CHALAPATHI INSTITUTE OF ENGINEERING & TECHNOLOGY

(Accredited by NBA, NAAC with ‘A’ grade,, Approved AICTE & Affiliated to ANU)(An ISO 9001-2015 Certified Institution)

Chalapathi Nagar, LAM, Guntur-522 034, Andhra Pradesh, INDIA

(Autonomous)

Scheme of Instruction, Examination and
Detailed Syllabi of

Electrical and Electronics Engineering

3rd YEAR SYLLABUS

SEMESTER V (THIRD YEAR 1ST SEM)

SI.NO.	CATEGORY	CODE	SUBJECT NAME	HOURS PER WEEK			SCHEME OF EXAMINATION		
				L	T	P	INT	EXT	CREDITS
1	PCC	EE 311	Linear Control Systems	3	1	0	30	70	3
2	PCC	EE 312	Power Systems – I	3	1	0	30	70	3
3	PCC	EE 313	Signals and Systems	3	1	0	30	70	3
4	OEC/JOE	EE 314	*Open Elective - 1	2	0	2	30	70	3
5	PEC	EE 315	**Professional Elective - 1	3	0	0	30	70	3
6	MC	MC 170	Life Sciences for Engineers	3	0	0	30	70	0
7	PCC LAB	EE 351	Linear Control Systems Lab	0	0	3	30	70	1.5
8	PCC LAB	EE 352	Signals and Systems Lab	0	0	3	30	70	1.5
9	Skill advanced course / soft skill course	EE 353	As Suggested By APSCHE	1	0	2	30	70	2
10		EE 354	Summer Internship (Electrical Industries/ Eduskills Training Program)	0	0	0	30	70	1.5
			TOTAL	**18**	**3**	**10**	**300**	**700**	**21.5**
HONORS / MINOR COURSES				**4**	**0**	**0**	**30**	**70**	**4**

SEMESTER V I (THIRD YEAR 2ND SEM)

SI.NO.	CATEGORY	CODE	SUBJECT NAME	HOURS PER WEEK			SCHEME OF EXAMINATION		
				L	T	P	INT	EXT	CREDITS
1	PCC	EE 321	Power Electronics	3	1	0	30	70	3
2	PCC	EE 322	Microprocessors and Microcontrollers	3	0	0	30	70	3
3	PCC	EE 323	Power Systems – II	3	1	0	30	70	3
4	OEC / JOE	EE 324	*Open Elective – II	2	0	2	30	70	3
5	PEC	EE 325	**Professional Elective - II	3	0	0	30	70	3
6	PCC LAB	EE 361	Power Electronics Lab	0	0	3	30	70	1.5
7	PCC LAB	EE 362	Microprocessors And Microcontrollers Lab	0	0	3	30	70	1.5
8	PCC LAB	EE 363	Power Systems & Simulation Lab	0	0	3	30	70	1.5
9	Skill advanced course / soft skill course	EE 364	As Suggested By APSCHE	1	0	2	30	70	2
			TOTAL	**15**	**2**	**13**	**270**	**630**	**21.5**
HONORS / MINOR COURSES				**4**	**0**	**0**	**30**	**70**	**4**
INDUSTRIAL / RESEARCH SUMMER INTERSHIP FOR 1 MONTH									

*OPEN ELECTIVE – 1:** Electrical Measurements and Instrumentation
***OPEN ELECTIVE – 2:** Electrical Machines
***OPEN ELECTIVE – 3:** Power systems
***OPEN ELECTIVE – 4:** Power electronics

****PROFESSIONAL ELECTIVE – 1:**

1. **Renewable Energy Sources**
2. Electrical Machine Design
3. Electromagnetic Waves
4. Power System Protection

****PROFESSIONAL ELECTIVE – 2**

1. Computer Architecture
2. Power System Dynamics and Control
3. Digital Signal Processing
4. Computational Electromagnetic

****PROFESSIONAL ELECTIVE – 3**

1. Electrical Drives
2. Electrical and Hybrid Vehicles
3. HVDC Transmission Systems
4. Line-Commutated and Active PWM Rectifiers

****PROFESSIONAL ELECTIVE – 4**

1. Power Quality and FACTS
2. High Voltage Engineering
3. Electrical Energy Conservation and Auditing
4. Advanced Electric Drives

****PROFESSIONAL ELECTIVE – 5**

1. Industrial Electrical Systems
2. Control Systems Design
3. Digital Control Systems
4. AI Applications to Power Systems

EE 311- LINEAR CONTROL SYSTEMS

L	T	P	C
3	1	0	3

COURSE OBJECTIVES:

1. To get familiarized with type of system, dynamics of physical systems and classification of control system.
2. To introduce the concepts of system representation by using transfer function, block diagram reduction method and Mason's gain formula.
3. To learn time response analysis and demonstrate their knowledge to frequency response.
4. To identify stability analysis of system using Root locus, bode plot, polar plot, and Nyquist plot

UNIT I: Introduction: Basic concept of simple control system, open loop, closed loop control systems. Effect of feedback on overall gain, stability sensitivity and external noise. Types of feedback control systems, linear time invariant, time variant systems and non-linear control systems.

UNIT II: Mathematical models and Transfer functions of Physical systems: Differential equations, impulse response and transfer functions, translational and rotational mechanical systems. Transfer functions and open-loop and closed-loop systems. Block diagram representation of control systems, block diagram algebra, signal flow graph, Mason's gain formula

Components of Control Systems: DC servo motor, AC servo motor, synchro transmitter and receiver.

UNIT III: Time Domain Analysis: Standard test signals – step, ramp, parabolic and impulse response function, characteristic polynomial and characteristic equations of feedback systems, transient response of first order and second order systems to standard test signals. Time domain specifications, steady state response, steady state error and error constants. Effect of adding poles and zeros on over shoot, rise time, band width, dominant poles of transfer functions.

Stability Analysis in the complex plane: Absolute, relative, conditional, bounded input, bounded output, zero input stability, conditions for stability, Routh – Hurwitz criterion

UNIT IV: Frequency Domain Analysis: Introduction, correlation between time and frequency responses, polar plots, Bode plots, Nyquist stability criterion, Nyquist plots. Assessment of relative stability using Nyquist criterion, closed loop frequency response.

UNIT V: Root Locus Technique: Introduction, construction of root loci, Introduction to Compensation Techniques

State space analysis: Concepts of stat, state variables and state models, digitalization, solution of state equations, state models for LTI systems. Concepts of controllability and Observability.

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to

1. Analyze the basic elements and structures of feedback control systems.
2. Explain block diagram reduction techniques and Mason's gain formulae.
3. Correlate the pole-zero configurations of transfer functions and their time-domain response.
4. Apply Routh-Hurwitz criterion, Root Locus, Bode Plot and Nyquist Plot to determine the stability of linear time- invariant systems.
5. Determine the steady-state response, errors of stable control systems and design compensators to achieve the desired Performance.
6. Express control system models using state space models.

TEXT BOOKS:

1. I.J.Nagrath M Gopal, Control Systems Engineering, 3rd edition, New Age International.
2. B.C. Kuo, Automatic control systems, 7th edition, PHI.

REFERENCE BOOKS:

1. K. Ogata, Modern Control Engineering, 3rd edition, PHI.
2. Schaum Series, Feedback and Control Systems, TMH
3. M.Gopal, Control Systems Principles and Design, TMH
4. John Van de Vegta, Feedback Control Systems, 3rd edition, Prentice Hall,1993

EE 312- POWER SYSTEMS – I

L	T	P	C
3	1	0	3

COURSE OBJECTIVES:

1. Compute inductance/capacitance of transmission lines and to understand the concepts of GMD/GMR.
2. Study the Short, Medium and longlength transmission lines, their models and affecting the performance of transmission lines.
3. Discuss sag and tension computation of transmission lines as well as to study the performance of overheadinsulators
4. Constructional details of different types of cables and study the different types of distribution
5. Formulate and derive the necessary conditions for economical load scheduling problem.

UNIT I: Transmission Line Parameters : Types of conductors - calculation of resistance for solid conductors - Calculation of inductance for single phase and three phase, single and double circuit lines, concept of GMR & GMD, symmetrical and asymmetrical conductor configuration with and without transposition. Calculation of capacitance for 2 wire and 3 wire systems, effect of ground on capacitance, capacitance calculations for symmetrical and asymmetrical single and three phase, single and double circuit lines, Numerical Problems.

UNIT II: Performance Of Transmission Lines: Classification of Transmission Lines - Short, Medium and Long Line and Their Exact Equivalent Circuits-Nominal-T, Nominal--π. Evaluation of A, B, C, D Constants. Numerical Problems and solutions for estimating regulation and efficiency of all types of lines. Surge Impedance and Surge Impedance Loading. Skin and Proximity effects, Ferranti effect, Charging Current.

UNIT III: Insulators, Corona and Mechanical Design of Lines: Types of Insulators- String efficiency and Methods for improvement– Voltage Distribution, Calculation of string efficiency- Capacitance grading and Static shielding. Corona - Description of the phenomenon, factors affecting corona, critical voltages and power loss, Radio Interference. Sag and Tension Calculations with equal and unequal heights of towers, Effect of Wind and Ice on weight of Conductor - Stringing chart and sag template and its applications.

UNIT IV: Underground Cables & Dc And Ac Distribution Underground Cables: Types of Cables, T ypes of Insulating materials, Calculations of Insulation resistance and stress Capacitance of Single and 3-Core belted cables, Grading of Cables- Capacitance grading, Description of Inter sheath grading.

DC and AC Distribution: Basic concepts of DC and AC distribution, Distributor fed at one end, Distributor fed at both end. Methods of AC distribution, Power factor referred to receiving end only, Numerical problems.

UNIT V: Economic Operation of Power System: Input-Output curves, Heat rates and incremental cost curves, Equal Incremental cost criterion Neglecting transmission losses with and without generator limits, Bmn Coefficients, Economic operation including transmission losses.

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to

1. Understand the electrical design of transmission lines.
2. Analyze the performances of transmission lines using phasor diagram and A.B,C,D constants.
3. Apply the mechanical design of transmission lines.
4. Understand the basic concepts of underground cables.
5. Determine the equal incremental cost with and without transmission losses and Bmn coefficients

TEXT BOOKS:

1. C.L.Wadhwa, “Electrical Power Systems”, New Age International (P) Limited, Publishers, 1998
2. V.K Mehta and Rohit Mehta (2004), “Principles of Power Systems”, S.Chand& Company, New Delhi.
3. K. Ogata, “Modern control Engineering”, Pearson, 2003.
4. M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A.Chakrabarthy, “A Text Book on Power System Engineering”, Dhanpat Rai & Co Pvt. Ltd. 1999.
5. Allen J. Wood, Bruce.F.Woolenberg,Power Generation, Operation & Control, Wiley Publishers, 2006

REFERENCE BOOKS:

1. John J Grainger William D Stevenson, “Power system Analysis”, TMC Companies, 4th edition, 2004
2. Hadi Saadat, “Power System Analysis”, TMH Edition. 2002..
3. J.B.Gupta “ A Course in Power systems”, S.K.Kataria& Sons,2009.

WEB RESOURCES:

1. http://www.eng.uwi.tt/depts/elec/staff/alvin/ee35t/notes/Transmission

http://engineering.electrical-equipment.org/others/underground-cables-advantages-

EE 313- SIGNALS AND SYSTEMS

L	T	P	C
3	1	0	3

COURSE OBJECTIVES:

1. To classify signals and systems from the electronics and communication engineering perspective.
2. To introduce the analysis of signals and systems in time and frequency domains.
3. To analyze Linear Time Invariant (LTI) systems using transform techniques.
4. To impart fundamentals for understanding of high-end courses such as signal processing, control systems and communications

UNIT I: Signal Analysis: Introduction to signals and systems, Classification of signals and systems (both discrete and continuous), Approximation of a function by a set of mutually orthogonal functions, Evaluation of mean square error, Orthogonality in complex functions.

UNIT II: Time-domain analysis of LTIC systems: Representation of LTIC systems, Representation of signals using dirac delta functions, Impulse response of a LTIC system, Convolution integral, Auto-correlation and Cross-correlation functions, Properties of correlation function.

UNIT III: Fourier Series and Fourier Transform: Trigonometric and exponential Fourier series, Representation of an arbitrary function over the entire interval: Fourier transform, Fourier transform of standard functions, Singularity functions, Fourier transform of periodic function, Properties of Fourier transform, Energy density spectrum.

UNIT IV: Signal Transmission through Linear Systems: Response of a Linear time invariant (LTI) system, Filter characteristics of linear systems, Distortion less transmission through a sys- tem, Signal bandwidth, system bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Poly-Wiener criterion for physical realization, Relationship between bandwidth and rise time. Energy and power spectral density, Sampling theorem and its implications.

UNIT V: Laplace Transform: The Laplace transform, Relationship between Laplace and Fourier transform, Region of Convergence, the inverse Laplace transform, Properties of Laplace trans- form, Applications of Laplace transforms, Stability analysis of LTI system.

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to

1. Explain mathematical description and representation of continuous and discrete time sig-nals and systems.
2. Develop input-output relationship for linear shift invariant system.
3. Illustrate the convolution operator for continuous and discrete time system.
4. Resolve the signals in frequency domain using Fourier series and Fourier transforms.
5. Evaluate the limitations of Fourier transform and need for Laplace transform.

TEXT BOOKS:

1. A V Oppenheim, A S Wilsky and IT Young, Signals and Systems, PHI/ Pearson,2003
2. Mandal, Mrinal Kr, and Amir Asif. Continuous and discrete time signals and systems,Cambridge University Press, 2007.

REFERENCE BOOKS:

1. B P Lathi, Signals, Systems and Communications, BSP, 2003
2. Simon Haykin, Signals and Systems, John Wiley, 2004
3. David K Cheng, Analysis of Linear Systems, Narosa Publishers, 1990.

WEB RESOURCES:

. https://nptel.ac.in/courses/117/101/117101055/
2. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/video-lectures/
3. https://eee.guc.edu.eg/Courses/Communications/COMM401%20Signal%20%20System%20Theory/ Alan%20V.%20Oppenheim,%20Alan%20S.%20Willsky,%20with%20S.%20Hamid-Signals%20and%20 Systems-Prentice%20Hall%20(1996).pdf

EE 314- RENEWABLE ENERGY SOURCES
(OPEN ELECTIVE – I)

L	T	P	C
2	0	2	3

COURSE OBJECTIVES:

1. Understand the Solar and Wind energy Sources
2. Recognize the need of renewable energy technologies and their role in the India and World energy demand
3. Gain knowledge on Renewable wave ocean and biomass energy
4. Model renewable electrical energy systems for analysis and design
5. Perform basic assessment and design of a renewable electrical energy system for a given application

UNIT I: Principle of Renewable Energy: Comparison of renewable and conventional energy sources - Ultimate energy sources - natural energy currents on earth - primary supply to end use - Spaghetti & Pie diagrams - energy planning – energy efficiency and management.

UNIT II: Solar Radiation: Extra-terrestrial solar radiation - terrestrial solar radiation – solar thermal conversion - solar thermal central receiver systems - photovoltaic energy conversion - solar cells – 4 models.

UNIT III: Wind energy: Planetary and local winds - vertical axis and horizontal axis wind mills - principles of wind power - maximum power - actual power - wind turbine operation - electrical generator.

UNIT IV: Energy from Oceans: Ocean temperature differences - principles of OTEC plant operations - wave energy - devices for energy extraction – tides - simple single pool tidal system.

UNIT V: Geothermal energy: Origin and types - Bio fuels – classification – direct combustion for heat and electricity generator - anaerobic digestion for biogas – biogas digester - power generation.

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to

1: Ability to Apply Engineering fundamentals to analysis and solve Engineering problems with a focus to meet the increasing energy Demand.

2: Ability to identify and organize process having higher priority for Environment conditions

3: Ability to Understand impact of the professional Engineering Problems in environmental contexts and demonstrate the need for sustainable development

TEXT BOOKS:

1. Renewable Energy Sources by John Twidell& Toney Weir: E&F.N. Spon
2. Renewable Energy Sources: Their impact on global warming and pollution byAbbasi&Abbasi – PHI

REFERENCE BOOKS:

1. Power plant technology by EL-Wakil, McGraw-Hill
2. Non-Conventional Energy Sources by G.D.Rai, Khanna Pub.

EEE 314/1: APPLIED ELECTROMAGNETIC FOR ENGINEERS (MOOCS)
(PROFESSIONAL ELECTIVE – 1)

L	T	P	C
3	0	0	3

COURSE LAYOUT:

Week 1:

1. Introduction to Applied EM theory
2. Lossless Transmission line equations
3. Frequency-domain behavior: Characteristic impedance of T-line
4. Reflection and transmission coefficients
5. Complete solution for sinusoidal propagation

Week 2:

1. More general T-lines
2. Attenuation and propagation coefficients
3. Transmission line techniques: Standing wave ratio (SWR) and line impedance
4. Visual aid: Smith Chart derivation
5. Smith chart applications: Impedance to admittance conversion, SWR and impedance calculation

Week 3:

1. Impedance matching techniques - Part 1
2. Impedance matching techniques - Part 2
3. T-lines in time-domain: Reflection from mismatched loads
4. Lattice diagram calculations
5. Pulse propagation on T-lines

Week 4:

1. Case study: High-speed digital signals on PCBs
2. Transients with reactive termination
3. Application: Time-domain reflectometry
4. Review of Coordinate Systems
5. Review of Vector analysis -1

Week 5:

1. Review of Vector analysis -2
2. Vector fields -Part 1
3. Vector fields - Part 2
4. Overview and importance of Maxwell's equations
5. Boundary conditions between two media

Week 6:

1. Solution of Laplace's and Poisson's equation -- Analytical techniques
2. Solution of Laplace's and Poisson's equation in two dimensions
3. Numerical solution of Laplace's equation: Finite difference method
4. Numerical technique: Method of moments
5. Quasi-statics: Does an ideal capacitor exist?

Week 7:

1. Magnetostatic fields: Biot Savart and Ampere's laws
2. Magnetic field calculations
3. Inductance and inductance calculation
4. Quasi-statics: Fields of a wire
5. Quasi-static analysis of skin effect

Week 8:

1. Uniform plane waves - one dimensional wave equation
2. Uniform plane waves: propagation in arbitrary direction, phase velocity, polarization
3. Plane waves in conductors an dielectric media
4. Reflection and transmission of plane waves at a planar interface
5. Oblique incidence and reflection of plane waves - s and p polarization

Week 9:

1. Total internal reflection and Snell's laws
2. Application: Multilayer thin films
3. Application: Fabry-Perot cavity
4. Waveguides - General introduction
5. Rectangular metallic waveguide modes

Week 10:

1. Dispersion and attenuation
2. Dielectric planar waveguides
3. Case study: Optical fibers
4. Application: Fiber-optic communications
5. WDM optical components

Week 11:

1. Wave propagation in crystals and index ellipsoid
2. Wave propagation in Ferrites
3. Wave propagation in periodic structures: Diffraction
4. Vector potential and wave equation
5. Radiation by dipole

Week 12:

1. Fundamental Antenna parameters
2. Half-wave dipole
3. Antenna array and diffraction
4. Application: RFID
5. Looking ahead

TEXT BOOKS:

1. Electromagnetics with applications, 5th ed, J. D. Kraus and D. Fleisch, McGraw Hill, 1999

REFERENCES BOOKS:

1. Engineering Electromagnetics, Hayt and Buck, 7th edition, McGraw Hill.
2. Electromagnetic waves, D. Staelin, A. Morgenthaler, and J. A. Kong, Pearson, Pearson, 1993.
3. Applied Electromagnetics: Early Transmission Line Approach, S. M. Wentworth, Wiley, 2007.
4. Practical Electromagnetics, D. Misra, Wiley, 2007.

EEE 314/2: CONTROL AND TUNING METHODS IN SWITCHED MODE POWER CONVERTERS (MOOCS)
(PROFESSIONAL ELECTIVE – 1)

L	T	P	C
3	0	0	3

COURSE LAYOUT:

Week 1: Switched mode power converters and MATLAB simulation
Week 2: Modulation techniques in SMPCs
Week 3: Fixed frequency control methods
Week 4: Variable frequency control methods
Week 5: Modeling and Analysis techniques in SMPCs
Week 6: Small-signal performance analysis
Week 7: Small-signal design and tuning of PWM voltage mode control
Week 8: Small-signal design of current mode control
Week 9: Large-signal model and nonlinear control
Week 10: Boundary control for time optimal recovery
Week 11: Large-signal controller tuning method
Week 12: Performance comparison and simulation

TEXT BOOKS:

1. S. Kapat and P. T. Krein, "A Tutorial and Review Discussion of Modulation, Control and Tuning of High-Performance DC-DC Converters based on Small-Signal and Large-Signal Approaches", IEEE Open Journal of Power Electronics, vol. 1, pp. 339 - 371, Aug. 2020.

REFERENCES BOOKS:

2. R. W. Erickson and D. Maksimovic, Fundamentals of Power Electronics, 3rd Ed., Springer, 2020.
3. P. T. Krein, Elements of Power Electronics, Indian Edition, Oxford University Press, 2012.

EEE 314/3: DIGITAL IMAGE PROCESSING (MOOCS)
(PROFESSIONAL ELECTIVE – 1)

L	T	P	C
3	0	0	3

COURSE LAYOUT:

Week 1: Introduction and signal digitization
Week 2: Pixel relationship
Week 3: Camera models & imaging geometry
Week 4: Image interpolation
Week 5: Image transformation
Week 6: Image enhancement I
Week 7: Image enhancement II
Week 8: Image enhancement III
Week 9: Image restoration I
Week 10: Image restoration II & Image registration
Week 11: Colour image processing
Week 12: Image segmentation
Week 13: Morphological image processing
Week 14: Object representation ,description and recognition

TEXT BOOKS:

1. Digital Image Processing by Rafael C Gonzalez & Richard E Woods, 3rd Edition

REFERENCES BOOKS:

1. Fundamentals of Digital Image Processing by Anil K Jain
2. Digital Image Processing by William K Pratt

EEE 314/4: DESIGN OF PHOTOVOLTAIC SYSTEMS (MOOCS)
(PROFESSIONAL ELECTIVE – 1)

L	T	P	C
3	0	0	3

COURSE LAYOUT:
Week 1: The PV Cell
Week 2: Series and Parallel Interconnection
Week 3: Energy from Sun
Week 4: Incident Energy Estimation
Week 5: Sizing PV
Week 6: Maximum Power Point Tracking
Week 7: MPPT Algorithms
Week 8: PV-Battery Interfaces
Week 9: Peltier Cooling
Week 10: PV and Water Pumping
Week 11: PV-Grid Interface-I
Week 12: PV-Grid Interface-Ii and Life Cycle Costing

TEXT BOOK:
1. Chenming, H. and White, R.M., "Solar *Cells from B to Advanced Systems"* , McGraw Hill Book Co, 1983

REFERENCES:
1. Ruschenbach, HS, Reinhold, " *Solar Cell Array Design Hand Varmostrand* ", NY, 1980
2. Proceedings of IEEE Photovoltaics Specialists Conferences, Solar Energy Journal.

WEB RESOURCES:
1. https://swayam.gov.in/nd1_noc20_ee57/preview

EE 316- LIFE SCIENCES FOR ENGINEERS (MC 170)

L	T	P	C
3	0	0	0

COURSE OBJECTIVES:

1. Understand the Plant Physiology covering, Ecology covering, Community ecology.
2. Recognize the need of Environmental Management covering, Environmental Impact Assessment
3. Gain knowledge on Molecular Genetics covering, Plant & Animal tissue culture
4. Introduction to Biostatistics

UNIT I: Plant Physiology covering, Transpiration; Mineral nutrition, Ecology covering, Ecosystems- Components, types, flow of matter and energy in an ecosystem; Community ecology- Characteristics, frequency, life forms, and biological spectrum; Ecosystem structure- Biotic and a-biotic factors, food chain, food web, ecological pyramids;

UNIT II: Population Dynamics covering, Population ecology- Population characteristics, ecotypes; Population genetics- Concept of gene pool and genetic diversity in populations, polymorphism and heterogeneity;

UNIT III: Environmental Management covering, Principles: Perspectives, concerns and management strategies; Policies and legal aspects- Environment Protection Acts and modification, International Treaties; Environmental Impact Assessment- Case studies (International Airport, thermal power plant);

UNIT IV: Molecular Genetics covering, Structures of DNA and RNA; Concept of Gene, Gene regulation, e.g., Operon concept; Biotechnology covering, Basic concepts: Totipotency and Cell manipulation; Plant & Animal tissue culture- Methods and uses in agriculture, medicine and health; Recombinant DNA Technology- Techniques and applications;

UNIT V: Biostatistics covering, Introduction to Biostatistics:-Terms used, types of data; Measures of Central Tendencies- Mean, Median, Mode, Normal and Skewed distributions; Analysis of Data- Hypothesis testing and ANNOVA (single factor)

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to

1. Understand the Plant Physiology covering, Ecology covering, Community ecology.
2. Recognize the need of Environmental Management covering, Environmental Impact Assessment
3. Gain knowledge on Molecular Genetics covering, Plant & Animal tissue culture
4. Understand the concepts of Biostatistics

TEXT BOOKS:

1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H. John Wiley and Sons

REFERENCE BOOKS:

1. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
2. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
3. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C Brown Publishers

EE 351- LINEAR CONTROL SYSTEMS LAB

L	T	P	C
0	**0**	**3**	**1.5**

COURSE OBJECTIVES

1. To obtain time response of linear system
2. To study the effect of different controllers on second order system
3. To study the effect of different controllers on DC servo motor by using PLC
4. To study the control of stepper motor
5. To obtain the characteristics of magnetic amplifier

LIST OF EXPERIMENTS

1. Time Response analysis of Second Order System.
2. Characteristics of synchros
3. Determination of transfer function and effect of feedback on DC servo motor
4. Study the effect of P,PD,PI,PID controllers on second order systems
5. Simulation of transfer function using operational amplifier
6. Lag and Lead Compensators-Magnitude and phase plot
7. Temperature controller using PID
8. Characteristics of magnetic amplifier
9. Study the effect of P, PD, PI, PID controllers on second order systems.
10. Stepper motor control
11. Time response analysis of Linear Systems for impulse and step inputs
12. Frequency response of first and second order Systems
13. P,PD,PI,PID controllers using op-amps
14. Study the effect of P, PD, PI, PID controllers on DC servo motor system using PLC.
15. Study the effect of P,PD ,PI, PID controllers on Temperature control system using PLC.

COURSE OUTCOMES

After completion of this lab course, the student able to

1. Simulate the physical control system for stability studies
2. Demonstrate feedback controllers
3. Develop logic gates using PLC
4. Obtain characteristics of magnetic amplifier

EE 352- SIGNALS AND SYSTEMS LAB

L	T	P	C
0	0	3	1.5

Course Objectives

1. To provide a thorough understanding and analysis of signals and systems using octave.

List of Experiments

1. Write a program to generate the discrete sequences:
   (a) Unit step.
   (b) Unit impulse.
   (c) Ramp.
   (d) Periodic sinusoidal sequences.
2. Find the fourier transform of a square pulse. Plot its amplitude and phase spectrum.
3. Write a program to convolve two discrete time sequences. Plot all the sequences. Verify the result by analytical calculation.
4. Write a program to find the trigonometric fourier series coefficients of a rectangular periodic signal. Reconstruct the signal by combining the fourier series coefficients with appropriate weightings.
5. Write a program to find the trigonometric and exponential fourier series coefficients of a periodic rectangular signal. Plot the discrete spectrum of the signal.
6. Generate a discrete time sequence by sampling a continuous time signal. Show that with sampling rates less than Nyquist rate, aliasing occurs while reconstructing the signal.
7. The signal x(t) is defined as below. The signal is sampled at a sampling rate of 1000 samples per second. Find the power content and power spectral density for this signal.
   $X(t)=\cos(2\pi * 47t)+\cos(2\pi * 219t), 0<t<10$ $X(t)=0$, otherwise.
8. Write a program to find the magnitude and phase response of first order low pass and high pass filter. Plot the responses in logarithmic scale.
9. Write a program to find the response of a low pass filter and high pass filter, when a realtime signal is passed through these filters.
10. Write a program to find the autocorrelation and cross correlation of sequences.
11. Generate a uniformly distributed length 1000 random sequence in the range (0,1). Plot the histogram and the probability function for the sequence. Compute the mean and variance of the random signal.
12. Generate a Gaussian distributed length 1000 random sequence. Compute the mean and variance of the random signal by a suitable method.
13. Write a program to generate a random sinusoidal signal and plot four possible realizationsof the random signal.
14. Generate a discrete time sequence of N=1000 i.i.d uniformly distributed random numbersin the interval (-0.5,-0.5) and compute the autocorrelation of the sequence.
15. Obtain and plot the power spectrum of the output process when a white random process is passed through a filter with specific impulse response.

Course Outcomes

At the end of course, the student will be able to

1. Generate and characterize various continuous and discrete time signals.
2. Perform the basic operations on continuous and discrete time signals.
3. Design linear time-invariant (LTI) systems and compute its response.
4. Analyze the spectral characteristics of signals using Fourier analysis.
5. Implement analog filters for real time signals.

EE 353- AS SUGGESTED BY APSCHE

L	T	P	C
1	0	2	2

EE 354- SUMMER INTERNSHIP

L	T	P	C
0	0	0	1.5

SEMESTER V I (THIRD YEAR 2ND SEM)

SI.NO.	CATEGORY	CODE	SUBJECT NAME	HOURS PER WEEK			SCHEME OF EXAMINATION		
				L	T	P	INT	EXT	CREDITS
1	PCC	EE 321	Power Electronics	3	1	0	30	70	3
2	PCC	EE 322	Microprocessors and Microcontrollers	3	0	0	30	70	3
3	PCC	EE 323	Power Systems – II	3	1	0	30	70	3
4	OEC / JOE	EE 324	*Open Elective – II	2	0	2	30	70	3
5	PEC	EE 325	**Professional Elective - II	3	0	0	30	70	3
6	PCC LAB	EE 361	Power Electronics Lab	0	0	3	30	70	1.5
7	PCC LAB	EE 362	Microprocessors And Microcontrollers Lab	0	0	3	30	70	1.5
8	PCC LAB	EE 363	Power Systems & Simulation Lab	0	0	3	30	70	1.5
9	Skill advanced course / soft skill course	EE 364	As Suggested By APSCHE	1	0	2	30	70	2
			TOTAL	**15**	**2**	**13**	**270**	**630**	**21.5**
HONORS / MINOR COURSES				**4**	**0**	**0**	**30**	**70**	**4**
INDUSTRIAL / RESEARCH SUMMER INTERSHIP FOR 1 MONTH									

EE 321- POWER ELECTRONICS

L	T	P	C
3	1	0	3

COURSE OBJECTIVES:

1. To Design/develop suitable power converter for efficient control or conversion of power in driveapplications
2. To Design / develop suitable power converter for efficient transmission and utilization of powerin power system applications.

UNIT I: Power Switching Devices: Concept of power electronics, scope and applications, types of power converters; Power semiconductor switches and their V-I characteristics - Power Diodes, Power BJT, SCR, Power MOSFET, Power IGBT; Thyristor ratings and protection, methods of SCR commutation,UJT as a trigger source, gate drive circuits for BJT and MOSFETs

UNIT II: AC-DC Converters (Phase Controlled Rectifiers): Principles of single-phase fully-controlled converter with R, RL, and RLE load, Principles of single-phase half-controlled converter with RL and RLE load, Principles of three-phase fully-controlled converter operation with RLE load, Effect of load and source inductances, General idea of gating circuits, Single phase and Three phase dual converters

UNIT III: DC-DC Converters (Chopper/SMPS): Introduction, elementary chopper with an active switch and diode, concepts of duty ratio, average inductor voltage, average capacitor current. Buck converter - Power circuit, analysis and waveforms at steady state, duty ratio control of output voltage. Boost converter - Power circuit, analysis and waveforms at steady state, relation between duty ratio and average output voltage. Buck-Boost converter - Power circuit, analysis and waveforms at steady state, relation between duty ratio and average output voltage.

UNIT IV: AC-DC Converters (Inverters): Introduction, principle of operation, performance parameters, single phase bridge inverters with R, RL loads, 3-phase bridge inverters - 120- and 180-degrees mode of operation, Voltage control of single-phase inverters –single pulse width modulation, multiple pulse widthmodulation, sinusoidal pulse width modulation.

UNIT V: AC-AC Converters: Phase Controller (AC Voltage Regulator)-Introduction, principle of operation of single-phase voltage controllers for R, R-L loads and its applications. Cyclo-converter-Principle of operation of single phase cyclo-converters, relevant waveforms, circulating current mode of operation,Advantages and disadvantages.

COURSE OUTCOMES:

1. Upon successful completion of the course, students will be able to
2. Understand the differences between signal level and power level devices.
3. Analyze controlled rectifier circuits.
4. Analyze the operation of DC-DC choppers.
5. Analyze the operation of voltage source inverters.

TEXT BOOKS:

1. M. H. Rashid, “Power electronics: circuits, devices, and applications”, Pearson Education India,2009.
2. N. Mohan and T. M. Undeland, “Power Electronics: Converters, Applications and Design”, JohnWiley & Sons, 2007.

REFERENCE BOOKS:

1. R. W. Erickson and D. Maksimovic, “Fundamentals of Power Electronics”, Springer Science &Business Media, 2007.
2. L. Umanand, “Power Electronics: Essentials and Applications”, Wiley India, 2009.
3. P.S.Bimbra “Power Electronics” Khanna Publishers, third Edition, 2003

EE 322- MICROPROCESSORS AND MICROCONTROLLERS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To introduce students with the architecture and operation of typical microprocessors and microcontrollers.
2. To familiarize the students with the programming and interfacing of microprocessors and microcontrollers.
3. To provide strong foundation for designing real world applications using microprocessors and microcontrollers.

UNIT I: 8086/8088 Processor: Features, Pin Diagram and Description, Architecture, Addressing Modes, Instruction Set and Assembly language Programming.

UNIT II: Programming Peripheral Interface and I/O Devices: Interfacing Programming peripheral interface PPI 8255, Bus architectures: PCI, ISA, VME, Interfacing memory and I/O Devices. LED and Switch interfacing to 8086 using 8255. Universal Synchronous Asynchronous ReceiverTransmitter – Interfacing of 8251,RS-232 Communication standard.

UNIT III: Direct Memory Access and Interrupt system: DMA, Need of DMA, Memory management, Interfacing 8257, DMA controller, Interrupts, Programmable interrupt controller PIC-8259.

UNIT IV: Introduction to Micro-controllers: Overview of 8051 micro-controller, Architecture, I/O ports, Memory organization, addressing modes and instruction set of 8051, Simple pro- grams.

UNIT V: 8051 Real Time Control: Programming Timer interrupts, programming external hardware interrupts, Programming the serial communication interrupts, Programming 8051 timers and counters, Communication Protocols: CAN, I2C, SPI.

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to

1. Assess and solve basic binary math operations using the microprocessor and explain the internal architecture of processors and micro-controllers.
2. Apply knowledge and demonstrate programming proficiency using the various addressing modes and data transfer instructions of the target microprocessor and micro-controller.
3. Compare accepted standards and guidelines to select appropriate microprocessor/micro-controller to meet specified performance requirements.
4. Analyze assembly language programs, select appropriate assembler/cross assembler utility of a microprocessor and micro-controller.
5. Evaluate assembly language programs and download the machine code that will provide solutions real-world control problems.

TEXT BOOKS:

1. 1. Microprocessor and interfacing by Douglas V.Hall, McGraw Hill International Edition, 1992.
2. Kenneth.J.Ayala. The 8051 microcontroller, 3rd edition, Cengage learning,2010

REFERENCE BOOKS:

1. The Intel microprocessor 8086/8088, 80186, 80286, 80386, and 80486 by Barry B. Brey, PHI,1998.
2. Advanced microprocessors and peripherals-A.K ray and K.M.Bhurchandani, TMH, 2ndedition 2006.
3. 8086/8088 Microprocessors by Walter A. Tribel and Avtar Singh, PHI, 1991.

EE 323- POWER SYSTEMS – II

L	T	P	C
3	1	0	3

COURSE OBJECTIVES:

1. To development the impedance diagram (p.u) and formation of Ybus
2. To study the different load flow methods.
3. To study the concept of the Zbusbuilding algorithm.
4. To study short circuit calculation for symmetrical faults
5. To study the effect of unsymmetrical faults and their effects
6. To study the rotor angle stability of power systems.

UNIT I: Per Unit Representation & Topology: Per Unit Quantities–Single line diagram–Impedance diagram of a power system–Graph theory definition – Formation of element node incidence and bus incidence matrices – Primitive network representation – Formation of Y–bus matrix by singular transformation and direct inspection methods.

UNIT II: Power Flow Studies: Necessity of power flow studies – Derivation of static power flow equations – Power flow solution using Gauss-Seidel Method – Newton Raphson Method (Rectangular and polar coordinates form) –Decoupled and Fast Decoupled methods – Algorithmic approach Problems on 3–bus system only.

UNIT III: Z–Bus formulation : Formation of Z–Bus: Partial network– Algorithm for the Modification of Zbus Matrix for addition element for the following cases: Addition of element from a new bus to reference– Addition of element from a new bus to an old bus– Addition of element between an old bus to reference and Addition of element between two old busses (Derivations and Numerical Problems).– Modification of Z–Bus for the changes in network (Problems).

UNIT IV: Fault Analysis&Symmetrical Components: Transients on a Transmission line-short circuit of synchronous machine (on no-load) – 3-Phase short circuit currents and reactance's of synchronous machine–Short circuit MVA calculations -Series reactors – selection of reactors.
Definition of symmetrical components - symmetrical components of unbalanced three phase systems – Power in symmetrical components – Sequence impedances – Synchronous generator – Transmission line and transformers – Sequence networks –Various types of faults LG– LL– LLG and LLL on unloaded alternator–unsymmetrical faults on power system. .

UNIT V: Power System Stability Analysis: Elementary concepts of Steady state– Dynamic and Transient Stabilities– Description of Steady State Stability Power Limit–Transfer Reactance–Synchronizing Power Coefficient Power Angle Curve and Determination of Steady State Stability – Derivation of Swing Equation–Determination of Transient Stability by Equal Area Criterion–Applications of Equal Area Criterion–Methods to improve steady state and transient stability.

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to

1. Able to draw impedance diagram for a power system network and to understand per unit quantities.
2. Able to form a Y bus and Z bus for a power system networks.
3. Able to understand the load flow solution of a power system using different methods.
4. Able to find the fault currents for all types faults to provide data for the design of protective devices. • Able to find the sequence components of currents for unbalanced power system network.
5. Able to analyze the steady state, transient and dynamic stability concepts of a power system.

TEXT BOOKS:

1. Power System Analysis by Grainger and Stevenson, Tata McGraw Hill.
2. Modern Power system Analysis – by I.J.Nagrath&D.P.Kothari: Tata McGraw–Hill Publishing Company, 2nd edition.

REFERENCE BOOKS:

1. Power System Analysis – by A.R.Bergen, Prentice Hall, Inc.
2. Power System Analysis by HadiSaadat – TMH Edition.
3. Power System Analysis by B.R.Gupta, Wheeler Publications.
4. Power System Analysis and Design by J.Duncan Glover, M.S.Sarma, T.J.Overbye – CengageLearning publications.

EE 324- ELECTRICAL MATERIALS
(OPEN ELECTIVE – II)

L	T	P	C
2	0	2	3

COURSE OBJECTIVES:

1. To clarify the students on insulating, conducting & magnetic materials.
2. To impart knowledge on the Physical, Electrical & Mechanical properties
3. To impart knowledge on practical uses of various materials in different areas.

UNIT I: Introduction: Resistivity, factors affecting resistivity-Classification of conducting materials into low-resistivity and high resistivity materials-Low Resistivity Materials and their Applications-Copper, Silver, Gold, Aluminum, Steel, Stranded conductors, Bundled conductors, Low resistivity copper alloys, High Resistivity Materials a -Tungsten, Carbon, Platinum, Mercury, Superconducting materials, Application of superconductor materials.

UNIT II: Semiconducting Materials: Semiconductors, Electron Energy and Energy Band Theory , Excitation of Atoms , Insulators, Semiconductors and Conductors , Semiconductor Materials, Covalent Bonds, Intrinsic Semiconductors, Extrinsic Semiconductors, N-Type Materials , P-Type Materials ,Minority and Majority Carriers, Semi-Conductor Material. Applications of Semiconductor materials-Rectifiers , Temperature-sensitive resisters or thermostats, Photoconductive cells , Photovoltaic cells, Varistors , Transistors, Hall effect generators ,Solar power.

UNIT III: Insulating Materials: General properties of Insulating Materials_ Electrical properties , Visual properties , Mechanical properties ,Thermal properties, Chemical properties, Ageing, Insulating Materials – Classification, properties, applications, Introduction, Classification of insulating materials on the basis physical and chemical structure, Insulating Gases_ Introduction, Commonly used insulating gases

UNIT IV: Dielectric Materials: Dielectric Constant of Permittivity, Polarization, Dielectric Loss, Electric Conductivity of Dielectrics and their Break Down, Properties of Dielectrics, Applications of Dielectrics.

UNIT V: Magnetic Materials: Introduction , Classification - Diamagnetism , Para magnetism , Ferromagnetism , Magnetization Curve, Hysteresis, Eddy Currents , Curie Point , Magneto-striction, Soft and Hard magnetic Materials ,Soft magnetic materials , Hard magnetic materials

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to

1. Classify and describe the properties electrical engineering materials.
2. Select the proper materials for the various components of electrical system.
3. Demonstrate installation and operations of domestic appliances
4. Find the fault and remedies of domestic appliances by reading the electrical diagram.
5. Check the connection diagram of the electrical system during installation and fallow all safety practices.
6. Trace connection diagram of the electrical system, equipments and their control circuit

TEXT BOOKS:

1. Title of the Book Name of Publisher 1 K.B.Raina, S.K. Bhattacharya, T. Joneja Electrical Engg. Material & Electronic components S. K. Kataria & Sons
2. R.K.Shukla, Archana Singh Electrical Engineering Materials Mc Graw Hill

REFERENCE BOOKS:

1. C.S.Indulkar and S. Thiruvengadam, S., “An Introduction to Electrical Engineerin
2. Kenneth G. Budinski,, “Engineering Materials: Prentice Hall of India, New Delhi

EE 325/1- UTILIZATION OF ELECTRICAL ENERGY
(PROFESSIONAL ELECTIVE – II)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To provide students with the fundamentals of electric traction, illumination, electric heating and welding.
2. To discuss the theory of motors rating and selection.
3. To introduce electric drives.
4. To teach various design considerations and theory of illumination methods.
5. To impart the knowledge of heating element design, heating and cooling curves etc.
6. To introduce storage batteries

UNIT I: Electric Traction: Introduction- Systems of electric traction- comparison between DC and AC systems in electric traction - mechanics of train movement- speed-time curves- effect of speed-acceleration and distance on schedule- Power and energy output from driving axles- specific energy output- collectors - introduction to electric braking – comparison of electric and mechanic braking.

UNIT II: Electric Heating: Introduction; Modes of heat transfer - Stefan's law –classification of electric heating methods- design of heating element - Construction and working of different types of induction furnaces - resistance furnace - Dielectric heating – arc furnaces .

UNIT III: Welding: Introduction- Types of welding - resistance and arc welding -Characteristics of Carbon and metallic arc welding - comparison (Excluding electronic controls)- requirements of good weld-ultra sonic-electron beam-laser beam welding.

UNIT IV: Illumination: Introduction- terms used in illumination-laws of illumination-Gas discharge lamps - Fluorescent lamps - Arc lamps - Filament lamps – comparison between filament and fluorescent lamps-square law methods of calculation – Factory lighting - flood lighting and street lighting-design of lighting schemes-introduction to Compact Fluorescent Lamps.

UNIT V: Storage batteries: Applications-rating-classification-dry cell and wet cells-primary and secondary cells-charging and discharging of lead acid cells, trickle charging methods of charging lead acid batteries-over discharging-common troubles with lead acid batteries and remedies-Nickel cadmium batteries.

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to

1. Calculate the specific energy output, tractive effort, schedule speed in traction.
2. Classify the different types of resistance heating.
3. Classify the different methods of welding.
4. Understand the laws of illumination; know the different sources of light.
5. Understand the different types of storage batteries

TEXT BOOKS:

1. **A** Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U. S. Bhatnagar and A.Chakraborti, Dhanpat Rai & Co. Pvt. Ltd., 2001.
2. Utilization Electric Power and electric traction by J.B.Gupta, publishers-Katson books
3. Utilization, generation & conservation of electrical energy by Sunil S Rao, Khanna publishers

REFERENCE BOOKS:

1. Generation, Transmission & Utilization Electric Power by A.T. Starr London,Pitman. 1953
2. Art and Science of Utilization of Electrical Energy by Partab H Dhanpat Rai and Sons, New Delhi. Second edition
3. Electrical Technology, volume-1 by B.L.Thereja, S.Chand &co publishers

EE 325/2- POWER SYSTEM DYNAMICS AND CONTROL
(PROFESSIONAL ELECTIVE – II)

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES:

1. To understand the power system stability and its impact on the system.
2. To Analyze linear dynamical systems and use of numerical integration methods
3. 3.To model different power system components for the study of stability and methods to improve stability

UNIT I: Introduction to Power System Operations: Introduction to power system stability, Power System Operations and Control. Stability problems in Power System, Impact on Power System Operations and control

UNIT II: Analysis of Linear Dynamical System and Numerical Methods: Analysis of dynamical System, Concept of Equilibrium, Small and Large Disturbance Stability, Modal Analysis of Linear System, Analysis using Numerical Integration Techniques, Issues in Modelling: Slow and Fast Transients, Stiff System.

UNIT III: Modeling of Synchronous Machines: Physical Characteristics, Rotor position dependent model, d-q Transformation, Model with Standard Parameters. Steady State Analysis, Short Circuit Transient Analysis, Synchronization of Synchronous Machine to an Infinite Bus, Modeling of Excitation and Prime Mover Systems, Physical Characteristics and Models.

UNIT IV: Stability Analysis: Angular stability analysis in Single Machine Infinite Bus System, Angular Stability in multi-machine systems–Intra-plant, Local and Inter-area modes, Frequency Stability, Centre of Inertia Motion, Load Sharing, Governor droop, Single Machine Load Bus System-Voltage Stability

UNIT V: Enhancing System Stability: Planning Measures, Stabilizing Controllers (Power System Stabilizers), Operational Measures-Preventive Control, and Emergency Control.

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to

1. Acquire the concepts of various types of stability and its control
2. Apply different numerical techniques for stability studies
3. Understand the concepts of small and large disturbance stability
4. Acquire the concepts of different models of synchronous machines and its controllers
5. Recognize the importance of enhancing the power system stability

TEXT BOOKS:

1. K.R. Padiyar, “Power System Dynamics, Stability and Control”, B. S. Publications, 2002.
2. P. Sauer and M. A. Pai, “Power System Dynamics and Stability”, Prentice Hall, 199

REFERENCE BOOKS:

1. P. Kundur, “Power System Stability and Control”, McGraw Hill, 1995
2. P. M. Anderson & A. A. Fouad “Power System Control and Stability”, Galgotia, New Delhi,

EE 325/3- DIGITAL SIGNAL PROCESSING
(PROFESSIONAL ELECTIVE – II)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. Use z-transform and discrete time Fourier transforms to analyze a digital systems.
2. Understand the Discrete Fourier Transform(DFT), its applications and its implementationby FFT techniques.
3. Design and understand infinite and finite impulse response filters for various applications.
4. Provides understanding and working knowledge of design, implementation, analysis and comparison of digital filters for processing of discrete time signals.

UNIT I: Discrete - Time Signals and Systems: Discrete - Time Signal's Sequences, Linear Shift- Invariant Systems, Stability and Casuality, Linearity, Linear constant - Coefficient Difference Equations, Frequency Domain Representation of Discrete - Time Signals and Systems.

UNIT II: Z-transforms, Region of convergence, Z-transform theorems and prop- erties, Parseval's relation, Relation between Z-transform and Fourier transform of a sequence, Inverse Z transform using Cauchy's integration theorem, Partial fraction method, Long division method, Solution of differential equations using one sided Z-transform, Frequency response of a stable system.

UNIT III: DFT and FFT: Discrete Fourier Series, Properties of DFS, Discrete Fourier Transform, Properties of DFT, Linear convolution using DFT. Efficient Computation of the DFT: Compu- tations for evaluating DFT, Decimationin time FFT algorithms, Decimation in frequency FFT algorithm, Computation of inverse DFT.

UNIT IV: IIR Filter Design Techniques: Introduction, Properties of IIR filters, Design of Digital Butterworth and Chebyshev filters using bilinear transformation, Impulse invariance transfor- mation methods. Design of digital filters using frequency transformation method.

UNIT V: FIR Filter Design Techniques: Introduction to characteristics of linear phase FIR fil- ters, Frequency response, Designing FIR filters using windowing methods: Rectangular window, Hanning window, Hamming window, Generalized Hamming window, Bartlett triangular win- dow, Comparison of IIR and FIR filters.

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to

1. Explain discrete time signals and systems.
2. Evaluate the Z transform and inverse Z transforms.
3. Differentiate discrete fourier transform and fast fourier transforms.
4. Analyze IIR, Butterworth and Chebyshev filters using by Bilinear transformation and impulse invariance transformation methods.
5. Design and realize FIR filters by using rectangular, hamming, hanning, Bartlett triangular, Windowing techniques and digital filters.

TEXT BOOKS:

1. Alan V Oppenheim and Ronald W Schafer - Digital Signal Processing, PearsonEduca-tion/PHI, 2004.
2. John G.Proakisand Dimitris G.Manolakis - Digital Signal Processing Principles, Algorithmsand Applications, 2007.
3. P Ramesh Babu - Digital Signal Processing, 5th edition, scitech, 2014.

REFERENCE BOOKS:

1. Tarun Kumar Rawat - Digital Signal Processing, Oxford University Press,2015.
2. Johnny R. Johnson - Introduction to Digital Signal Processing, PHI, 2001.
3. Andreas Antoniou - Digital Signal Processing,TMH, 2006.
4. Lonnie C Ludeman - Fundamentals of Digital Signal Processing, John Wiley Sons, 2003.
5. S K Mitra - Digital Signal Processing: A Computer Based Approach, 4th Edition, TMH,2011.

EE 325/4- RENEWABLE ENERGY SOURCES
(PROFESSIONAL ELECTIVE – II)

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES:

1. Understand the Solar and Wind energy Sources
2. Recognize the need of renewable energy technologies and their role in the India and World energy demand
3. Gain knowledge on Renewable wave ocean and biomass energy
4. Model renewable electrical energy systems for analysis and design
5. Perform basic assessment and design of a renewable electrical energy system for a given application

UNIT I: Principle of Renewable Energy: Comparison of renewable and conventional energy sources - Ultimate energy sources - natural energy currents on earth - primary supply to end use - Spaghetti & Pie diagrams - energy planning – energy efficiency and management.

UNIT II: Solar Radiation: Extra-terrestrial solar radiation - terrestrial solar radiation – solar thermal conversion - solar thermal central receiver systems - photovoltaic energy conversion - solar cells – 4 models.

UNIT III: Wind energy: Planetary and local winds - vertical axis and horizontal axis wind mills - principles of wind power - maximum power - actual power - wind turbine operation - electrical generator.

UNIT IV: Energy from Oceans: Ocean temperature differences - principles of OTEC plant operations - wave energy - devices for energy extraction – tides - simple single pool tidal system.

UNIT V: Geothermal energy: Origin and types - Bio fuels – classification – direct combustion for heat and electricity generator - anaerobic digestion for biogas – biogas digester - power generation.

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to

1: Ability to Apply Engineering fundamentals to analysis and solve Engineering problems with a focus to meet the increasing energy Demand.

2: Ability to identify and organize process having higher priority for Environment conditions

3: Ability to Understand impact of the professional Engineering Problems in environmental contexts and demonstrate the need for sustainable development

TEXT BOOKS:

1. Renewable Energy Sources by John Twidell& Toney Weir: E&F.N. Spon
2. Renewable Energy Sources: Their impact on global warming and pollution byAbbasi&Abbasi – PHI

REFERENCE BOOKS:

1. Power plant technology by EL-Wakil, McGraw-Hill
2. Non-Conventional Energy Sources by G.D.Rai, Khanna Pub

EE 361- POWER ELECTRONICS LAB

L	T	P	C
0	0	3	1.5

OBJECTIVES:

1. To make the students to design triggering circuits of SCR.
2. To introduce power electronics components from which the characteristics of SCR, TRIAC, IGBT and MOSFET are obtained.
3. To perform the experiments on various converters.

LIST OF EXPERIMENTS:

1. Static characteristics of SCR, Triac
2. Characteristics of MOSFET & IGBT
3. Gate triggering methods for SCR's (R, R-C, UJT)
4. Single phase fully controlled rectifier with R, RL & RLE load (with or without feedback diode)
5. Characteristics of Jone's chopper
6. Characteristics of single – phase modified series inverter
7. Characteristics of single - phase parallel inverter with R & RL loads
8. Characteristics of single - phase cyclo-converter (Center tapped or Bridge)
9. Single phase dual converter with R & RL loads (Circulating and non circulating modes)
10. Characteristics of PWM inverter
11. Converter based DC motor control.
12. Characteristics of Morgan's chopper
13. Study of single - phase full wave McMurray Bedford inverter
14. Inverter based Induction motor control
15. Voltage commutated DC chopper

OUTCOMES:

1. Upon completing this lab students must be able to correlate theoretical and practical analysis of AC-AC, DC-AC converters and also converter fed to AC&DC drives.
2. Also analyze the characteristics of MOSFET, IGBT, SCR and SCR firing CKTs, these commutation techniques.

EE 362- MICROPROCESSORS AND MICROCONTROLLERS LAB

L	T	P	C
0	0	3	1.5

Course Objectives

1. To study programming based on 8086 microprocessor and 8051 microcontroller.
2. To write Assembly language programs for various arithmetic and logical operations.
3. To interface 8086 with I/O and other devices.

List of Experiments

Experiments Based on ALP (8086)

1. Programs on Data Transfer Instructions.
2. Programs on Arithmetic and Logical Instructions.
3. Programs on Branch Instructions.
4. Programs on Subroutines.
5. Sorting of an Array.
6. Programs on Interrupts (Software and Hardware).
7. 8086 Programs using DOS and BIOS Interrupts.

Experiments Based on Interfacing Microcontroller (8051)

8. DAC Interface-Waveform generations.
9. Stepper Motor Control.
10. Keyboard Interface / LCD Interface.
11. Data Transfer between two PCs using RS.232 C Serial Port
12. Programs on Data Transfer Instructions using 8051 Microcontroller.
13. Programs on Arithmetic and Logical Instructions using 8051 Microcontroller.
14. Applications with Microcontroller 8051.

Course Outcomes

At the end of course, the student will be able to

1. Set up programming strategies and select proper mnemonics and run their program on the training boards.
2. Demonstrate ability to handle arithmetic and logical operations using assembly languageprogramming in MASM and training boards.
3. Implement the algorithms for sorting and string manipulations in 8086 microprocessor.
4. Experiment with standard microprocessor real time interfaces including serial ports, digital-to-analog converters and analog-to-digital converters.

EE 363- POWER SYSTEMS & SIMULATION LAB

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

1. To determine regulation & efficiency of short, medium and long transmission lines and to calculate A, B, C, D constants and study Ferranti effect in long lines.
2. To calculate the sequence impedance of alternator and transformer
3. To simulate and understand the load flows, Fault Analysis of power system.
4. To understand the transient stability studies, Economic power scheduling and Load frequency control in power system.

LIST OF EXPERIMENTS:

1. Determination of positive, negative and zero-sequence impedance of 3 -Phase transformers.
2. Determination of Sequence impedance of 3-Phase Alternators by fault Analysis.
3. Determination of Sequence impedance of 3-Phase Alternators.
4. Determination of A, B, C, D constants of 1-Phase transmission line.
5. Determination of regulation & efficiency of 3-Phase transmission line.
6. Determination of Voltage distribution and String efficiency of string of Insulators.
7. Evaluate the Power Factor Improvement methods in 3-Phase Transmission Line.
8. IDMT characteristics of Over-current relay.
9. Simulation of Load Flow Studies
10. Simulation of Fault Analysis.
11. Simulation of Transient stability studies.
12. Simulation of Economic power scheduling.
13. Simulation of Load Frequency control of one area system.

COURSE OUTCOMES:

After completion of the course, students will be able to:

1. Evaluate the Line Constants, ABCD constants, regulation and efficiency of a transmission line.
2. Calculate the sequence parameters of the transformer and alternator.
3. Apply the load flow studies for any given power system.
4. Analyze the fault in the real time power system.
5. Estimate the consequences of transient stability, economic power scheduling and load frequency control.

Note: At least **TEN** experiments should be conducted in the semester.

EE 364- AS SUGGESTED BY APSCHE

L	T	P	C
1	**0**	**2**	**2**