Nirman Dhanasahayam Online disbursement of housing assistance in Kerala.

UNIT - V: DEVELOPMENT ADMINISTRATION (9 Periods)

Introduction; Development Administration-Administrative Development- Sustainable Development -Significance- Objectives; Bureaucracy - Personnel administration and human resources development; Role of civil society-Citizens and administration; Development and Engineering: Issues Challenges and Opportunities.

Case Study: Neeru-Chettu (Water-Tree) of Andhra Pradesh.

Case Study: TPDDL of Delhi and Odisha.

Total Periods: 45

TEXT BOOKS

1. M.P. Sharma, B.L. Sadana, HarpreetKaur. ***Public Administration in Theory and Practice***. KitabMahal, Mumbai, 1/e,2014.
2. CSR Prabhu, ***E. Governance – concepts and case studies***.PHI, New Delhi, 2/e 2012.

REFERENCE BOOKS

1. Surendra Munshi, Bijupaul Abraham ***Good Governance, Democratic societies and Globalization***, Sage publications, New Delhi,1/e ,2004.

2. R.K.Sapru, ***Public Policy***, Sterling Publishers Pvt Ltd., New Delhi, 1/e, 2001.

(16BT60112) BUILDING MAINTENANCE AND REPAIR

(Open Elective)

(Common to EEE, ECE & EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P
30	70	100	3	1	-

PREREQUISITES: --

COURSE DESCRIPTION:

Durability of buildings, Failure and repair of buildings, Material Techniques for repair, Maintenance of buildings, Conservation and recycling.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Acquire basic knowledge on durability and serviceability, failures, repair and rehabilitation of buildings.
CO2. Analyze failures, repair and rehabilitation techniques.
CO3. Solve complex building maintenance problems through proper investigations and interpretation.
CO4. Use modern tools and techniques for various repairs and rehabilitation of structures.
CO5. Provide solutions for building maintenance and repair problems considering health and safety.
CO6. Consider environmental sustainability in building maintenance and repair.
CO7. Maintain ethical standards for quality in repairs and rehabilitation of structures.
CO8. Evaluate specifications and perform cost analysis of building components while repair and rehabilitation.

DETAILED SYLLABUS:

UNIT-I: DURABILITY AND SERVICEABILITY OF BUILDINGS (10 Periods)

Life expectancy of different types of buildings; Effect of environmental elements such as heat, dampness, frost and precipitation on buildings; Effect of chemical agents on building materials, Effect of pollution on buildings, Effect of fire on building; Damage by biological agents like plants, trees, algae, fungus, moss, insects, etc.; Preventive measures on various aspects, Inspection, Assessment procedure for evaluating for damaged structures, Causes of deterioration, Testing techniques.

UNIT-II:FAILURE AND REPAIR OF BUILDINGS (10 Periods)

Building failure – Types, Methodology for investigation; Diagnostic testing methods and equipment, Repair of cracks in concrete and masonry, Materials for Repair, Methods of repair, Repair and strengthening of concrete buildings, Foundation repair and strengthening, Underpinning, Leakage of roofs and repair methods.

UNIT-III: TECHNIQUES FOR REPAIR (08 Periods)

Rust eliminators and polymers coating for rebars during repair, Foamed concrete, Mortar and dry pack, Vacuum concrete, Gunite and shotcrete, Epoxy injection, Mortar repairs for cracks, Shoring and underpinning.

UNIT-IV: MAINTENANCE OF BUILDINGS (09 Periods)

Reliability principles and its applications in selection of systems for building, Routine maintenance of building, Maintenance cost, Specifications for maintenance works, Dampness-Damp proof courses, Construction details for prevention of dampness; Termite proofing, Fire protection, Corrosion protection.

UNIT-V: CONSERVATION AND RECYCLING (08 Periods)

Performance of construction materials and components in service, Rehabilitation of constructed facilities, Conservation movement, Materials and methods for conservation work, Recycling of old buildings and its advantages, Examples.

Total Periods: 45

TEXT BOOKS:

1. Dennison Campbell, Allen and Harold Roper, *Concrete Structures – Materials, Maintenance and Repair*, Longman Scientific and Technical, UK, 1991.
2. Allen, R.T. L., Edwards, S.C. and J. D. N. Shaw, *The Repair of Concrete Structures*, Blackie Academic & Professional, UK, 1993.

REFERENCE BOOKS:

1. Peter H. Emmons, *Concrete Repair and Maintenance*, John Wiley and Sons Publications, 2002.
2. Building Construction under Seismic Conditions in the Balkan Region, UNDP/UNIDO Project Rer/79/015,Volume 5, *Repair and Strengthening of Reinforced Concrete, Stone and Brick Masonry Buildings*, United Nations Industrial Development Organisation, Vienna.
3. Shetty, M. S., *Concrete Technology*, S. Chand and Company.
4. Smith, P. and Julian, W., *Building Services*, Applied Science Publications, London, 1976.
5. SP: 25, BIS; *Causes and Prevention of Cracks in Buildings*.
6. Champion, S., *Failure and Repair of Concrete Structures*, John Wiley and Sons Publications, 1961.
7. Perkins, P. H., Repair, Protection and Water Proofing of Concrete Structures, E& FN Spon, UK, 3rd Edition, 1997.

IV B.Tech - I Semester

(16BT60115)ENVIRONMENTAL POLLUTION AND CONTROL

(Open Elective)

(Common to EEE, ECE & EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PREREQUISITES: --

COURSE DESCRIPTION:

Fundamentals ofair pollution;Dispersion of pollutants; Effects and control of air pollution; Water pollution;Soil pollution and control; Municipal solid waste management.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrateknowledge on air, water, soil pollution and their control and solid waste management.
CO2. Analyze causes and effects of air, water and soilpollution and their remedial measures.
CO3. Recommend suitable solutionsto complex environmental pollution problems.
CO4. Use appropriate remedial technique to solve environmental pollution problems.
CO5. Understand the effects of environmental pollutionon human health and vegetation.
CO6. Encourage sustainable development through implementation of pollution control measures.
CO7. Maintain IS Codes for environmental quality control.

DETAILED SYLLABUS:

UNIT-I: AIR AND NOISE POLLUTION (08 Periods)

Air Pollution: Scope, Significance, Classification, Sources – Line, Area, Stationary, Mobile; Effects of air pollutants on man, material and vegetation; Global effects of air pollution; Air pollution meteorology - Lapse rate, Inversion, Plume pattern; Dispersion of air pollutants - Dispersion models and applications; Ambient air quality standards.

Noise Pollution: Sound pressure, Power and intensity, Impacts of noise, permissible limits of noise pollution, measurement of noise.

UNIT-II: AIR AND NOISE POLLUTIONCONTROL (10 Periods)

Self-cleansing properties of the environment, Dilution method, Control at source, Process changes and equipment modifications, Control of particulates–Types of equipment, Design and operation –Settling chambers, Centrifugal separators, Bag house filters, Wet scrubbers, Electrostatic precipitators; Control of gaseous pollutants – Adsorption, Absorption, Condensation, Combustion; Control of air pollution from automobiles, Control of noise pollution.

UNIT-III: WATER POLLUTIONAND CONTROL (10 Periods)

Water pollution – Sources, Causes, Effects; Surface and groundwater quality – Physical, Chemical, Biological; Drinking water quality standards, Water purification – Processes, Engineered systems – Aeration, Solids separation, Settling operations, Coagulation,

Softening, Filtration, Disinfection; Wastewater – Sources, Causes, Effects, Treatment and disposal – Primary, Secondary, Tertiary; Case studies.

UNIT-IV: SOIL POLLUTION AND CONTROL (08 Periods)

Soil pollutants, Sources of soil pollution, Causes, Effects and control of soil pollution, Diseases caused by soil pollution, Methods to minimize soil pollution, Effective measures to control soil pollution, Case studies.

UNIT-V: MUNICIPAL SOLID WASTE MANAGEMENT (09 Periods)

Types of solid waste, Composition of solid waste, Collection and transportation of solid waste, Methods of disposal – Open dumping, Sanitary landfill, Composting, Incineration, Utilization - Recovery and recycling, Energy Recovery.

Total Periods: 45

TEXT BOOKS:

1. Peavy, H. S, Rowe, D. R., and Tchobanoglous, G., *Environmental Engineering*, McGraw Hill Inc., 1985.
2. C.S.Rao, *Environmental Pollution Control Engineering*, New Age International Pvt. Ltd., 2nd Edition, 2007.
3. Ibrahim A. Mirsa, *Soil Pollution: Origin, Monitoring & Remediation*, Springer, UK, 2nd Edition, 2008.

REFERENCE BOOKS:

1. M.N. Rao and H.V.N. Rao, *Air Pollution,* Tata McGraw–Hill Education Pvt. Ltd., 19th Edition, 2010.
2. Daniel Vallero, *Fundamentals of Air Pollution,* Academic Press (Elsevier)*,* 5th Edition, 2014.
3. S.M.Khopkar,*Environmental Pollution Monitoring and Control,* New Age International Pvt. Ltd., 2nd Edition, 2007.
4. V. M. Domkundwar, Environmental Engineering, DhanpatRai& Co. Pvt. Ltd., New Delhi, 2014.

IV B.Tech - I Semester
14BT70106: ENVIRONMENTAL POLLUTION AND CONTROL
(Open Elective)
(Common to ECE, EEE, EIE & CE)

Internal Marks	External Marks	Total	L	T	P	C
30	70	100	3	1	–	3

PREREQUISITES: Environmental Sciences

COURSE DESCRIPTION: Introduction, Sources and Effects of Air Pollution – Dispersion of Pollutants and their control – Surface and Ground Water Pollution and control–Soil Pollution and remediation– Management of Municipal Solid Wastes.

COURSE OUTCOMES:
On successful completion of the courses, the students will be able to:
CO1. Explain various pollutants, characteristics and their dispersion
CO2. Analyze the major pollutants that causes environmental pollution.
CO3. Conduct research and select suitable techniques to control pollution.
CO4. Understand the effects of environmental pollutions on human beings and vegetation.
CO5. Communicate the methods of management and control of environmental pollution.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO AIR POLLUTION AND DISPERSION OF POLLUTANTS (08 Periods)
Scope – Air Pollutants – Classifications – Natural and Artificial – Primary and Secondary, Point and Non– Point, Line and Area Sources of Air Pollution – Stationary and Mobile Sources – Dispersion of Pollutants – Dispersion Models – Applications.

UNIT-II: EFFECTS AND CONTROL OF PARTICULATES (09 Periods)
Effects of Air Pollutants on Man, Material and Vegetation – Global Effects of Air Pollution – Green House Effect, Heat Island, Acid Rains, Ozone Holes – Control of Particulates – Control at Sources – Process Changes – Equipment Modifications – Design and Operation of Control Equipment – Settling Chambers – Centrifugal Separators – Bag Filters, Dry and Wet Scrubbers – Electrostatic Precipitators.

UNIT-III: WATER POLLUTION (10 Periods)
Introduction–Water Quality in Surface Waters – Nutrients – Controlling Factors in Eutrophication– Effects of Eutrophication – Ground Water Pollution – Thermal Pollution – Marine Pollution – Sewage Disposal in Ocean – Types of Marine Oil Pollution – Cleanup of Marine Oil Pollution – Control of Water Pollution – Case Study on Tanneries – Drinking Water Quality Standards.

UNIT-IV: SOIL POLLUTION (09 Periods)
Soil Pollutants – Sources of Soil Pollution – Causes of Soil Pollution and their Control – Effects of Soil Pollution–Diseases Caused by Soil Pollution – Methods to Minimize Soil Pollution – Effective Measures to Control Soil Pollution – Case Study on Fertilizer.

UNIT-V: MUNICIPAL SOLID WASTE MANAGEMENT (09 Periods)
Introduction – Types of Solid Wastes – Principles of Excreta Disposal – Domestic Solid Waste Production – Collection of Solid Wastes – Transport of Solid Wastes – Management of Solid Wastes – Methods of Land Disposal – Sanitary Landfill – Composting – Incineration.

Total Periods: 45

TEXT BOOKS:

1. C.S.Rao, *Environmental Pollution Control Engineering*, 2nd Edition, New Age International Pvt Ltd., 2007.
2. Y.Anjaneyulu, *Introduction to Environmental Science,* 1st Edition, BS Publications*.,* 2009.

REFERENCE BOOKS:

1. M.N. Rao and H.V.N. Rao, *Air Pollution,* 19th Edition, Tata McGraw–Hill Education Pvt. Ltd., 2010.
2. Daniel Vallero, *Fundamentals of Air Pollution,* 5th Edition, Academic Press (Elsevier)*,* 2014.
3. S.M.Khopkar , *Environmental Pollution Monitoring and Control,* 2nd Edition, New Age International Pvt Ltd., 2007.
4. S.Deswal and K.Deswal, *Environmental Science,* 2nd Edition, Dhanpat Rai & Co, 2011.

IV B.Tech. - I semester

(16BT70402) EMBEDDED SYSTEMS

(Common to EEE, ECE & CSSE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100				

PREREQUISITES:
Courses on Switching Theory and Logic Design, Microprocessors and Microcontrollers.

COURSE DESCRIPTION:
Embedded system design approaches; MSP430 Architecture; Instruction Set; On-Chip Resources; Programming; Communication with peripherals; Internet of Things related Issues.

COURSE OUTCOMES: On successful completion of the course, students will be able to:

CO1. Apply knowledge in
- MSP430 Architecture, Pin out, Instruction set
- High level programming
- Usage of On-chip resources like ADC, DAC, Timers
- Internet of Things related issues

CO2. Analyze various design issues regarding
- Usage of on chip resources
- Low power modes
- Communication support

CO3. Design embedded systems using MSP430 series microcontrollers to suit market requirements.

CO4. Solve engineering problems and arrive at solutions in designing embedded systems to support interconnectivity.

CO5. Apply techniques, program skills, On-Chip resources to design networked embedded systems with an understanding of limitations.

CO6. Reason out and practice professional engineering to deliver efficient and costeffective embedded based products to society.

DETAILED SYLLABUS:

UNIT - I: INTRODUCTION TO EMBEDDED SYSTEMS (09 Periods)
Embedded Systems - Definition, Approaches, Applications, Anatomy of microcontroller, Memory, Software; MSP430 Introduction- Pin out, Functional Block diagram, Memory, CPU, Memory mapped input and output, Clock generator; Exceptions- Interrupts and Resets.

UNIT - II: ARCHITECTURE OF MSP430 (09 Periods)
CPU, Addressing Modes, Constant Generator and Emulated Instructions, Instruction Set, Example programs, Reflections on CPU and Instruction set, Resets, Clock System.

UNIT - III: FUNDAMENTALS FOR PROGRAMMING (09 Periods)

Development Environment, C Programming Language, Assembly Language, Programming and Debugging, Sample programs- Light LEDs in C, Read input from a switch; Automatic Control-Flashing light by delay, use of subroutines, using Timer_A; Header files and issues, Functions, Interrupts and Low power modes.

UNIT - IV: TIMERS, MIXED SIGNAL SYSTEMS AND COMMUNICATION (09 Periods)

Timers - Watchdog Timer, RTC, Measurement in capture mode; Mixed-Signal Systems-Comparator_A, ADC10 Architecture & operation, ADC12, Sigma-Delta ADC Architecture & operation, DAC; Communication- Communication Peripherals in MSP430, SPI, Inter-integrated Circuit Bus, Asynchronous communication with the USCI_A.

UNIT - V: HARDWARE SOFTWARE CO-DESIGN AND INTERNET OF THINGS (09 Periods)

CO- Design Issues: Co-design Models, Architectures, Languages, a Generic Co-design Methodology

IOT: Introduction, Origins, Drivers and Applications, IOT Communication Models - Device to Device, Device to Cloud, Device to Gateway, Back end Data Sharing Model; IPV6 and IOTs', IOT Issues, Security Issues-challenges; Privacy Considerations, Interoperability/Standards.

Total Periods: 45

TEXT BOOKS:

1. John H. Davies, *MSP430 Microcontroller Basics*, Newnes Publications, 2008.
2. Karen Rose, Scott Eldridge, Lyman Chapin, *The Internet of Things: An Overview: Understanding the Issues and Challenges of a More Connected World, Internet Society*, Oct. 2015.
3. Jorgen Staunstrup, Wayne Wolf, *Hardware/software co-design Principles and Practice*, Springer, 2009.

REFERENCE BOOK:

1. Chris Nagy, *Embedded Systems Design using the TI MSP30 Series*, Newnes Publications, 2003.

IV B.Tech - I Semester
14BT70402: EMBEDDED SYSTEMS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	--	3

PREREQUISITES: A course on Microprocessors and Microcontrollers.

COURSE DESCRIPTION:
Introduction to Embedded System; State Machines and Concurrent Process Models; Various Communication interfacing Models; RTOS Concepts; Target Architectures.

COURSE OUTCOMES:
On successful completion of the course, the students will be able to:
CO1. Demonstrate knowledge on Communication Interfacing Models, Processor Technology, State Machines, Kernel Objects, ARM and SHARC Controllers.
CO2. Analyze Various problems in Optimization of Single Purpose Processor, Synchronization among the Processes, Clock Driven and Event Driven Scheduling and Debugging Techniques
CO3. Design and develop embedded system to suit a particular Application.
CO4. Choose suitable Hardware and software components of a system that Work together to solve engineering problems to exhibit a specific behavior.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION (12 Periods)
Embedded systems overview, classification, applications, design challenge, processor technology, IC technology, Design Technology, Trade-offs. Single purpose processors RT-level combinational logic, sequential logic (RT-level), custom single purpose processor design (RT-level), optimizing custom single purpose processors, Basic architecture, operation, Pipelining, Programmer's view, development environment.

UNIT-II: STATE MACHINE AND CONCURRENT PROCESS MODELS (08 Periods)
Introduction, models versus languages, finite state machines with data path model (FSMD), using state machines, program state machine model (PSM), concurrent process model, concurrent processes, communication among processes, synchronization among processes, implementation, data flow model.

UNIT-III: COMMUNICATION INTERFACE (07 Periods)
Need for communication interfaces, RS232 / UART, RS422 / RS485, USB, Infrared, IEEE 1394 Fire wire, Ethernet, I^2C bus and CAN.

UNIT-IV: RTOS CONCEPTS (10 Periods)
CONCEPTS 1: Architecture of the Kernel, Tasks and Task scheduler, Types of real-time tasks, Task periodicity, Task scheduling, Classification of scheduling algorithms, Clock driven Scheduling, Event driven Scheduling, resource sharing, Commercial RTOs.
CONCEPTS 2: Interrupt service routines, Semaphores, Mutex, Mailboxes, Message Queues, Event Registers, Pipes, Signals, Timers, Memory Management, Priority inversion problem.

UNIT-V: TARGET ARCHITECUTERS (08 Periods)

Host and target machines, linkers, loading software into target machine, debugging techniques,ARM microcontroller, ARM pipeline, Instruction set architecture, THUMB instructions, Exceptions in ARM, salient features of SHARC microcontroller and comparison with ARM microcontroller.

Total Periods: 45

TEXT BOOKS:

1. Frank Vahid, Tony D. Givargis, *Embedded System Design – A Unified Hardware/Software Introduction,* John Wiley, 2002.
2. KVKK Prasad, *Embedded/Real Time Systems,* Dramatic Press, 2005.

REFERENCE BOOKS:

1. Raj Kamal, *Embedded System Architectures Programming & Design*, Tata MC Graw-Hill Publising, 2003.
2. David E.Simons, *An Embedded Software Premier*, Pearson Educational, 2004.

IV B.Tech. - I semester

(16BT70432) EMBEDDED SYSTEMS LAB

(Common to EEE, ECE & CSSE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PREREQUISITES: Courses on Embedded systems, C Programming.

COURSE DESCRIPTION:

IDE for Embedded System Design using MSP430; Interfacing Switch & LED; Timers-WDT, Configuring, Programming; ADC-usage; Power down modes; DAC; PWM Generator; Networking – SPI, Wi-Fi.

COURSE OUTCOMES:

On successful completion of the course,students will be able to:

CO1. Demonstrate knowledge in designing complex energy efficient embedded systems.
CO2. Analyze usage of various on-chip resources like GPIO, Timers, Interrupts, ADC, DAC,Comparator, SPI.
CO3. Design embedded systems to suit market requirements.
CO4. Solve engineering problems by proposing potential solutions using industry choice advanced Microcontrollers.
CO5. Apply appropriate techniques, resources, and CCSV6 based IDE for modeling embedded systems with understanding of limitations.
CO6. Provide embedded system solutions for societal needs.
CO7. Work individually and in a group to develop embedded systems.
CO8. Communicate effectively in oral and written form in the field of embedded systems.

LIST OF EXCERSISES:

1. Introduction to MSP430 launch pad and Programming Environment.
2. Read input from switch and Automatic control/flash LED (software delay).
3. Interrupts programming example using GPIO.
4. Configure watchdog timer in watchdog & interval mode.
5. Configure timer block for signal generation (with given frequency).
6. Read Temperature of MSP430 with the help of ADC.
7. Test various Power Down modes in MSP430.
8. PWM Generator.
9. Use Comparator to compare the signal threshold level.
10. Speed Control of DC Motor

11. Master slave communication between MSPs using SPI.

12. Networking MSPs using Wi-Fi.

Tool Requirement:

Code Composer Studio Version 6, MSP430 based launch pads, Wi-Fi booster pack.

REFERENCE BOOKS:

1. John H Davies, *MSP430 Microcontrollers Basics*, Newnes Publishers, 1st Edition, 2008.
2. C P Ravikumar, *MSP430 Microcontrollers in Embedded System Projects*, Elite Publishing House, 1st Edition, 2012.

I B. Tech. – II Semester

(16BT20541) FOUNDATIONS OF DATA STRUCTURES

(Common to ECE, EEE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	0	3

PRE-REQUISITES: A course on "Programming in C"

COURSE DESCRIPTION: Concepts of sorting: sorting by exchange, sorting by distribution, sorting by merging and data structures: stacks, queues, linked lists, trees, graphs, and hash table.

COURSE OUTCOMES: On successful completion of this course the students will be able to:

CO1. Gain knowledge in Sorting techniques, Linear and Non-linear Data Structures.

CO2: Analyze the performance of sorting techniques and their relationship to Data Structures.

CO3. Design appropriate hashing function for a given application and develop programs to implement Linear and Non-Linear data structures

CO4. Apply appropriate data structure to provide solutions for real time problems using C Language

DETAILED SYLLABUS:

UNIT - I :SORTING
(9 Periods)

SORTING - Sorting by Exchange-Shell Sort, Quick sort. Sorting By Distribution-Counting Sort, Bucket Sort, Radix Sort. Sorting By Merging-Merge Sort.

UNIT – II: STACKS AND QUEUES (9 Periods)

STACKS -Introduction, Stack Operations, Applications.
QUEUES - Introduction, Operations on Queues, Circular Queues, Applications.

UNIT – III: LINKED LISTS (9 Periods)

LINKED LISTS –Introduction, Single Linked List, Circular Linked List, Doubly Linked List, Multiply Linked List, Applications.

LINKED STACKS AND LINKED QUEUES - Introduction, Operations on Linked Stack and Linked Queues, Dynamic Memory Management and Linked Stacks.

UNIT – IV: TREES AND BINARY TREES (9 Periods)

TREES– Introduction, Definition and Basic Terminologies, Representation of Trees.
BINARY TREES – Basic Terminologies and Types, Representation of Binary Trees, Binary Tree Traversals, Binary Search Trees: Definition and Operations, Applications.

UNIT – V: Graphs and Hashing (9 Periods)

Graphs – Introduction, Definitions and Basic Terminologies, Representation of Graphs, Graph Traversals, Applications.
Hashing – Introduction, Hash Table Structure, Hash Functions, Linear Open Addressing, Chaining, Applications.

Total Periods: 45

TEXT BOOK:

1. G.A.V. Pai, "Data Structures and Algorithms", Tata McGraw Hill, Second Edition, 2009.

REFERENCE BOOK:

1. DebasisSamanta, "Classic Data Structures", PHI Learning, Second Edition, 2009.

I B. Tech. – II Semester

(16BT20551) FOUNDATIONS OF DATA STRUCTURES LAB

(Common to ECE, EEE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	0	0	3	2

PRE-REQUISITES: A course on "Foundations of Data Structures"

COURSE DESCRIPTION: Hands on programming to implement data structures - Linked lists, Stacks, Queues, Trees, Search trees, Sorting, and Hashing in C Language.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Gain practical knowledge on stacks, queues, trees, graphs and Hashing Techniques
CO2. Identify suitable data structure to solve real world engineering problems.
CO3. Design solutions for complex engineering problems using linear and non-linear data structures.
CO4. Develop algorithms leading to multiple solutions by conducting investigations of complex problems.
CO5. Apply 'C' language as a tool for implementing linear and non linear data

CO6. Communicate effectively by writing Programs and document practical work.

LIST OF PRACTICAL EXERCISES:

EXERCISE NUMBER	NAME OF THE EXERCISE	No. of Slots required
EXERCISE 1	ement the following sorting techniques Quick Sort (b) Radix Sort (c) Merge Sort	2
EXERCISE 2	ement the following data structures using arrays tack (b) Queue (c) Circular Queue	2
EXERCISE3	ement the following operations on a single linked list. reation (b) Insertion (c) Deletion (d) Display	2
EXERCISE4	ement the following operations on a double linked list. reation (b) Insertion (c) Deletion (d) Display	1
EXERCISE 5.	ement the following operations on a circular linked list. reation (b) Insertion (c) Deletion (d) Display	1
EXERCISE 6.	ement the following data structures using linked list. tack (b) Queue (c) Circular Queue	1
EXERCISE 7.	ement the following tree traversals on a binary tree reorder (b) Inorder (c) Postorder	1
EXERCISE 8.	ement the following operation on binary search tree reation (b) Insertion (c) Deletion (d) Inorder	1
EXERCISE 9.	ement the following graph traversal techniques readth First traversal (b) Depth First Traversal	2
EXERCISE 10.	ement the following Hashing Techniques eparate Chaining (b) Open addressing methods	2

Reference Books:

1. G.A.V. Pai, *"Data Structures and Algorithms",* Tata McGraw Hill, Second Edition, 2009.
2. Debasis Samanta, "*Classic Data Structures",* PHI Learning, Second Edition, 2009.

III B.Tech. - I Semester

(16BT51041) SENSORS AND SIGNAL CONDITIONING

(Interdisciplinary Elective-1)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	--	3

PREREQUISITES: Courses onElectrical Measurements andLin- ear & DigitalICs.

COURSE DESCRIPTION:
Principleofoperation,construction,advantages,limitationsand applicationsofresistive,inductive,capacitive,self-generating, digitalandothersensors;Signalconditioningcircuitsandtheir operations.

COURSE OUTCOMES: On completion of the course, the stu- dents will be able to
CO1. demonstrate knowledgeon varioussensors.
- signal conditioningcircuits. CO2. analyze
- various sensors for measuring physicalquantities.
- signal conditioningcircuits.

CO3. designanappropriateinstrumentationamplifiersforcom mercialapplications.
CO4. evaluatephysicalquantitiesusingsensorsandsignal conditioningcircuitstoprovidefeasiblesolutions.
CO5. select&useappropriatesensorsforthemeasurementof physical quantities in domestic and industrial applica tions.
CO6. applytheconceptualknowledgeofsensorsandsignal conditioning circuits in relevance to industry and soci ety.

DETAILED SYLLABUS:

UNIT-I:RESISTIVESENSORS (09Periods)
Principle of transducers, classification, Factors influencing the choiceoftransducers.Potentiometers,Metalandsemiconduc- tor strain gauges-principle of operation, gauge factor, gauge sensitivity; Resistance temperature detectors, Thermistors,Light dependentresistors,resistivehygrometer.

UNIT-II: CAPACITIVE AND INDUCTIVE SENSORS
(09 Periods) Capacitor sensors: Variation in overlapping area, variation in dielectric constant, variation in distance between the platesof variable and differential capacitor. Frequency response ofca pacitive sensors.
Inductive sensors: Variable reluctance sensors, Eddy current sensors,Linearvariabledifferentialtransformers,Synchros,Re- solvers, Electromagnetic sensors based on Faraday's law, Hall effectsensors.

UNIT-III:SELF-GENERATINGSENSORS (09Periods)
Thermoelectricsensors:Thermoelectriceffects,Thermocouple laws,Coldjunctioncompensation,commonthermocouples.Pi- ezoelectric sensors-Piezoelectric effect, deformation modes, equivalent circuit, materials; Pyro electric Sensors-Pyro elec- tric effect, materials; Photoelectric sensors-photovoltaic ef- fect, materials; Magneto-strictivesensors.

UNIT-IV:DIGITALANDOTHERSENSORS (09Periods)
Digital transducers: Tachometer encoder, incrementalencoder, absolute encoder. Semiconductor sensors- principle of opera- tionandtechniques;Filmsensors-Thinfilmsensors,Thickfilm sensors;Fiberopticsensors-

principleofoperation,sensortech- nology;Ultrasonicsensors-principleofoperation,sensingmeth- ods; Basics of SMARTsensors.

UNIT-V:SIGNALCONDITIONING (09Periods)

Blockdiagramofsignalconditioning,balanceanddeflectionmea- surement in Wheatstone bridge, measurement of reactance; Push-pullbridgeandBlumeinbridge;Carrieramplifier,chopper amplifier,lowdriftamplifierandchargeamplifier,Instrumenta- tionamplifier.

Total Periods: 45

TEXT BOOKS:

1. RamonPallas-ArenyandJohnG.Webster,*SensorsandSignalConditioning*,JohnWiley&Sons,Inc.,2nd edition,2001.
2. A.K.Sawhney, *A Course in Electrical and Electronic Measurements and Instrumentation*, Dhanpat Rai &Co., 19th edition,2015.

REFERENCE BOOKS:

1. D.V.SMurty,*TransducersandInstrumentation*,PHILearn- ing Private Limited, 2nd edition, 2010.

2. D. Patranabis, *Sensors and Transducers*, PHI Learning Pri vate Limited, 2nd edition, 2003.

3. JohnP.Bentley, *Principles o fMeasurement Systems*, Pearson Education, 4th edition, 2005

II B.Tech. I Semester

(16BT30451): ANALOG ELECTRONIC CITCUITS LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PREREQUISITES: Course on Electronic Devices and Circuits and Analog Electronic Circuits.

COURSE DESCRIPTION:

Diode characteristics; Rectifiers; BJT and FET characteristics; UJT and SCR characteristics; BJT Amplifiers; Non-linear AND Linear Wave shaping circuits; Feed Back Amplifiers; Design of Multi-vibrator circuits; Power Amplifiers.

COURSE OUTCOMES: On successful completion of the course students will be able to:

CO1. Apply the knowledge in

- Diodes-PN Junction Diodes, Zener Diodes, SCR
- Transistors-BJT,FET,UJT
- Feedback amplifiers and oscillators
- Clipping and Clamping Circuits
- RC High Pass and Low Pass Circuits
- Multi-vibrators

CO2. Analyze different types amplifier, oscillator and pulse circuits.

CO3. Design different types of Electronic circuits like feedback amplifiers, Oscillators, Multi-vibrators, Schmitt Trigger.

CO4. Provide solutions through the design and conduct of experiments, analysis and synthesis.

CO5. Apply biasing technique for design of amplifiers.

CO6. Function effectively as an individual and as a member in a group in the area of analog electronic circuits.

CO7. Communicate effectively in oral and written form in the area of analog electronic circuits.

LIST OF EXERCISES:

(Minimum of **twelve experiments** to be conducted)

PART – A

ELECTRONIC DEVICES AND CIRCUITS (Minimum five experiments to be conducted)

1. PN Junction and Zener diodes characteristics.
2. Ripple Factor and Load Regulations of Rectifier with and without filters of Half wave Rectifiers.
3. Ripple Factor and Load Regulations of Rectifier with and without filters of Full wave Rectifiers.
4. Input and Output characteristics of Transistor in CE configuration.
5. Drain and Transfer Characteristics of JFET.
6. Gain and Frequency response of CE Amplifier.
7. UJT characteristics.
8. SCR characteristics.

PART B

ANALOG ELECTRONIC CIRCUITS (Minimum five experiments to be conducted)

1. Voltage series Feedback Amplifier
2. Current shunt Feedback Amplifier
3. Class A Power Amplifier (with transformer load).
4. Hartley and Colpitt's Oscillators.
5. Linear wave shaping- RC High Pass and Low Pass.
6. Non Linear wave shaping - Clippers and Clampers.
7. Astable Multivibrator
8. Schmitt Trigger

III B.Tech. I Semester

14BT50423: **ANALOG ELECTRONICS AND IC LAB**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
25	50	75	-	-	3	2

PREREQUISITE(S): Semiconductor Devices and Circuits, Analog Electronic Circuits, Linear IC and Digital IC Applications.

COURSE DESCRIPTION: Design and verification of OPAMP applications; Filters; VCO; Multivibrators; Linear and non-linear Wave-shaping circuits; Feedback amplifiers and Oscillators.

COURSE OUTCOMES: On successful completion of the course, the students will be able to:

1. perform analysis of digital and electronic circuits.
2. design and develop different circuits like Multivibrators, Power amplifiers, Feedback amplifiers and oscillators.
3. solve problems arising due to poor circuit design by choosing the appropriate design parameters.

LIST OF EXPERIMENTS: (Minimum Twelve Experiments to be conducted)

PART A: Analog Electronic Circuits (Minimum of six experiments to be conducted)

1. Voltage series Feedback Amplifier
2. Current shunt Feedback Amplifier
3. Class A Power Amplifier (with transformer load).
4. Hartley and Colpitt's Oscillators.
5. Non Linear wave shaping - Clippers and Clampers.
6. Bistable Multivibrator.
7. Monostable Multivibrator.
8. Astable Multivibrator.

PART B: Linear and Digital ICs (Minimum of six experiments to be conducted)

1. OP AMP Applications-Adder, Subtractor, Comparator circuits.
2. Active Filter Applications-LPF, HPF (first and second order).
3. IC 555 Timer - Monostable and Astable Operation circuit.
4. IC 566-VCO Applications.
5. Logic Gates - 74XX.
6. 4 bit Comparator - 74X85.
7. D Flip-Flop 74X74 and JK Flip-Flop 74X109.
8. Universal shift register - 74X194.

IV B.Tech. - I Semester

(16BT70413) INTRODUCTION TO NANOSCIENCE AND NANOTECHNOLOGY

(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PREREQUISITES:--

COURSE DESCRIPTION:

Introduction to the concept ofnano;Description of nanomaterial;Nanostructure characterization tools;Classification of nanomaterials;Fabrication of nanomaterial;Different applications of nanostructures and nanomaterials.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate knowledge in
- Nanoscale technology.
- Difference between micro and nanotechnology
- Classification of Nanostructure and Nanomaterial
- Fabrication of various nanomaterials and nanostructures.

CO2. Analyze numerical and analytical problems in
- Nanomaterial size by using Scanning Electron Microscope and X-Ray diffraction

CO3. Design and fabricate devices based on nanostructures like
- Nano solar cell
- Nano cantilever
- Nano bio-sensor

CO4. Synthesize nano particle of different materials to solve the problems related to fabrication of nanostructures.

CO5. Select appropriate technique for fabrication ofnanostructures and Nano composites.

CO6. Apply ethical standards and legal issues while using chemical substances infabrication of new nanostructures.

DETAILED SYLLABUS:

UNIT-I: FUNDAMENTALS OF NANOTECHNOLOGY(08 Periods)

Introduction – Scientific revolutions, Time and length scale in structures, Definition of a nanosystem; Dimensionality and size dependent phenomena - Surface to volume ratio Fraction of surface atoms, Surface energy and surface stress, surface defects, Properties at nanoscale (optical, mechanical, electronic, and magnetic).

UNIT-II:IDENTIFICATION AND CHARACTERIZATION TOOLS FOR NANOMATERIALS AND NANOSTRUCTURE(10 Periods)

Field Emission Scanning Electron Microscopy (FESEM), Environmental Scanning ElectronMicroscopy (ESEM) High Resolution, Transmission Electron Microscope (HRTEM), Scanning Tunneling Microscope(STM), Surface enhanced Raman spectroscopy (SERS), Secondary Ion Mass Spectroscopy, Focused Ion Beam Photoelectron Spectroscopy, X-ray

Photoelectron Spectroscopy (XPS), Auger electron spectroscopy (AES), Rutherford backscattering spectroscopy (RBS), X-Ray Diffraction, Intensities in X-Ray Scattering Particle Size Effect.

UNIT-III:CLASSIFICATION OF NANOMATERIALS(10 Periods)

Classification based on dimensionality, Quantum Dots,Wells and Wires-III-V Nanoparticles, Electronic Structure of Nanosemiconductor, Carbon based nanomaterials (buckyballs, nanotubes, graphene), Metal based nano materials (nanogold, nanosilver and metal oxides), Nanocomposites,Nanopolymers,Nanoglasses, Nano ceramics, Biological nanomaterials, Fulrene-discovery and early years,.

UNIT-IV: SOME FABRICATION TECHNIQUES OF NANOMATERIALS AND NANOSTRUCTURES (09 Periods)

Chemical Methods: Metal Nanocrystals by Reduction, Solvothermal Synthesis, Photochemical Synthesis,Sonochemical Routes, Chemical Vapor Deposition (CVD), Metal Oxide Chemical Vapor Deposition (MOCVD), Plasma Enhanced Chemical Vapour Deposition Technique(PECVD), Hydrothermal Method, Sol-Gel.

PhysicalMethods: Ball Milling, Electrodeposition, Spray Pyrolysis, Flame Pyrolysis, DC/RF Magnetron Sputtering, Molecular Beam Epitaxy (MBE) Thermal Evaporation Method.

UNIT-V:APPLICATIONS (08 Periods)

Solar energy harvesting, Catalysis,Molecular electronics and printed electronics Nanoelectronics, Polymers with aspecial architecture, Liquid crystalline systems, Linear and nonlinear optical and electro-optical properties, Applications in displays and other devices, Nanomaterials for data storage, Photonics, Plasmonics, Chemical and biosensors, Nanomedicine and Nanobiotechnology, MESFET.

Total Periods: 45

TEXT BOOKS:

1. Pradeep T., *A Textbook of Nanoscience and Nanotechnology*, Tata McGraw Hill Education Pvt. Ltd., 2012.
2. Hari Singh Nalwa, *Nanostructured Materials and Nanotechnology*,Academic Press, 2002.

REFERENCE BOOKS:

1. Nabok A., *Organic and Inorganic Nanostructures*, Artech House, 2005.
2. Dupas C., Houdy P., Lahmani M*, Nanoscience: Nanotechnologies and Nanophysics*, Springer - Verlag Berlin Heidelberg, 2007.
3. S.M. Sze, Physics of Semiconductor Devices, 2ndEdition, 2001.

III B. Tech. – II Semester

(16BT60310) MANAGING INNOVATION AND ENTREPRENEURSHIP

(Common to CE, ME, CSE, IT & CSSE)
(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: —

COURSE DESCRIPTION: Evolution of entrepreneurship from economic theory Managerial and entrepreneurial competencies; Concepts of Shifting Composition of the Economy Purposeful Innovation & Sources of Innovative Opportunity; The Innovation Process; Innovative Strategies; Entrepreneurial Motivation; Entrepreneurs versus inventors; Ethics and International Entrepreneurship; Strategic Issues in International Entrepreneurship; Problem solving Innovation and Diversification.

COURSE OUTCOMES: On successful completion of this course, the student will be able to:

CO1. Demonstrate the principles of business innovation and entrepreneurship for establishing industrial ventures.

CO2. Analyze business plans for potential investors and stakeholders and effectively answer probabilistic questions on the substance of plan.

CO3. Develop a comprehensive and well planned business structure for a new venture.

CO4. Conduct investigation on complex problems, towards the development of Project.

CO5. Apply modern statistical and mathematical tools to design projects and subsequent work procedures.

CO6. Apply ethics in constructive innovation framework.

CO7. Exhibit professionalism by employing modern project management and financial tools.

DETAILED SYLLABUS:

UNIT - I: Creativity and Innovation (07 Periods)

Introduction, Levels of innovation, Purposeful innovation and the sources of innovative opportunity, The innovation process, Innovative strategies, Strategies that aim at introducing and innovation, Dynamics of ideation and creativity – Inbound, Outbound; Context and process of new product development, Theories of outsourcing.

UNIT - II: Paradigms of Innovation (11 Periods)

Systems approach to innovation, Innovation in the context of developed economies and Emerging economies, Examining reverse innovation and its application, Performance gap, Infrastructure gap, Sustainability gap, Regulatory gap, Preference gap, organizational factors effecting innovation at firm level.

UNIT - III: Sources of finance and venture capital (07 Periods)

Importance of finance, Comparison of venture capital with conventional development capital, Strategies of venture funding, Investment phases, Investment process, Advantages and disadvantages of venture capital, Venture capital developments in India.

UNIT - IV: Intellectual property innovation and Entrepreneurship (11 Periods)

Introduction to Entrepreneurship, Evolution of entrepreneurship from economic theory, Managerial and entrepreneurial competencies, Entrepreneurial growth and development, Concepts, Ethics and Nature of International Entrepreneurship, Intellectual property – forms of IP, Patents, Trademarks, Design registration, Copy rights, Geographical indications, Patent process in India.

UNIT - V: Open Innovation framework & Problem solving (09 Periods)

Concept of open innovation approach, Difference between open innovations and Cloud innovation approaches, Limitations and

Opportunities of open innovation framework, Global context of strategic alliance, Role of strategic alliance, Problem Identification and Problem Solving, Innovation and Diversification.

Total Periods: 45

TEXT BOOKS:

1. Vinnie Jauhari, Sudhanshu Bhushan, *Innovation Management*, Oxford University Press, 1st Edition, 2014.
2. Drucker, P. F., *Innovation and Entrepreneurship*, Taylor & Francis, 2nd Edition, 2007.

REFERENCE BOOKS:

1. Robert D Hisrich, Claudine Kearney, *Managing Innovation and Entrepreneurship*, Sage Publications, 1st Edition, 2014.
2. V.K.Narayanan, *Managing Technology and Innovation for Competitive Advantage*, Pearson India, 1st Edition, 2002.

III B.Tech - II Semester

14BT60308:MANAGING INNOVATION AND ENTREPRENEURSHIP

(OPEN ELECTIVE)

(Common to CSE, IT, CSSE, CE & ME)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Nil

Course Description:

Evolution of entrepreneurship from economic theory Managerial and entrepreneurial competencies; Concepts Shifting Composition of the Economy Purposeful Innovation & 7 Sources of Innovative Opportunity The Innovation Process; Innovative Strategies; Entrepreneurial Motivation; Entrepreneurs versus inventors; Ethics and International Entrepreneurship; Strategic Issues in International Entrepreneurship; Problem solving Innovation and Diversification.

Course Outcomes:

After completion of this course, a suessful student will be able to:

CO1: Define, explain and illustrate theories of business innovation and entrepreneurship, the evolution of industries and economies, and the roles of Entrepreneurs.

CO2: Develop a comprehensive and well structured business plan for a new venture.

CO3: Present a persuasive business plan to potential investors or to internal stakeholders and effectively answer probing questions on the substance of the plan; and,

CO4: Work effectively in multidisciplinary, cross-cultural teams, towards the development of a Team Project.

Unit-I: ENTREPRENEURSHIP (7 Periods)

Introduction to Entrepreneurship: Evolution of entrepreneurship from economic theory; Managerial and entrepreneurial competencies, entrepreneurial growth and development.

UNIT II: CREATIVITY AND INNOVATION (11Periods)

Creativity and Innovation: Concepts Shifting Composition of the Economy; Purposeful Innovation & the 7 Sources of Innovative Opportunity; The Innovation Process; Innovative Strategies: Strategies that aim at introducing an innovation, innovation & entrepreneurship, planning -incompatible with Innovation & entrepreneurship.

Unit-III: THE INDIVIDUAL ENTREPRENEUR (7 Periods)

Entrepreneurial Motivation: Need for continuous learning & relearning; AcquiringTechnological Innovation Entrepreneurial motivation (nach story); Achievement Motivation in Real life- Case Study. Entrepreneurs versus inventors

Unit-IV: INTERNATIONAL ENTREPRENEURSHIP OPPORTUNITIES (11 Periods)

International Entrepreneurship: Concepts and Nature of International Entrepreneurship. The changing International environment. Ethics and International Entrepreneurship. Entrepreneurial entry in to international business, strategic Issues in International Entrepreneurship.

Unit-V: Creative Problem Solving (9 Periods)

Problem Identification and Problem Solving: Problem Identification. Problem solving Innovation and Diversification.

Total Periods: 45

TEXT BOOKS:

1: Martin, M.J. "Managing Innovation and Entrepreneurship in Technology based Firm", John Wiley Interscience, 1994.

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