ACE
Engineering College

Ankushapur(V), Ghatkesar(M), R.R.Dist - 501 301

(An Autonomous Institution)

B.TECH. THIRD YEAR DEGREE COURSE

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE STRUCTURE

(R20 Regulation)

III Year				I Semester			
S.No.	Course type	Course Code	Course Title	Periods per week			Credits
				L	T	P	
1	PCC	EE501PC	Power Electronics	3	1	0	4
2	PCC	EE502PC	Power System-II	3	1	0	4
3	PCC	EE503PC	Electrical Measurements And Instrumentation	3	1	0	4
4	PEC		Professional Elective-I	3	0	0	3
5	HSMC	SM504MS	Business Economics and Financial Analysis	3	0	0	3
6	PCC	EE505PC	Power System Lab-II	0	0	2	1
7	PCC	EE506PC	Power Electronics Lab	0	0	2	1
8	PCC	EE507PC	Electrical Measurements and Instrumentation Lab	0	0	2	1
9	HSMC	EN508HS	Advanced English Communication skills Lab	0	0	2	1
10	MC	MC509	Intellectual Property Rights	3	0	0	0
11	MC	MC511	Artificial Intelligence	3	0	0	0
Total				**21**	**3**	**8**	**22**

Note: *MC = Satisfactory/Unsatisfactory

EE501PC: POWER ELECTRONICS

B.TECH. III YEAR I SEMESTER

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
EE501PC	PCC	3	1	0	4	30	70	100

Prerequisite: Analog Electronics(EE303PC), Digital Electronics (EE403PC)

Course Objectives:

1. To analyze the power electronic circuits.
2. To understand the principle of operation of different power conversion circuits.
3. To design suitable power converter for efficient control of power.
4. To design suitable power converter for efficient transmission and utilization of power in power system applications.

Course Outcomes: Upon completing this course, the student will be able to

1. Understand operation of different power electronics devices.
2. Explain workings of phase-controlled rectifier circuits.
3. Examine the operation of DC-DC converter
4. Compare different modes of operation of inverters
5. Judge the performance of ac voltage controller

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

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

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	DC-AC CONVERTERS

: 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 width modulation, 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.

TEXT BOOKS:

1. M. H. Rashid, "Power electronics: circuits, devices, and applications", Pearson Education India, 4th Edition, 2014.
2. N. Mohan and T. M. Undeland, "Power Electronics: Converters, Applications and Design", John Wiley & Sons, 3rd Edition , 2007.

REFERENCE BOOKS:

1. R. W. Erickson and D. Maksimovic, "Fundamentals of Power Electronics", 4th Edition Springer Science & Business Media, 2007.
2. L. Umanand, "Power Electronics: Essentials and Applications", Wiley India, 2009.

WEB REFERENCES:

1. https://nptel.ac.in/courses/108/105/108105066/
2. https://nptel.ac.in/courses/108/101/108101126/
3. https://nptel.ac.in/courses/108/101/108101038/

EE502PC: POWER SYSTEM – II

B.TECH. III YEAR I SEMESTER

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
EE502PC	PCC	3	1	0	4	30	70	100

Prerequisite: Power System-I(EE405PC)

Course Objectives:

1. To analyze the performance of transmission lines
2. To understand the voltage control and compensation methods
3. To understand the per unit representation of power systems
4. To understand the per unit representation of power systems

Course Outcomes: Upon completing this course, the student will be able to

1. Analyze transmission line performance
2. Apply load compensation techniques to control reactive power
3. Understand the application of per unit quantities
4. Design over voltage protection and insulation coordination
5. Determine the fault currents for symmetrical and unbalanced faults

UNIT: I PERFORMANCE OF LINES

Representation of lines, short transmission lines, medium length lines, nominal T and PI- representations, long transmission lines. The equivalent circuit representation of a long Line, A, B, C, D constants, Ferranti Effect, Power flow through a transmission line, receiving end power circle diagram.

UNIT: II VOLTAGE CONTROL

Introduction – methods of voltage control, shunt and series capacitors / Inductors, tap changing transformers, synchronous phase modifiers. Compensation In Power Systems: Introduction - Concepts of Load compensation – Load ability characteristics of overhead lines – Uncompensated transmission line – Symmetrical line – Radial line with asynchronous load – Compensation of lines.

UNIT: III PER UNIT REPRESENTATION OF POWER SYSTEMS

The one-line diagram, impedance and reactance diagrams, per unit quantities, changing the base of per unit quantities, advantages of per unit system. Travelling Waves on Transmission Lines: Production of travelling waves, open circuited line, short circuited line, line terminated through a resistance, line connected to a cable, reflection and refraction at T-junction line terminated through a capacitance, capacitor connection at a T-junction, Attenuation of travelling waves.

UNIT: IV OVERVOLTAGE PROTECTION AND INSULATION COORDINATION

Over voltage due to arcing ground and Peterson coil, lightning, horn gaps, surge diverters, rod gaps, expulsion type lightning arrester, valve type lightning arrester, ground wires, ground rods, counter poise, surge absorbers, insulation coordination, volt-time curves.

UNIT: V SYMMETRICAL COMPONENTS AND FAULT CALCULATIONS

Significance of positive, negative and zero sequence components, Average 3-phase power in terms of symmetrical components, sequence impedances and sequence networks, fault calculations, sequence network equations, single line to ground fault, line to line fault, double line to ground fault, three phase fault, faults on power systems, faults with fault impedance, reactors and their location, short circuit capacity of a bus.

TEXT BOOKS:

1. John J. Grainger & W.D. Stevenson, "Power System Analysis", Mc Graw Hill International, 2017.
2. C.L. Wadhwa, "Electrical Power Systems" – New Age International Pub. Co. Third Edition, 2016.

REFERENCE BOOKS:

1. D. P. Kothari;I. J. Nagrath, "Power System Engineering", McGraw-Hill; Third edition, 26 April 2019
2. A.N Kani, "Power System Analysis", CBS; Reprint edition, 2020
3. D.P. Kothari and I. J. Nagrath, "Modern Power System Analysis", Tata Mc Graw Hill Pub. Co., New Delhi, Fourth edition, 2011

WEB REFERENCES:

1. https://nptel.ac.in/courses/108/105/108105104/
2. https://nptel.ac.in/courses/108/105/108105067/

EE503PC: ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

B.TECH. III YEAR I SEMESTER

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
EE503PC	PCC	3	1	0	4	30	70	100

Prerequisite: Basic Electrical Engineering (EE103ES), AnalogElectronics (EE303PC), ElectricalCircuits (EE302PC) & Electro Magnetic Fields (EE305PC).

Course Objectives:

1. To introduce the basic principles of all measuring instruments
2. To understand the constructional details and principle of operation of basic analog and digital measuring instruments.
3. To deal with the measurement of voltage, current, Power factor, power, energy and magnetic measurements.
4. To understand the basic concepts of smart and digital metering.

Course Outcomes: Upon completing this course, the student will be able to

1. Illustrate different types of measuring instruments, their construction, operation and characteristics
2. Identify the instruments suitable for typical measurements
3. Apply the knowledge about transducers and instrument transformers to use them effectively.
4. Analyze smart and digital metering for industrial applications.
5. Examine the operation of potentiometer for calibration of Instruments.

UNIT: I INTRODUCTION TO MEASURING INSTRUMENTS

Classification – deflecting, control and damping torques – Ammeters and Voltmeters – PMMC, moving iron type instruments – expression for the deflecting torque and control torque – Errors and compensations, extension of range using shunts and series resistance. Electrostatic Voltmeters electrometer type and attracted disc type – extension of range of E.S. Voltmeters.

UNIT: II POTENTIOMETERS & INSTRUMENT TRANSFORMERS

Principle and operation of D.C. Crompton"s potentiometer – standardization – Measurement of unknown resistance, current, voltage. A.C. Potentiometers: polar and coordinate type"s standardization – applications. CT and PT – Ratio and phase angle errors.

UNIT: III MEASUREMENT OF POWER & ENERGY

Single phase dynamometer wattmeter, LPF and UPF, Double element and three element dynamometer wattmeter, expression for deflecting and control torques – Extension of range of wattmeter using instrument transformers – Measurement of active and reactive powers in balanced and unbalanced systems. Single phase induction type energy meter – driving and braking torques – errors and compensations – testing by phantom loading using R.S.S. meter. Three phase energy meter – tri-vector meter, maximum demand meters.

UNIT: IV DC & AC BRIDGES

Method of measuring low, medium and high resistance – sensitivity of Wheat-stone"s bridge – Carey Foster"s bridge, Kelvin"s double bridge for measuring low resistance, measurement of high resistance – loss of charge method. Measurement of inductance- Maxwell"s bridge, Hay"s bridge, Anderson"s bridge - Owen"s bridge. Measurement of capacitance and loss angle –Desaunty"s Bridge - Wien"s bridge – Schering Bridge.

UNIT: V TRANSDUCERS

Definition of transducers, Classification of transducers, Advantages of Electrical transducers, Characteristics and choice of transducers; Principle operation of LVDT and capacitor transducers; LVDT Applications, Strain gauge and its principle of operation, gauge factor, Thermistors, Thermocouples, Piezo electric transducers, photovoltaic, photo conductive cells, and photo diodes.

Introduction to Smart and Digital Metering: Digital Multi-meter, True RMS meters, Clamp-on meters, Digital Storage Oscilloscope

TEXT BOOKS:

1. G. K. Banerjee, "Electrical and Electronic Measurements", PHI Learning Pvt. Ltd., 2nd Edition, 2016
2. S. C. Bhargava, "Electrical Measuring Instruments and Measurements", BS Publications, 2013.

REFERENCE BOOKS:

1. A. K. Sawhney, "Electrical & Electronic Measurement & Instruments", Dhanpat Rai & Co. Publications, 2021.
2. R. K. Rajput, "Electrical & Electronic Measurement & Instrumentation", S. Chand and Company Ltd., 2016.

WEB REFERENCES:

1. https://nptel.ac.in/courses/108/105/108105153/
2. https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-ee44/
3. https://www.classcentral.com/course/swayam-electrical-measurement-and-electronic-instruments-14032

EE511PE: COMPUTER ARCHITECTURE
(Professional Elective-I)

B.TECH. III YEAR I SEMESTER

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
EE511PE	PEC	3	0	0	3	30	70	100

Prerequisite: Digital Electronics(EE403PC)

Course Objectives:

1. To understand basic components of computers.
2. To understand the architecture of 8086 processor.
3. To understand the instruction sets, instruction formats and various addressing modes of 8086.
4. To understand the representation of data at the machine level and how computations are Performed at machine level.
5. To understand the memory organization and I/O organization.
6. To understand the parallelism both in terms of single and multiple processors.

Course Outcomes: Upon completing this course, the student will be able to

1. Understand the concepts of microprocessors, their principles and practices.
2. Write efficient programs in assembly language of the 8086 family of microprocessors.
3. Organize a modern computer system and be able to relate it to real examples.
4. Develop the programs in assembly language for 80286, 80386 and MIPS processors in real and protected modes.
5. Implement embedded applications using ATOM processor.

UNIT: I	INTRODUCTION TO COMPUTER ORGANIZATION

Architecture and function of general computer system, CISC Vs RISC, Data types, Integer Arithmetic - Multiplication, Division, Fixed and Floating-point representation and arithmetic, Control unit operation, Hardware implementation of CPU with Micro instruction, microprogramming, System buses, Multi-bus organization.

UNIT: II	MEMORY AND INPUT – OUTPUT ORGANIZATION

System memory, Cache memory - types and organization, Virtual memory and its implementation, Memory management unit, Magnetic Hard disks, Optical Disks.

Input – Output Organization Accessing I/O devices, Direct Memory Access and DMA controller, Interrupts and Interrupt Controllers, Arbitration, Multilevel Bus Architecture, Interface circuits - Parallel and serial port. Features of PCI and PCI Express bus.

UNIT: III	16 AND 32 MICROPROCESSORS

80x86 Architecture, IA – 32 and IA – 64, Programming model, Concurrent operation of EU and BIU, Real mode addressing, Segmentation, addressing modes of 80x86, Instruction set of 80x86, I/O addressing in 80x86

UNIT: IV	PIPELINING

Introduction to pipelining, Instruction level pipelining (ILP), compiler techniques for ILP,Data hazards, Dynamic scheduling, Dependability, Branch cost, Branch Prediction, Influence on

instruction set.

UNIT: V	DIFFERENT ARCHITECTURES

VLIW Architecture, DSP Architecture, SoC architecture, MIPS Processor and programming

TEXT BOOKS:

1. V. Carl, G. Zvonko and S. G. Zaky, "Computer organization", McGraw Hill, 1978.
2. B. Brey and C. R. Sarma, "The Intel microprocessors", Pearson Education, 2000.

REFERENCE BOOKS:

1. 1. J. L. Hennessy and D. A. Patterson, "Computer Architecture A Quantitative Approach", Morgan Kauffman, 2011.
2. W. Stallings, "Computer organization", PHI, 1987.
3. P. Barry and P. Crowley, "Modern Embedded Computing", Morgan Kaufmann, 2012.
4. N. Mathivanan, "Microprocessors, PC Hardware and Interfacing", Prentice Hall, 2004.
5. Y. C. Lieu and G. A. Gibson, "Microcomputer Systems: The 8086/8088 Family", Prentice Hall India, 1986.
6. J. Uffenbeck, "The 8086/8088 Design, Programming, Interfacing", Prentice Hall, 1987.
7. B. Govindarajalu, "IBM PC and Clones", Tata McGraw Hill, 1991.
8. P. Able, "8086 Assembly Language Programming", Prentice Hall India.

EE512PE: HIGH VOLTAGE ENGINEERING
(Professional Elective-I)

B.TECH. III YEAR I SEMESTER

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
EE512PE	PEC	3	0	0	3	30	70	100

Prerequisite: Power Systems – I (EE405PC), Electro Magnetic Fields (EE305PC)

Course Objectives:

7. To analyze breakdown phenomenon gaseous, liquids and solid dielectrics.
8. To inform about generation and measurement of high voltage and current.
9. To understand lightning surges and switching over-voltages.
10. To introduce high voltage testing methods.

Course Outcomes: Upon completing this course, the student will be able to

6. Understand breakdown incident in solid, liquid and gaseous insulating materials.
7. Differentiate the generation and measurement of D. C., A.C., & Impulse voltages.
8. Develop tests on H. V. equipment and insulating materials, as per the standards.
9. Analyze the generation of over-voltages in a power system.
10. Describe protection of over-voltages.

UNIT: I **FUNDAMENTALS OF INSULATING MATERIALS**

Ionization processes and de-ionization processes, Types of Discharge, Gases as insulating materials, Breakdown in Uniform gap, non-uniform gaps, Townsend"s theory, Streamer mechanism, Corona discharge. Breakdown in pure and commercial liquids, Solid dielectrics and composite dielectrics, intrinsic breakdown, electromechanical breakdown and thermal breakdown, Partial discharge, applications of insulating materials.

UNIT: II **GENERATION OF HIGH VOLTAGES**

Generation of high D. C. and A.C. voltages, generation of impulse voltages, generation of impulse currents, tripping and control of impulse generators.

UNIT: III **MEASUREMENTS OF HIGH VOLTAGES AND CURRENTS**

Peak voltage, impulse voltage and high direct current measurement method, cathode ray oscillo-graphs for impulse voltage and current measurement, measurement of dielectric constant and loss factor, partial discharge measurements.

UNIT: IV **LIGHTNING AND SWITCHING OVER-VOLTAGES**

Charge formation in clouds, stepped leader, Dart leader, Lightning Surges. Switching over-voltages, Protection against over-voltages, Surge diverters, and Surge modifiers.

UNIT: V **HIGH VOLTAGE TESTING OF ELECTRICAL COMPONENTS**

Various standards for HV Testing of electrical apparatus, IS, IEC standards, testing of insulators and bushings, testing of isolators and circuit breakers, testing of cables, power transformers and some high voltage equipment, High voltage laboratory layout, indoor and outdoor laboratories, testing facility requirements, safety precautions in H. V. Labs.

TEXT BOOKS:

3. "M. S. Naidu","V.Kamaraju", High Voltage Engineering, McGraw Hill Education, 2020 6th Edition
4. "C. L. Wadhwa", High Voltage Engineering, New Age Science, 2010

REFERENCE BOOKS:

9. "John Kuffel", High Voltage Engineering Fundamentals, Elsevier, 3rd Ed2012
10. "E. Kuffel", "W. S. Zaengl","J.Kuffel", "High Voltage Engineering Fundamentals", Newnes Publication, 2000.
11. "R. Arora","W.Mosch", "High Voltage and Electrical Insulation Engineering", John Wiley & Sons, 2011.

WEB REFERENCES:

1. https://nptel.ac.in/courses/108/104/108104048/
2. https://ietresearch.onlinelibrary.wiley.com/journal/23977264

EE513PE: SPECIAL ELECTRICAL MACHINES
(Professional Elective-I)

B.TECH. III YEAR I SEMESTER

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
EE513PE	PEC	3	0	0	3	30	70	100

Prerequisite: Electrical Machines-I(EE304PC), Electrical Machines-II(EE402PC)

Course Objectives:

1. To learnthe construction and operation of PMDC motor
2. To understand working and application of BLDC motor
3. To illustrate the application of special machines
4. To understand working principle of stepper motor

Course Outcomes: Upon the completion of this subject, the student will be able

1. Apply the working principle of PMDC motor.
2. Analyze the performance of a BLDC motor.
3. Derive emf equation of various special machines.
4. Develop controlling technique to PMSM motor.
5. Analyze the operation of stepper motor.

UNIT: I **SPECIAL PURPOSE DC MOTORS**

Permanent magnet DC Motor- PMDC Motors-construction-Principle of operation- characteristics and applications

Brushless DC motor- BLDC Motors-construction-Principle of operation- characteristics and applications

UNIT: II **PERMANENT MAGNET AC MOTORS**

Permanent magnet Synchronous Motor- PMSM Motors-construction-Principle of operation-characteristics, applications and control techniques.

UNIT: III **SWITCHED RELUCTANCE MOTOR**

Introduction-construction-operation-application – improvements in the design of conventional reluctance motors- Some distinctive differences between SR and conventional reluctance motors-principle of operation of SRM

UNIT: IV **STEPPER MOTORS**

Stepper Motors: Introduction-synchronous inductor (or hybrid stepper motor), Hybrid stepping motor, construction, principles of operation, Energization with two phase at a timeessential conditions for the satisfactory operation of a 2-phase hybrid step motor- very slow speed synchronous motor for servo control-different configurations for switching the phase windings-control circuits for stepping motors-an open-loop controller for a 2-phase stepping motor.

UNIT: V **SYNCHRONOUS RELUCTANCE MOTOR &LINER INDUCTION MOTORS**

Synchronous Reluctance Motor Construction, Working, Phasor Diagram, Torque Equation, Control - Direct Axis Current Control, Fast Torque Response Control, Advantages

Linear induction motors (LIM) Construction – Principle of operation – Double sided LIM from

rotating type Induction Motor – Schematic of LIM drive for traction – Development of one-sided LIM with back iron-equivalent circuit of LIM.

TEXT BOOKS:

1. K. Venkataratnam, Special electrical machines, university press, 2009
2. R. K. Rajput - Electrical machines, Laxmi Publications, 5th Edition 2016

REFERENCE BOOKS:

1. V.V. Athani - Stepper motor: Fundamentals, Applications and Design, New age International publishers, 1997
2. "E. G. Janardanan", Special electrical machines-PHI 2014.

WEB REFERENCES:

1. https://nptel.ac.in/courses/108/102/108102156/

EE514PE: LINEAR SYSTEMS ANALYSIS

(Professional Elective I)

B.TECH. III YEAR I SEMESTER

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
EE514PE	PEC	3	0	0	3	30	70	100

Prerequisite: Mathematics – II (MA201BS), Electrical Circuits(EE302PC)

Course Objectives:

1. To develop ability to analyze linear systems and signals
2. To develop critical understanding of mathematical methods to analyze linear systems and signals
3. To understand about Fourier Series and Fourier Transform representation
4. To understand, Laplace transform and its applications

Course Outcomes: Upon completing this course, the student will be able to

1. Understand State Variable Analysis
2. Apply mathematical modeling tools to represent linear systems
3. Employmathematical modeling tools to analyze linear systems
4. Understand the concepts of Fourier Series, Fourier Transform representation, Laplace transform
5. Know about sampling theorem.

UNIT: I STATE VARIABLE ANALYSIS

Choice of state variables in Electrical Networks-Formulation of state equations for Electrical networks Equivalent source method. Network topological method - Solution of state equations-Analysis of simple networks with state variable approach.

UNIT: II FOURIER SERIES AND FOURIER TRANSFORM REPRESENTATION AND APPLICATIONS

Introduction, Trigonometric form of Fourier series, Exponential form of Fourier series, Wave symmetry, Fourier integrals and transforms, Fourier transform of a periodic function ,Properties of Fourier Transform, Parseval"s theorem , Fourier transform of some common signals, Fourier transform relationship with Laplace Transform.

Introduction, Effective value, and average values of non sinusoidal periodic waves, currents, Power Factor, Effects of harmonics, Application in Circuit Analysis, Circuit Analysis using Fourier Series.

UNIT: III LAPLACE TRANSFORM APPLICATIONS AND NETWORK SYNTHESIS

Application of Laplace transform Methods of Analysis – Response of RL, RC, RLC Networks to Step, Ramp, and impulse functions, Shifting Theorem – Convolution Integral – Applications Testing of Polynomials: Elements of realisability - Hurwitz polynomials-positive real functions-Properties-Testing-Sturm"s Test, examples.

Synthesis of one port LC networks-Foster and Cauermethods-Synthesis of RL and RC one port networks-Foster and Cauer methods

UNIT: IV SAMPLING

Sampling theorem – Graphical and Analytical proof for Band Limited Signal impulse sampling, natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling – Aliasing, introduction to Band Pass sampling, Cross correlation and auto correlation of functions, properties of correlation function, Energy density spectrum, Power density spectrum, Relation between auto correlation function and Energy / Power spectral density function.

UNIT: V Z-TRANSFORMS

Fundamental difference between continuous and discrete time signals, discrete time complex, exponential and sinusoidal signals, periodicity of discrete time complex exponential, concept of Z Transform of a discrete sequence. Distinction between Laplace, Fourier, and Z-Transforms. Region of convergence in Z-Transforms, constraints on ROC for various classes of signals, Inverse Z-Transform properties of Z-Transforms.

TEXT BOOKS:

1. "B. P. Lathi", "Signals, Systems and Communications", BS Publications 2020.
2. "Umesh Sinha" "Network Analysis and Synthesis", Satya Prakashan Publications, 2013.

REFERENCE BOOKS:

1. "A. N. Tripathi", "Linear System Analysis", New Age International, 2nd Edition 2010.
2. "D. Roy Chowdhary", "Network and Systems", New Age International, 2013.
3. "Gopal G Bhise, Prem R. Chadha", Engineering Network Analysis and Filter Design, Umesh Publications 2012.

WEB REFERENCES:

1. https://nptel.ac.in/courses/108/106/108106162/
2. https://onlinecourses.nptel.ac.in/noc19_ee43

SM504MS: BUSINESS ECONOMICS AND FINANCIAL ANALYSIS

B.TECH. III YEAR I SEMESTER

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
SM504MS	HSMC	3	0	0	3	30	70	100

Prerequisite: Nil

Course Objectives:

1. To learn the basic business types, impact of the economy on Business and Firms specifically.
2. To analyze the Business from the Financial Perspective.

Course Outcomes: Upon completing this course, the student will be able to

1. Understand the various Forms of Business and the impact of economic variables on the Business. The Demand, Supply, Production, Cost, Market Structure, Pricing aspects are learnt.
2. The Students can study the firm's financial position by analysing the Financial Statements of a Company.

Unit: I	INTRODUCTION TO BUSINESS AND ECONOMICS

Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company, Non-Conventional Sources of Finance. Economics: Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply and Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.

Unit: II	DEMAND AND SUPPLY ANALYSIS

Elasticity of Demand: Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting. Supply Analysis: Determinants of Supply, Supply Function and Law of Supply.

Unit: III	PRODUCTION, COST, MARKET STRUCTURES AND PRICING

Production, Cost, Market Structures & Pricing Production Analysis: Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions. Cost analysis: Types of Costs, Short run and Long run Cost Functions. Market Structures: Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, Monopolistic Competition. Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, Cost Volume Profit Analysis.

Unit: IV	FINANCIAL ACCOUNTING:

Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, Preparation of Final Accounts.

UNIT-V	FINANCIAL ANALYSIS THROUGH RATIOS

Concept of Ratio Analysis, Importance, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios – Analysis and Interpretation (simple problems).

TEXT BOOKS:

1. D. D. Chaturvedi, S. L. Gupta, Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.
2. Dhanesh K Khatri, Financial Accounting, Tata Mc –Graw Hill, 2011.
3. Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e,Tata Mc Graw Hill Education Pvt. Ltd. 2012.

REFERENCE BOOKS:

1. Paresh Shah, Financial Accounting for Management 2e, Oxford Press, 2015.
2. S. N. Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, Financial Accounting, 5e, Vikas Publications, 2013

WEB REFERENCES:

1. https:// www.slideshare.net/glory1988/managerial-economics-and- financial analysis.
2. https:// thenthata.web4kurd.net/mypdf/managerial-economics-and- financial analysis.

EE505PC: POWER SYSTEM LAB-II

B.TECH. III YEAR I SEMESTER

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
EE505PC	PCC	0	0	2	1	30	70	100

Prerequisite: Power System-I(EE405PC),Power System-II(EE502PC), Electrical Machines-I(EE304PC), Electrical Machines-II(EE402PC),

Course Objectives:

1. To find sequence impedances of 3-Φ synchronous machine
2. To find sequence impedances of 3-Φ Transformer
3. To find ABCD parameters of a transmission line
4. To perform fault analysis on Transmission line.

Course Outcomes: After completion of this lab, the student will be able to

1. Analyze IDMT over current relay
2. Understand differential protection of single-phase transformer
3. Analyze ABCD constants of a long transmission line.
4. Determine characteristics of under voltage and over voltage
5. Simulate shunt capacitor for under voltage control using MATLAB

List of Experiments:

1. Characteristics of IDMT Over-Current Relay
2. Differential protection of 1-Φ transformer
3. Characteristics of Micro Processor based Over Voltage/Under Voltage relay
4. A, B, C, D constants of a Long Transmission line
5. Finding the sequence impedances of 3-Φ synchronous machine.
6. Finding the sequence impedances of 3-Φ Transformer.
7. Simulation of LG, LL, LLG and LLL faults on a simple power system using PSCAD/MATLAB
8. Simulation of load compensation
9. Determination of Sequence components (Positive, Negative and Zero) of an Alternator
10. Determine ABCD parameters of short, medium and long Transmission lines using MATLAB.
11. Determine Characteristics of under voltage and over voltage using PSCAD/MATLAB
12. Simulation of a shunt capacitor for under voltage control using MATLAB.

WEB REFERENCES:

1. https://vp-dei.vlabs.ac.in/Dreamweaver/list.html

EE506PC: POWER ELECTRONICS LAB

B.TECH. III YEAR I SEMESTER

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
EE506PC	PCC	0	0	2	1	30	70	100

Prerequisite : Power Electronics(EE501PC)

Course Objectives:

1. Apply the concepts of power electronic converters for efficient conversion/control of power from source to load.
2. Design the power converter with suitable switches meeting a specific load requirement.
3. To make the students to design triggering circuits of SCR.
4. To perform the experiments on various converters.

Course Outcomes: Upon completing this course, the student will be able to

1. Understand the operating principles of various power electronic converters.
2. Analyze the characteristics of MOSFET, IGBT, SCR and SCR firing CKTs,
3. Develop the simulation model power converters.
4. Apply different commutation technique to turn off SCR
5. Examine output of inverter for different types of loads

List of Experiments:

1. Study of Characteristics of SCR, MOSFET & IGBT,
2. Gate firing circuits for SCR's
3. Single Phase AC Voltage Controller with R and RL Loads
4. Single Phase half controlled &fully controlled bridge converter with R and RL loads
5. Forced Commutation circuits (Class A, Class B, Class C, Class D & Class E)
6. Single Phase Cyclo-converter with R and RL loads
7. Single Phase series& parallel inverter with R and RL loads
8. Single Phase Bridge inverter with R and RL loads.
9. DC Jones chopper with R and RL Loads
10. Single Phase dual converter with RL loads

Following experiment are to be done by using suitable software.

11. (a) Simulation of single-phase Half wave converter using R and RL loads
    (b) Simulation of single-phase full converter using R, RL and RLE loads
    (c) Simulation of single-phase Semi converter using R, RL and RLE loads
12. (a) Simulation of Single-phase AC voltage controller using R and RL loads
    (b)Simulation of Single phase Cyclo-converter with R and RL-loads
13. Simulation of Buck chopper
14. Simulation of single-phase Inverter with PWM control
15. Simulation of three phase fully controlled converter with R and RL loads, with and without Freewheeling diode. Observation of waveforms for Continuous and Discontinuous modes of Operation.
16. Study of PWM techniques

Virtual Lab

http://vlabs.iitb.ac.in/vlabs-dev/labs/mit_bootcamp/power_electronics/labs/index.php

EE507PC: ELECTRICAL MEASUREMENTS AND INSTRUMENTATION LAB

B.TECH. III YEAR I SEMESTER

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
EE507PC	PCC	0	0	2	1	30	70	100

Prerequisite: Electrical Measurements and Instrumentation (EE503PC)

Course Objectives:

1. To calibrate LPF Watt Meter, energy meter, P. F Meter using electro dynamo meter type instrument as the standard instrument
2. To determine unknown inductance, resistance, capacitance by performing experiments on D.C Bridges & A. C Bridges
3. To determine three phase active & reactive powers using single wattmeter method practically
4. To determine the ratio and phase angle errors of current transformer and potential transformer.

Course Outcomes: Upon completing this course, the student will be able to

1. To select instruments
2. Analyze anyelectrical instrument
3. Find the accuracy of any instrument by performing experiment.
4. Calibrate PMMC instrument using D.C potentiometer.
5. Estimate the Strength of Dielectric oil

List of Experiments:

1. Calibration and Testing of single-phase energy Meter.
2. Calibration of dynamometer power factor meter.
3. Crompton D.C. Potentiometer – Calibration of PMMC ammeter and PMMC voltmeter.
4. Kelvin"s double Bridge – Measurement of resistance – Determination of Tolerance.
5. Dielectric oil testing using H.T. testing Kit.
6. Schering Bridge & Anderson Bridge.
7. Measurement of 3 - Phase reactive power with single-phase wattmeter.
8. Measurement of displacement with the help of LVDT.
9. Calibration LPF wattmeter – by Phantom testing.
10. Measurement of 3-phase power with single watt meter and two CTs.
11. C.T. testing using mutual Inductor – Measurement of % ratio error and phase angle of given CT by Null method.
12. PT testing by comparison – V. G. as Null detector – Measurement of % ratio error and phase angle of the given PT
13. Resistance strain gauge – strain measurements and Calibration.
14. Transformer turns ratio measurement using AC bridges.
15. Measurement of % ratio error and phase angle of given CT by comparison.

WEB REFERENCES:

1. http://vlabs.iitkgp.ernet.in/asnm/exp10/index.html
2. http://vlabs.iitkgp.ernet.in/asnm/exp23/index.html
3. http://vlabs.iitkgp.ernet.in/asnm/exp21/index.html
4. https://vp-dei.vlabs.ac.in/Dreamweaver/exp4.html
5. http://vlabs.iitkgp.ernet.in/asnm/exp7/index.html

EN508HS: ADVANCED ENGLISH COMMUNICATION SKILLS LAB

B.TECH. III YEAR I SEMESTER

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
EN508HS	HSMC	0	0	2	1	30	70	100

Prerequisite: Knowledge of functional English, basics in grammar, understanding of LSRW skills

Course Objectives:

1. To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
2. Further, they would be required to communicate their ideas relevantly and coherently in writing.
3. To prepare all the students for their placements.

Course Outcomes: Upon completing this course, the student will be able to

1. Better understanding of nuances of English language through audio- visual experience and group activities
2. Neutralization of accent for intelligibility
3. Speaking skills with clarity and confidence which in turn enhances their employability skills

SYLLABUS

1. Activities on Fundamentals of Inter-personal Communication and Building Vocabulary - Starting a conversation – responding appropriately and relevantly – using the right body language – Role Play in different situations & Discourse Skills- using visuals - Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.

2. Activities on Reading Comprehension –General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading& effective googling.

3. Activities on Writing Skills – Structure and presentation of different types of writing – letter writing/Resume writing/ e-correspondence/Technical report writing/ – planning for writing – improving one's writing.

4. Activities on Presentation Skills – Oral presentations (individual and group) through JAM sessions/seminars/PPTs and written presentations through posters/projects/reports/ emails/assignments etc.

5. Activities on Group Discussion and Interview Skills – Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conference and Mock Interviews.

MINIMUM REQUIREMENT:

The Advanced English Communication Skills (AECS) Laboratory shall have the following infrastructural facilities to accommodate at least 35 students in the lab:

- Spacious room with appropriate acoustics.

- Round Tables with movable chairs
- Audio-visual aids
- LCD Projector
- Public Address system
- P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ
- T. V, a digital stereo & Camcorder
- Headphones of High quality

SUGGESTED SOFTWARE: The software consisting of the prescribed topics elaborated above should be procured and used.

- Oxford Advanced Learner's Compass, 7th Edition
- DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.
- Lingua TOEFL CBT Insider, by Dream tech
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)

TEXT BOOKS:

1. Effective Technical Communication by M Asharaf Rizvi. McGraw Hill Education (India) Pvt. Ltd. 2 nd Edition

2. Academic Writing: A Handbook for International Students by Stephen Bailey, Routledge, 5th Edition.

References:

1. Learn Correct English – A Book of Grammar, Usage and Composition by Shiv K. Kumar and HemalathaNagarajan. Pearson 2007

2. Professional Communication by ArunaKoneru, McGraw Hill Education (India) Pvt. Ltd, 2016.

3. Technical Communication by Meenakshi Raman &Sangeeta Sharma, Oxford University Press 2009.

4. Technical Communication by Paul V. Anderson. 2007. Cengage Learning pvt. Ltd. New Delhi.

5. English Vocabulary in Use series, Cambridge University Press 2008.

6. Handbook for Technical Communication by David A. McMurrey& Joanne Buckley. 2012. Cengage Learning.

7. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.

8. Job Hunting by ColmDownes, Cambridge University Press 2008.

9. English for Technical Communication for Engineering Students, AyshaVishwamohan, Tata Mc Graw-Hill 2009.

MC509: INTELLECTUAL PROPERTY RIGHTS

B.TECH. III YEAR I SEMESTER

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
MC509	MC	3	0	0	0	100	0	100

UNIT: I

Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT: II

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

UNIT: III

Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law. Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

UNIT: IV

Trade Secrets: Trade secret law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation. Unfair competition: Misappropriation right of Publicity, false advertising.

UNIT: V

New development of intellectual property: new developments in trade mark law; copy right law, patent law, intellectual property audits. International overview on intellectual property, international – trade mark law, copy right law, international patent law, and international development in trade secrets law.

TEXT BOOKS & REFERENCE BOOKS:

1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.
2. Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tata McGraw Hill Publishing company ltd.

MC511: ARTIFICIAL INTELLIGENCE

B.TECH. III YEAR I SEMESTER

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
MC511	MC	3	0	0	0	100	0	100

Prerequisite: Nil

Course Objectives:

1. To train the students to understand different types of AI agents, various AI search algorithms, fundamentals of knowledge representation, building of simple knowledge-based systems and to apply knowledge representation, reasoning. Study of Markov Models enable the student ready to step into applied AI.

UNIT: I

Introduction: AI problems, Agents and Environments, Structure of Agents, Problem Solving Agents Basic Search Strategies: Problem Spaces, Uninformed Search (Breadth-First, Depth-First Search, Depth-first with Iterative Deepening), Heuristic Search (Hill Climbing, Generic Best-First, A*), Constraint Satisfaction (Backtracking, Local Search)

UNIT: II

Advanced Search: Constructing Search Trees, Stochastic Search, A* Search Implementation, Minimax Search, Alpha-Beta Pruning Basic Knowledge Representation and Reasoning: Propositional Logic, First-Order Logic, Forward Chaining and Backward Chaining, Introduction to Probabilistic Reasoning, Bayes Theorem

UNIT: III

Advanced Knowledge Representation and Reasoning: Knowledge Representation Issues, Nonmonotonic Reasoning, Other Knowledge Representation Schemes Reasoning Under Uncertainty: Basic probability, Acting Under Uncertainty, Bayes' Rule, Representing Knowledge in an Uncertain Domain, Bayesian Networks

UNIT: IV

Learning: What Is Learning? Rote Learning, Learning by Taking Advice, Learning in Problem Solving, Learning from Examples, Winston's Learning Program, Decision Trees.

UNIT: V

Expert Systems: Representing and Using Domain Knowledge, Shell, Explanation, Knowledge Acquisition.

TEXT BOOKS:

1. Russell, S. and Norvig, P, Artificial Intelligence: A Modern Approach, Third Edition, PrenticeHall, 2010.

REFERENCE BOOKS:

1. Artificial Intelligence, Elaine Rich, Kevin Knight, Shivasankar B. Nair, The McGraw Hill publications, Third Edition, 2009.

2. George F. Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education, 6th ed., 2009.