# VIGNANA BHARATHI INSTITUTE OF TECHNOLOGY

(AN AUTONOMOUS INSTITUTION)

## B. Tech. in ELECTRICAL AND ELECTRONICS ENGINEERING COURSE STRUCTURE

(**R21 Regulations**) Applicable from AY0 2021-22 Batch

**III Year I Semester:**

| S. No | Course Code | Course Title | Category | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1. | 21EE3111 | Power Electronics | PC | 3 | 1 | - | 4 |
| 2. | 21EE3112 | Power Systems-II | PC | 3 | 1 | - | 4 |
| 3. | 21EC3116 | Signals and Systems | PC | 3 | - | - | 3 |
| 4. | | **Open Elective-I** | OE | 3 | - | - | 3 |
| | | **Professional Elective-I** | PE | 3 | - | - | 3 |
| 5 | 21EE3171 | Power Systems Reliability | | | | | |
| | 21EE3172 | Renewable Energy Systems | | | | | |
| | 21EE3173 | Computer Architecture | | | | | |
| 6 | 21EE3151 | Control Systems Lab | PC | - | - | 2 | 1 |
| 7 | 21EE3153 | Power Electronics Lab | PC | - | - | 2 | 1 |
| 8 | 21EC3154 | Signals and Systems Lab | PC | - | - | 2 | 1 |
| 9 | 21EE3181 | Summer Internship | PW | - | - | 2 | 1 |
| 10 | 21MC0005 | Indian Constitution | MC | 3 | - | - | - |
| 11 | 21MC0006 | Aptitude and Logical Reasoning | MC | 3 | - | - | - |
| **Total** | | | | **21** | **2** | **8** | **21** |

**III Year II Semester:**

| S. No | Course Code | Course Title | Category | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1. | 21EE3211 | Power Systems Analysis | PC | 3 | 1 | - | 4 |
| 2. | 21EE3212 | Power System Protection | PC | 3 | - | - | 3 |
| 3 | 21EC3216 | Microprocessors and Microcontrollers | PC | 3 | - | | 3 |
| 4. | | **Open Elective-II** | OE | 3 | - | - | 3 |
| | | **Professional Elective-II** | PE | 3 | - | - | 3 |
| 5 | 21EE3271 | Digital Signal Processing | | | | | |
| | 21EE3272 | High Voltage Engineering | | | | | |
| | 21EE3273 | Application of Machine Learning | | | | | |
| 6 | 21EC3254 | Microprocessors and Microcontrollers Lab | PC | - | - | 2 | 1 |
| 7 | 21EE3251 | Power Systems Lab | PC | - | - | 2 | 1 |
| 8 | 21EE3252 | Electrical Simulation Lab | PC | - | - | 2 | 1 |
| 9 | 21HS3253 | Advanced English Communication Skills Lab | HS | - | - | 2 | 1 |
| 10 | 21MC0007 | Yoga and Indian Philosophy | MC | 3 | - | - | - |
| **Total** | | | | **18** | **1** | **8** | **20** |

| 21EE3111: POWER ELECTRONICS | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| **B.Tech. III Year I Sem** | | **L** | **T** | **P** | **C** |
| | | **3** | **1** | **0** | **4** |
| **Prerequisite:** Analog Electronics | | | | | |
| **Course Objectives:** | | | | | |
| | • To understand the basic characteristics of different switching device, | | | | |
| | • To design/develop suitable power converter for efficient control or conversion of power in dc drive applications, | | | | |
| | • To design/develop suitable power converter for efficient control or conversion of power in ac drive applications, | | | | |
| | • Develop a suitable inverter for solar and fuel cell systems applications, | | | | |
| | • To design / develop suitable power converter for efficient transmission and utilization of power in power system applications. | | | | |
| **Course Outcomes:** At the end of this course students will demonstrate the ability to | | | | | |
| | • Explain switching characteristics for active power devices, | | | | |
| | • Analyze controlled rectifier circuits, | | | | |
| | • Analyze the operation of AC-AC converter circuits, | | | | |
| | • Analyze the operation of DC-DC converter, | | | | |
| | • Analyze the operation of voltage source inverters. | | | | |

| **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, SCR, Power MOSFET, Power IGBT; methods of SCR commutation, Gate firing circuit (R, RC, and UJT), Series and Parallel connections of SCRs, Thyristor protection. | |

| **UNIT - II:** | |
|---|---|
| **AC-DC Converters (Phase Controlled Rectifiers):** Principles of single-phase half and fully-controlled converter with *R* and *R-L* loads, Effect of free-wheeling diode, Principles of three-phase half and fully-controlled converter operation with *R* and *R-L* loads, Single-phase and Three-phase dual converters, Numerical Problems. | |

| **UNIT - III:** | |
|---|---|
| **AC-AC Converters:** Phase Controller (AC Voltage Regulator): Introduction and its applications, principle of operation of single-phase half and bidirectional ac voltage controllers for *R* and *R-L* loads,<br>**Cyclo-converter:** Basic concepts of single-phase cyclo-converters, relevant waveforms, circulating current mode of operation, Numerical Problems. | |

| **UNIT - IV:** | |
|---|---|
| **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, Control Strategies, Types of choppers, Numerical Problems.

| **UNIT - V:** | |
|---|---|
| **AC-DC Converters (Inverters):** Introduction, principle of operation, single-phase bridge inverters with *R* and *R-L* 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. Basic concepts of current source inverter (CSI). | |

| **TEXT BOOKS:** | |
|---|---|
| 1. P. S. Bimbhra, "Power Electronics", Khanna Publishers, 2013. | |
| 2. M. D Singh and K. B. Khanchandani, "Power Electronics", Mc Graw Hill, 2017. | |
| 3. M. H. Rashid, "Power Electronics: circuits, devices, and applications", Pearson Education India, 2009. | |

| **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. N. Mohan and T. M. Undeland, "Power Electronics: Converters, Applications and Design", John Wiley & Sons, 2007. | |

| 21EE3112: POWER SYSTEMS-II | | | | |
|---|---|---|---|---|
| | | | | |
| **B.Tech. III Year I Sem** | **L** | **T** | **P** | **C** |
| | **3** | **1** | **0** | **4** |

**Prerequisite:** Power Systems –I, Electromagnetic Field Theory.

**Course Objectives:**

- To determine the parameters of transmission line.
- To analyze the performance of transmission lines.
- To interpret the transient phenomenon of transmission lines.
- To know the factors effecting performance of lines
- To interpret the underground cables.

**Course Outcomes:** At the end of this course students will demonstrate the ability to

- To determine the parameters of transmission line.
- To analyze the performance of transmission lines in terms of voltage regulation and efficiency.
- To interpret the transient phenomenon of transmission lines.
- To explain the factors effecting performance of lines.
- To interpret the underground cables.

**UNIT - I:**

**Transmission Line Parameters:** Constants of Transmission line - calculation of resistance of a transmission line- calculation of inductance of a single phase two wire line, inductance of three phase single and double circuit line-symmetrical spacing, unsymmetrical spacing but transposed, concept of GMR and GMD, Numerical Problems. Calculation of capacitance of a single phase 2- wire line, effect of ground on capacitance, capacitance of three phase single and double circuit line-symmetrical spacing, unsymmetrical spacing but transposed, Numerical problems.

**UNIT - II:**

**Performance of Overhead Transmission Lines:** Classification of overhead Transmission Lines – Definitions of Transmission efficiency and voltage regulation. Performance of single-phase short transmission line taking Vr as reference, medium transmission line: Nominal-T, Nominal-Pie methods and A, B, C, D Constants, Numerical Problems.

**Long Transmission Lines:** Long Transmission Line - Rigorous Solution, Evaluation of A, B, C, D Constants, Numerical problems, Equivalent T and Pie representation of long lines.

**UNIT - III:**

**Traveling Waves on Transmission Line**: Surge Impedance, Surge Impedance loading, Wave Length and Velocity of Propagation of waves. Production of travelling waves, open circuited line, short circuited line, Line terminated through a resistance-reflection and refraction coefficients, Line terminated through inductance and capacitance. Line terminated by T-junction, Numerical problems.

| **UNIT - IV:** | |
|---|---|
| **Various Factors Governing the Performance of Transmission Line:** Skin, Proximity and Ferranti effects - Description. Corona - Description of the phenomenon, factors affecting corona, advantages, disadvantages of corona, critical and visual disruptive voltages, and power loss. Numerical problems. Radio Interference definition.<br>**Sag and Tension Calculations:** Sag and Tension calculations with equal and unequal heights of towers, Numerical Problems - Stringing chart and sag template and its applications. | |

| **UNIT - V:** | |
|---|---|
| **Under Ground Cables:** Classification of cables, properties of insulating materials of cable, construction of single core cable, calculation of insulation resistance and stress in insulation, numerical problems. Capacitance of single core cable, numerical problems. Grading of cables-capacitance grading, inter-sheath grading. | |

| **TEXT BOOKS:** | |
|---|---|
| 1. M. L. Soni, P. V. Gupta, U. S. Bhatnagar and A. Chakraborti, "A Text Book on Power System Engineering", Dhanpat Rai and Co. Pvt. Ltd,1999. | |
| 2. V.K Mehta and Rohit Mehta, "Principles of Power Systems", S. Chand & Company Ltd, New Delhi, 2004. | |
| 3. C. L. Wadhwa, "Electrical Power Systems", New Age International (P) Limited Publishers, 1998. | |

| **REFERENCE BOOKS:** | |
|---|---|
| 1. "I. J. Nagarath and D. P Kothari", "Power System Engineering", TMH, 2nd Edition 2010 | |
| 2. "B. R. Gupta", "Power System Analysis and Design", Wheeler Publishing, 1998. | |

| 21EC3116: SIGNALS AND SYSTEMS | | | | |
|---|---|---|---|---|
| | | | | |
| **B.Tech. III Year I Sem** | **L** | **T** | **P** | **C** |
| | **3** | **0** | **0** | **3** |

**Prerequisite:** Control Systems, Laplace Transforms, Numerical Methods and Complex variables

**Course Objectives:**

- To develop ability to analyze linear systems and signals
- To develop critical understanding of mathematical methods to analyze linear systems and signals
- To understand the behavior of signal in time and frequency domain
- To understand continuous and discrete time signals using various transform techniques
- To understand sampling principles

**Course Outcomes:** At the end of this course students will demonstrate the ability to

- Analyze linear systems and signals
- Discuss the concepts of continuous time and discrete time systems.
- Analyze the characteristics of systems using Fourier analysis
- Analyze systems using Laplace and Z- Transforms
- Discuss sampling theorem and its implications.

**UNIT - I:**

**Introduction to Signals and Systems:** Signals and systems as seen in everyday life, and in various branches of engineering and science.
**Signal properties**: periodicity, absolute integrability, determinism and stochastic character.
**Some special signals of importance**: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals.
**System properties**: linearity: additivity and homogeneity, shift-invariance, causality, stability, reliability. Examples.

**UNIT - II:**

**Characteristics of Continuous and Discrete-Time LTI Systems:** Impulse response and step response, concept of convolution, Transfer function of a LTI System, cascade interconnections. Ideal and practical filters, Filter characteristics of LTI System, Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.

**UNIT - III:**

**Representation of Fourier Series and Fourier Transforms:** Fourier series representation of periodic signals, Dirichlet's conditions, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, properties- convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality, Parseval's theorem.

| **UNIT - IV:** | |
|---|---|
| **Laplace and Z-Transforms:** Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis. | |

| **UNIT - V:** | |
|---|---|
| **Sampling and Reconstruction:** The Sampling Theorem and its implications. Spectra of sampled signals for band limited signals. Sampling techniques-ideal, natural and flat top sampling.<br>**Reconstruction**: ideal interpolator, zero-order hold, first-order hold. Effect of under sampling-Aliasing, Anti-aliasing filter. | |

| **TEXT BOOKS:** |
|---|
| 1. Alan V. Oppenheim, Alan S. Willsky, S. Hamid Nawab, Signals and Systems Prentice Hall India, 2nd Edition, 2009. |
| 2. John G. Proakis, Dimitris G. Manolakis, Digital Signal Processing, Principles, Algorithms, and Applications, 4th Edition, PHI, 2007. |
| 3. Signals, Systems &Communications- B.P. Lathi,2013, BSP. |

| **REFERENCE BOOKS:** |
|---|
| 1. H. P. Hsu, “Signals and Systems”, Schaum’s series, McGraw Hill Education,2010. |
| 2. S. Haykin and B. V. Veen, “Signals and Systems”, John Wiley and Sons, 2007. |
| 3. M. J. Robert “Fundamentals of Signals and Systems”, McGraw Hill Education, 2007. |

| 21EE3171: POWER SYSTEMS RELIABILITY | | | | |
|---|---|---|---|---|
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| **B.Tech. III Year I Sem** | **L** | **T** | **P** | **C** |
| | **3** | **0** | **0** | **3** |
| **Prerequisite:** Power System-I, Power System-II. | | | | |
| **Course Objectives:** | | | | |
| • To describe the generation system model and recursive relation for capacitive model building | | | | |
| • To explain the equivalent transitional rates, cumulative probability, and cumulative frequency | | | | |
| • To develop an understanding of risk, system, and load point reliability indices | | | | |
| • To explain the basic and performance reliability indices. | | | | |
| • To describe the importance of maintaining reliability of power system components | | | | |
| **Course Outcomes:** At the end of this course students will demonstrate the ability to | | | | |
| • Estimate loss of load and energy indices for the generation systems model | | | | |
| • Describe merging generation and load models | | | | |
| • Apply various indices for distribution systems | | | | |
| • Evaluate the reliability of interconnected systems | | | | |
| • Assess the reliability of power systems | | | | |

| **UNIT - I:** |
|---|
| **Basic Probability Theory:** Elements of probability, probability distributions, Random variables, Density and Distribution functions- Binomial distribution- Expected value and standard deviation - Binomial distribution, Poisson distribution, normal distribution, exponential distribution, Weibull distribution.<br>**Definition of Reliability:** Definition of terms used in reliability, Component reliability, Hazard rate, derivation of the reliability function in terms of the hazard rate. Hazard models - Bath tub curve, Effect of preventive maintenance. Measures of reliability: Mean Time to Failure and Mean Time between Failures. |

| **UNIT - II:** |
|---|
| **Generating System Reliability Analysis**: Generation system model – capacity outage probability tables – Recursive relation for capacitive model building – sequential addition method – unit removal – Evaluation of loss of load and energy indices – Examples. Frequency and Duration methods – Evaluation of equivalent transitional rates of identical and non-identical units – Evaluation of cumulative probability and cumulative frequency of non-identical generating units – 2-level daily load representation - merging generation and load models – Examples. |

| **UNIT - III:** |
|---|
| **Operating Reserve Evaluation:** Basic concepts - risk indices – PJM methods – security function approach – rapid start and hot reserve units – Modeling using STPM approach.<br>**Bulk Power System Reliability:** Evaluation: Basic configuration – conditional probability approach – system and load point reliability indices – weather effects on transmission lines – Weighted average rate and Markov model – Common mode failures. |

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| **Inter Connected System Reliability Analysis:** Probability array method – Two inter-connected systems with independent loads – effects of limited and unlimited tie capacity - imperfect tie – Two connected Systems with correlated loads – Expression for cumulative probability and cumulative frequency |

| **UNIT - IV:** | |
|---|---|
| **Distribution System Reliability Analysis:** Basic Techniques – Radial networks –Evaluation of Basic reliability indices, performance indices – load point and system reliability indices – customer oriented, loss and energy-oriented indices – Examples. Basic concepts of parallel distribution system reliability | |

| **UNIT - V:** | |
|---|---|
| **Substations and Switching Stations: Effects:** of short-circuits - breaker operation – Open and short-circuit failures – Active and Passive failures – switching after faults – circuit breaker model – preventive maintenance – exponential maintenance times. | |

| **TEXT BOOKS:** | |
|---|---|
| 1. R. Billinton, and R.N. Allan, "Reliability Evaluation of Power Systems" BS Publications, 2007. | |
| 2. J. Endrenyi, "Reliability Modeling in Electric Power Systems", John Wiley and Sons, 1978. | |
| **REFERENCE BOOKS:** | |
| 1. Alessandro Birolini, "Reliability Engineering: Theory and Practice", Springer Publications. | |
| 2. Charles Ebeling, "An Introduction to Reliability and Maintainability Engineering" TMH Publications. | |
| 3. E. Balaguruswamy, "Reliability Engineering" TMH Publications. | |
| 4. A. Elsayed, "Reliability Engineering", Prentice Hall Publications. | |

| 21EE3172: RENEWABLE ENERGY SYSTEMS | | | | |
|---|---|---|---|---|
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| **B.Tech. III Year I Sem** | **L** | **T** | **P** | **C** |
| | **3** | **0** | **0** | **3** |

**Prerequisite:** Electrical Machines –II, Power System- I, Power Electronics.

**Course Objectives:**

- To study the concepts of Wind Energy Conversion Systems.
- To study and understand wind generation topologies.
- To know the concepts of Solar Thermal Power Generation.
- To study the characteristics of photo voltaic cells.
- To study the concepts of renewable energy systems other than solar and wind power generations.

**Course Outcomes:** At the end of this course students will demonstrate the ability to

- Discuss the energy scenario from wind energy conversion system.
- Analyze Wind Generator Topologies.
- Discuss the solar resources & solar thermal power generation.
- Analyze the characteristics of photo voltaic systems.
- Differentiate the concepts of renewable power generations excluding solar and wind.

**UNIT - I:**

**Wind Energy:** Introduction to Wind energy, Site selection consideration, Basic component of Wind Energy Conversion Systems (WECS) ; Classification of Wind Energy Conversion system- Horizontal axis & Vertical axis; Advantages & Disadvantages of wind energy conversion system

**UNIT - II:**

**Wind Generator Topologies:** Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent-Magnet Synchronous Generators,

**UNIT - III:**

**Solar Thermal Power Generation:** Introduction, solar radiation- Beam & Diffuse radiation, solar geometry, Earth Sun angles, observer Sun angles, solar day length, focusing type **Solar Collector** - Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond**.**

**UNIT - IV:**

**Solar Photovoltaic:** Basic Principle of solar photovoltaic conversion, Types of Solar Cells - Amorphous, Mono crystalline, polycrystalline; V-I characteristics of a PV cell, PV module, Maximum Power Point Tracking (MPPT) algorithms.

**UNIT - V:**

**Other Renewable Energy Sources:** Energy from Bio mass: conversion processes, Geothermal Power Plant: Dry Steam System, Flash Steam System, Binary Cycle System; MHD Generation, Ocean Thermal Energy Conversion (OTEC), Energy from the tides

| **TEXT BOOKS:** |
|---|
| 1. G. D. Rai, "Non-Conventional Energy Sources", Khanna Publishers, 2011. |
| 2. T. Ackermann, "Wind Power in Power Systems", John Wiley and Sons Ltd., 2005. |
| 3. G. M. Masters, "Renewable and Efficient Electric Power Systems", John Wiley and Sons, 2004. |

| **REFERENCE BOOKS:** |
|---|
| 1. D.P.Kothari, K.C Singal, Rakesh Ranjan "Renewable Energy Sources and Emerging Technologies", PHI Learning Pvt.Ltd, New Delhi, 2013. |
| 2. S. P. Sukhatme, "Solar Energy: Principles of Thermal Collection and Storage", McGrawHill,1984. |
| 3. H. Siegfried and R. Waddington, "Grid integration of wind energy conversion systems" JohnWileyand Sons Ltd., 2006. |

| 21EE3173: COMPUTER ARCHITECTURE | | | | |
|---|---|---|---|---|
| | | | | |
| **B.Tech. III Year I Sem** | **L** | **T** | **P** | **C** |
| | **3** | **0** | **0** | **3** |
| **Prerequisite:** Digital Electronics | | | | |
| **Course Objectives:** | | | | |
| • To understand basic components of computers. | | | | |
| • To understand the architecture of 8086 processor. | | | | |
| • To understand the instruction sets, instruction formats and various addressing modes of 8086 | | | | |
| • To understand the representation of data at the machine level and how computations are performed at machine level | | | | |
| • To understand the memory organization and I/O organization. | | | | |
| **Course Outcomes:** At the end of this course students will demonstrate the ability to | | | | |
| • Understand the concepts of microprocessors, their principles and practices. | | | | |
| • Write efficient programs in assembly language of the 8086 family of microprocessors. | | | | |
| • Organize a modern computer system and be able to relate it to real examples. | | | | |
| • Develop the programs in assembly language for 80286, 80386 and MIPS processors in real and protected modes | | | | |
| • Implement embedded applications using ATOM processor. | | | | |

| **UNIT - I:** | |
|---|---|
| **INTRODUCTION TO COMPUTER ORGANIZATION**<br>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, Hard ware implementation of CPU with Micro instruction, micro programming, System buses, Multi-bus organization. | |

| **UNIT - II:** | |
|---|---|
| **MEMORY ORGANIZATION**<br>System memory, Cache memory-types and organization, Virtual memory and its implementation, Memory management unit, Magnetic Hard disks, Optical Disks.<br>**INPUT–OUTPUT ORGANIZATION**<br>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 MICRO PROCESSORS**<br>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: | |
|---|---|
| **PIPE LINING**<br>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: | |
|---|---|
| VLIW Architecture, DSP Architecture, SoC architecture, MIPS Processor and programming | |

| TEXT BOOKS: | |
|---|---|
| 1. V. Carl, G.ZvonkoandS.G.Zaky, "Computer organization", McGrawHill, 1978 | |
| 2. B. Brey and C. R. Sarma, "The Intel microprocessors", Pearson Education, 2000 | |
| 3. J.L.Hennessy and D.A.Patterson, "Computer Architecture A Quantitative Approach", | |

| REFERENCE BOOKS: | |
|---|---|
| 1. W. Stallings, "Computer organization", PHI, 1987. | |
| 2. P. Barryand P. Crowley, "Modern Embedded Computing", Morgan Kaufmann, 2012.. | |
| 3. N. Mathivanan, "Microprocessors, P C Hardware and Interfacing", Prentice Hall, 2004. | |
| 4. Y.C.Lieu and G.A.Gibson, "Microcomputer Systems: The 8086/8088Family", Prentice Hall India, 1986. | |
| 5. J. Uffenbeck, "The 8086/8088 Design, Programming, Interfacing", Prentice Hall, 1987. | |
| 6. B. Govindarajalu, "IBMP C and Clones", Tata McGraw Hill, 1991. | |
| 7. P.Able,"8086 Assembly Language Programming", Prentice Hall India. | |

| 21EE3151: CONTROL SYSTEMS LAB | | | | |
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| **B.Tech. III Year I Sem** | **L** | **T** | **P** | **C** |
| | **0** | **0** | **2** | **1** |
| **Prerequisite:** Control Systems. | | | | |
| **Course Objectives:** | | | | |
| | • To understand the different ways of system representations such as Transfer function representation and state space representations and to assess the system dynamic response | | | |
| | • To assess the system performance using time domain analysis and methods for improving it | | | |
| | • To assess the system performance using frequency domain analysis and techniques for improving the performance | | | |
| | • To design various controllers and compensators to improve system performance | | | |
| **Course Outcomes:** At the end of this course students will demonstrate the ability to | | | | |
| | • To improve the system performance by selecting a suitable controller and/or a compensator for a specific application. | | | |
| | • Analyze the transfer function of DC Motor and Generator. | | | |
| | • Apply various time domain and frequency domain techniques to assess the system performance. | | | |
| | • Apply various control strategies to different applications (example: Power systems, electrical drives etc.) | | | |
| | • Test system controllability and observability using state space representation and applications of state space representation to various systems. | | | |
| | | | | |

| Any eight experiments should be conducted | |
|---|---|
| 1 | Time response of Second order system. |
| 2 | Characteristics of Synchros. |
| 3 | Programmable logic controller – Study and verification of truth tables of logic gates, simple Boolean expressions, and application of speed control of motor. |
| 4 | Effect of feedback on DC servo motor. |
| 5 | Transfer function of DC motor. |
| 6 | Transfer function of DC generator. |
| 7 | Temperature controller using PID. |
| 8 | Characteristics of AC servo motor. |

| Any two experiments should be conducted | |
|---|---|
| 1 | Effect of P, PD, PI, PID Controller on a second order systems. |
| 2 | Lag and lead compensation – Magnitude and phase plot. |
| 3 | Linear system analysis (Time domain analysis, Error analysis) using suitable software |

| | |
|---|---|
| 4 | Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using suitable software. |
| 5 | State space model for classical transfer function using suitable software -Verification. |

| **TEXT BOOKS:** | |
|---|---|
| M. Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 1997. | |
| B. C. Kuo, "Automatic Control System", Prentice Hall, 1995. | |

| **REFERENCE BOOKS:** | |
|---|---|
| K. Ogata, "Modern Control Engineering", Prentice Hall, 1991. | |
| I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009. | |

| 21EE3153: POWER ELECTRONICS LAB | | | | |
|---|---|---|---|---|
| | | | | |
| **B.Tech. III Year I Sem** | **L** | **T** | **P** | **C** |
| | **0** | **0** | **2** | **1** |
| **Prerequisite:** Power Electronics, Analog Electronics. | | | | |
| **Course Objectives:** | | | | |
| | • To expose students to operation and characteristics of power semiconductor devices and their practical application in power electronics. | | | |
| | • To expose students to different commutation circuits. | | | |
| | • To apply the concepts of power electronic converters for efficient conversion/control of power from source to load. | | | |
| | • To provide a practical exposure to operating principles, design and synthesis of different power electronic converters. | | | |
| | • To introduce students to industrial control of power electronic circuits as well as safe electrical connection and measurement practices. | | | |
| **Course Outcomes:** At the end of this course students will demonstrate the ability to | | | | |
| | • Understand the operating principles of various power electronic converters. | | | |
| | • Study and understand the different firing circuits of SCR. | | | |
| | • Study and understand the concept of different commutation circuits. | | | |
| | • Use power electronic hardware to develop the power converters. | | | |
| | • Analyze and choose the appropriate converters for various applications. | | | |

| Any ten experiments should be conducted | |
|---|---|
| 1 | Study of characteristics of SCR. |
| 2 | Gate firing circuits for SCR's. |
| 3 | Single-phase half-controlled bridge converter with *R* and *R-L* loads. |
| 4 | Single-phase fully controlled bridge converter with *R* and *R-L* loads. |
| 5 | Three-phase half-bridge converter with *R* and *R-L* loads. |
| 6 | Single-phase A.C voltage controller with *R* and *R-L* loads. |
| 7 | Single-phase Cyclo-converter with R and RL loads. |
| 8 | Single-phase series& parallel inverter with *R* and *R-L* loads. |
| 9 | Single-phase Bridge inverter with R and RL loads. |
| 10 | Forced Commutation circuits (Class A, Class B, Class C, Class D & Class E). |
| 11 | Single-phase Inverter with PWM control technique. |
| 12 | Single-phase dual converter with *R* and *R-L* loads. |

| **TEXT BOOKS:** |
|---|
| **1.** P. S. Bimbhra, "Power Electronics", Khanna Publishers, 2013. |
| **2.** M. D Singh and K. B. Khanchandani, "Power Electronics", Mc Graw Hill, 2017. |
| 3. M. H. Rashid, Simulation of Electric and Electronic circuits using PSPICE – by M/s PHI Publications. |

| **REFERENCE BOOKS:** | |
|---|---|
| 1. N. Mohan and T. M. Undeland, Power Electronics: Converters, Applications and Design, John Wiley & Sons, 2007. | |
| 2. M. H. Rashid, *Power Electronics: Circuits, Devices, and Applications*, Pearson Education India, 2009. | |
| 3. Rashid, Spice for Power Electronics and Electric Power, CRC Press. | |

| 21EC3154: SIGNALS AND SYSTEMS LAB | | | | |
|---|---|---|---|---|
| | | | | |
| **B.Tech. III Year I Sem** | **L** | **T** | **P** | **C** |
| | **0** | **0** | **2** | **1** |
| **Prerequisite:** Signals and Systems. | | | | |
| **Course Objectives:** | | | | |
| | • To develop ability to analyze linear systems and signals | | | |
| | • To develop critical understanding of mathematical methods to analyze linear systems and signals | | | |
| | • To know the various transform techniques | | | |
| | • To analyze sampling principles | | | |
| **Course Outcomes:** At the end of this course students will demonstrate the ability to | | | | |
| | • Understand the concepts of continuous time and discrete time systems. | | | |
| | • Analyze systems in complex frequency domain. | | | |
| | • Understand sampling theorem and its implications. | | | |

| Any eight experiments should be conducted | |
|---|---|
| 1 | Basic Operations of Matrices. |
| 2 | Generation of Various Signals and Sequences, such as Unit Impulse, Unit step, Square, Sawtooth, Triangular, Sinusoidal, Ramp, Sinc |
| 3 | Operation on Signals and Sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Power |
| 4 | Finding the Even and Odd Parts of Signal/Sequence and Real and Imaginary Parts of Signal |
| 5 | Convolution of Signals and Sequences |
| 6 | Verification of Linearity and Time Invariance Properties of a Given System |
| 7 | Computation of Unit Sample, Unit step and Sinusoidal response of the given LTI system and verifying its physical realizability and stability properties |
| 8 | Gibbs Phenomenon Simulation |
| 9 | Finding the Fourier Transform of a given signal and plotting its magnitude and phase spectrum. |
| 10 | Waveform Synthesis using Laplace Transform |
| 11 | Locating the Zeros and Poles and Plotting the Pole-Zero Maps in S-Plane and Z-Plane for the given transfer function |
| 12 | Verification of Sampling Theorem |

## 21MC0005: INDIAN CONSTITUTION

**B. Tech. III Year I Sem** **L T P C**
**3 0 0 0**

The Constitution of India is the supreme law of India. Parliament of India cannot make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the "basic structure" of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments.

The Constitution of India reflects the idea of "Constitutionalism" –a modern and progressive concept historically developed by the thinkers of "liberalism" –an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of "constitutionalism" in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom and America.

The Constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India's legacy of "diversity". It has been said that Indian constitution reflects ideals of its freedom movement; however, few critics have argued that it does not truly incorporate our own ancient legal heritage and cultural values. No law can be "static" and therefore the Constitution of India has also been amended more than one hundred times. These amendments reflect political, social and economic developments since the year 1950.

The Indian judiciary and particularly the Supreme Court of India has played an historic role as the guardian of people. It has been protecting not only basic ideals of the Constitution but also strengthened the same through progressive interpretations of the text of the Constitution. The judicial activism of the Supreme Court of India and its historic contributions has been recognized throughout the world and it gradually made it "as one of the strongest court in the world".

**COURSE CONTENT:**

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status

6. The Directive Principles of State Policy –Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India –The constitution powers and status of the President of India
9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
11. Emergency Provisions: National Emergency, President Rule, Financial Emergency
12. Local Self Government –Constitutional Scheme in India
13. Scheme of the Fundamental Right to Equality
14. Scheme of the Fundamental Right to certain Freedom under Article 19
15. Scope of the Right to Life and Personal Liberty under Article 21

## 21MC0006-APTITUDE AND LOGICAL REASONING

**B.Tech. III Year I Sem.** **L T P C**

3 0 0 0

**Course Objectives:**

1.Student learns the techniques to solve all the problems in his real life.
2.It can improve the numerical ability.
3.The quicker methods are useful to solve the problems within the time and it is helpful in his duties.
4.Quantative Aptitude helps in solving the practical life problems.
5.Students can use Quantitative Aptitude in everyday life to figure out mathematically.
6.Student can improve his mental capacity.
7.It helps in sharpening their minds.

**UNIT I**

Number System, Percentages, Profit And Loss, Simple Interest - Compound Interest, Partnership Ratio And Proportion ,Chain Rule, Time And Work - Pipes And Cistern, Time And Distance - Problems On Trains, Boats And Streams, Races And Games Of Skill

**UNIT II**

Average, Alligation And Mixture, Permutation-Combination, Probability, Geometry (Co-Ordinate, Solid-2d Areas & 3d Volumes), D I (Tabulation, Bar Graphs, Pie Charts & Line Graphs), Elementary Statistics

**UNIT III:**

Series Completion, Analogy, Classification / Odd One Out, Coding – Decoding, Blood Relations, Deciphering Jumbled up Descriptions,

**UNIT IV:**

Relation Puzzle, Direction sense test, Number, Ranking & Time Sequence Test, Puzzle Test, Seating Arrangements Comparison Type Questions, Sequential Order of Things, Selection Based on gave conditions,

**UNIT V**

Family – Based Puzzles, Jumbled Problems. Logical Venn Diagrams

Alpha Numeric Sequence Puzzle, Cubes, Dice, Clocks, Calendar, Data Sufficiency, Syllogism.

**TEXT BOOKS:**

1. Quantitative Aptitude by R.S.Agarwal
2. Quantitative Aptitude by Abhijit Guha
3. Quantitative Aptitude for Competative Examinations, U.Mohan Rao, Scitech Publication.

| 21EE3211: POWER SYSTEMS ANALYSIS | | | | |
|---|---|---|---|---|
| | | | | |
| **B.Tech. III Year II Sem** | **L** | **T** | **P** | **C** |
| | **3** | **1** | **0** | **4** |

**Prerequisite:** Electrical Circuits, Power System- I, Power System- II.

**Course Objectives:**

- To develop Ybus and Zbus matrices.
- To determine the load flow parameters using Gauss-Seidel and Newton Raphson methods.
- To obtain the power flow parameters using Decoupled methods.
- To determine the fault current using symmetrical Components.
- To analyze the rotor angle stability of power systems.

**Course Outcomes:** At the end of this course students will demonstrate the ability to

- Develop Ybus and Zbus matrices using graph theory concepts.
- Calculate the power flow parameters using Gauss-Seidel and Newton Raphson methods.
- Compute the power flow parameters using decoupled methods.
- Analyze the Symmetrical & Unsymmetrical Fault.
- Analyze the stability and instability of the power systems.

**UNIT - I:**

**POWER SYSTEM NETWORK MATRICES & PER UNIT REPRESENTATION**

Definition: Graph and Oriented Graph; Incidence matrix and Bus Incidence Matrix; Formation of Ybus: Direct and Singular Transformation Method (Simple Numerical Problems); Formation of ZBus: Modification of existing ZBus Matrix (Simple Numerical Problems). Single line diagram; per unit quantities; advantages of per unit system; changing the base of per unit quantities; impedance and reactance diagrams (Numerical Problem).

**UNIT - II:**

**Power Flow Studies – I:** Necessity of Power Flow Studies, Types of Bus, Load Flow Methods: Gauss-Seidel Method in complex form without & with voltage control buses, line flows and loss calculations (Derivation, Algorithm & Flow Chart- Numerical Problem for one iterations –Not more than 3 bus system ) Newton Raphson method in Polar (Derivation, Algorithm & Flow Chart).

**UNIT - III:**

**Power Flow Studies – II:** Decoupled load flow method and its assumptions, Fast Decoupled load method and its assumptions, (Derivation, Algorithm & Flow Chart- Numerical Problem for one iteration -only 3 bus system), Comparison of Gauss Seidel, Newton Raphson & Fast Decoupled Load flow method.

**UNIT - IV:**

**SHORT CIRCUIT ANALYSIS:** Symmetrical short circuit analysis using Kirchhoff's

| |
|---|
| Law; Symmetrical components - Sequence impedances - Sequence networks; Unsymmetrical Fault Analysis: Fault current calculations for LG, LL, LLG faults on an unloaded generator ( No Numerical Problems) |

| **UNIT - V:** | |
|---|---|
| **Stability Analysis:** Classification of power system stability, Swing equation, Power-Angle equation, Determination of Transient Stability through Equal Area Criterion for single machine infinite system (Derivation), Critical clearing angle & time (Derivation), Methods to improve transient Stability. | |

| **TEXT BOOKS:** |
|---|
| 1. P.S.R. Murthy, "Power System Analysis", BS Publications, 2007. |
| 2. A. Nagoor Kani, "Power System Analysis", CBS Publishers & Distributors Pvt. Ltd, Reprint 2020. |
| 3. Hadi Saadat, 'Power System Analysis', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010. |
| 4. John J. Grainger, William D. Stevenson, Jr, 'Power System Analysis', Mc Graw Hill Education (India) Private Limited, New Delhi, 2015. |

| **REFERENCE BOOKS:** |
|---|
| 1. M. A. Pai, "Computer Techniques in Power System Analysis", TMH Publications, 3rd edition 2014. |
| 2. Gupta B.R., 'Power System - Analysis and Design', S. Chand Publishing, 2001 |
| 3. I. J. Nagrath & D. P. Kothari, "Modern Power system Analysis", Tata McGraw-Hill Publishing Company, 4th Edition 2011. |

| 21EE3212: POWER SYSTEM PROTECTION | | | | |
|---|---|---|---|---|
| | | | | |
| **B.Tech. III Year II Sem** | **L** | **T** | **P** | **C** |
| | **3** | **0** | **0** | **3** |

**Prerequisite:** Power Systems-I and Power Systems-II

**Course Objectives:**

- To introduce all kinds of circuit breaker for protection.
- To introduce various types of relays.
- To describe about protection of Generators and Transformers.
- To describe the importance of neutral grounding.
- To analyze the phenomenon of over voltages and its classifications.

**Course Outcomes:** At the end of this course, students will be able to

- Understand the quenching mechanisms used in various circuit breakers.
- Understand the choice of relays for appropriate protection of power systems equipment.
- Apply technology to protect power system equipment.
- Analyze the need of grounding system.
- Analyze the phenomenon of voltage surges.

**UNIT - I:**

**Circuit Breakers:** Arc Phenomenon, Methods of Arc Extinction, Arc Voltage, Restriking voltage, Recovery voltage, RRRV, Definitions of current chopping and Resistance switching. CB ratings and specifications Numerical problems, types of circuit breakers: Minimum oil circuit breakers, Air blast circuit breakers, Vacuum and SF6 circuit breakers.

**UNIT - II:**

**Protective Relays:** Principle of operation, construction of attracted armature, balanced beam, induction Disc and induction cup relays.
Relays classification: comparison of Instantaneous, DMT and IDMT types
**Application of relays:** Over current / under voltage relays, Direction relays, Differential Relays and percentage differential relays.
**Distance relays:** Impedance, reactance, Mho and Off-set Mho relays, Introduction to static relays and Introduction to Microprocessor relay.

**UNIT - III:**

**Apparatus Protection:** Protection of Alternators**:** Differential Protection of Alternators, Modified Differential Protection for Alternators, Balanced Earth-Fault Protection, Stator Inter-turn Protection
**Protection of Transformers**: Common transformer faults, Buchholz Relay, Earth-Fault or Leakage Protection, Merz-Price circulating-current scheme for the transformer protection.

**UNIT - IV:**

| |
|---|
| **Line Protection & Grounding:** Protection of Lines: Time-Graded Overcurrent Protection-Radial feeder, Parallel feeders, Ring main system, Merz-Price voltage balance system, Translay scheme.<br>**Neutral Grounding:** Grounding or Earthing, Equipment Grounding, Ungrounded Neutral System, Neutral Grounding and its advantages, Methods of neutral grounding: solid, resistance, reactance, Peterson coil grounding. |

| **UNIT - V:** | |
|---|---|
| **Surge and Over Voltage Protection:** Internal and external Causes of Overvoltage's, Protection Against Lightning, Earthing Screen, Overhead Ground Wires, introduction to lightning Arresters, Rod gap arrester, Valve type lightning arrester and advantages, sure absorbers. | |

| **TEXT BOOKS:** |
|---|
| 1.V. K. Mehta, Rohit Mehta, Principles of Power Systems, S Chand, 2005. |
| 2.Badri Ram and Vishwakarma D N, Power System Protection and Switchgear, Tata McGraw-Hill, New Delhi, 2011. |
| 3.Ravindranath B and Chander M, Power System Protection and Switchgear, New Age International, New Delhi, July 2011. |

| **REFERENCE BOOKS:** |
|---|
| 1. Sunil S Rao, Switchgear Protection and Power Systems, Khanna Publishers, New Delhi, 2012. |
| 2. J. L. Blackburn, Protective Relaying: Principles and Applications, Marcel Dekker, New York, 1987. |
| 3. Donald Reimert, "Protective Relaying for Power Generation Systems", Taylor and Francis, CRC Press, 2006 |

| 21EC3216: MICROPROCESSORS AND MICROCONTROLLERS | | | | |
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| **B.Tech. III Year II Sem** | **L** | **T** | **P** | **C** |
| | **3** | **0** | **0** | **3** |

**Prerequisite: Digital Electronics, Computer Architecture**

**Course Objectives:**

- To familiarize the architecture of microprocessors and microcontrollers.
- To provide the knowledge about interfacing techniques of bus & memory.
- To study various ICs to 8086 and interfacing buses.
- To develop programming skills using 8051 based systems.
- To study the basic concepts of Advanced ARM processors.

**Course Outcomes:** At the end of this course students will demonstrate the ability to

- Understands the internal architecture, organization and assembly.
- Language programming of 8086 processors.
- Understands the internal architecture, organization and assembly language programming of 8051/controllers.
- Understands the interfacing techniques to 8051 based systems.
- To outline basic concepts of advanced ARM processors.

**UNIT - I:**

**8086 Architecture:**

Architecture of 8086. Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Signal descriptions of 8086, interrupts of 8086.

**UNIT - II:**

**Instruction Set and Assembly Language Programming of 8086:**

Maximum mode and minimum mode, Instruction formats, addressing modes, Instruction Set, Assembler Directives, Macros, and Simple Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations.

**UNIT - III:**

**I/O devices:** 8255 programmable peripheral interface, 8251 Universal Asynchronous/Synchronous Receiver Transmitter, 8257 Programmable interrupt controllers, cascade multiple PICs. ADC, LCD interfaces.

**Serial Communication and Bus Interface:** Serial Communication Standards, Serial Data Transfer Scheme, On board Communication Interfaces-I2C Bus, SPI Bus, UART; External Communication Interfaces-RS232, USB.

**UNIT - IV:**

**Introduction to Microcontrollers:**

| |
|---|
| Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Addressing Modes and Instruction set of 8051, Interface external memory RAM, ROM. |

| **UNIT - V:** | |
|---|---|
| 8051 Real Time Control: Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Programming 8051 Timers and Counters.<br>**ARM Architecture:** Introduction to ARM Processor and its architecture, ARM Architecture | |

| **TEXT BOOKS:** | |
|---|---|
| 1. Advanced Microprocessors and Peripherals – A. K. Ray and K. M. Bhurchandani, TMH, 2nd Edition 2006. | |
| 2. ARM System Developers guide, Andrew N SLOSS, Dominic SYMES, Chris WRIGHT, Elsevier, 2012 | |

| **REFERENCE BOOKS:** | |
|---|---|
| 1. The 8051 Microcontroller, Kenneth. J. Ayala, Cengage Learning, 3rd Ed,2004. | |
| 2. Microprocessors and Interfacing, D. V. Hall, TMGH, 2nd Edition2006. | |
| 3. The 8051 Microcontrollers, Architecture and Programming and Applications -K. Uma Rao, Andhe Pallavi, Pearson, 2009. | |

| 21EE3271: DIGITAL SIGNAL PROCESSING | | | | |
|---|---|---|---|---|
| **B.Tech. III Year II Sem** | **L** | **T** | **P** | **C** |
| | **3** | **0** | **0** | **3** |
| **Prerequisite:** Laplace Transforms, Numerical Methods and Complex variables, ControlSystems, Signals and Systems | | | | |
| **Course Objectives:** | | | | |
| • To provide background and fundamental material for the analysis and processing of digital signals. | | | | |
| • To familiarize the relationships between continuous-time and discrete time signals and systems. | | | | |
| • To study fundamentals of time, frequency and Z-plane analysis and to discuss the inter-relationships of these analytic method. | | | | |
| • To study the designs and structures of digital (IIR and FIR) filters from analysis to synthesis for a given specifications. | | | | |
| • To acquaint in FFT algorithms, multi-rate signal processing techniques and finite word length effects. | | | | |
| **Course Outcomes:** At the end of this course students will demonstrate the ability to | | | | |
| • Perform time, frequency, and Z-transform analysis on signals and systems. | | | | |
| • Determine the inter-relationship between DFT and various transforms. | | | | |
| • Explain the significance of various filter structures and effects of round off errors. | | | | |
| • Design a digital filter for a given specification. | | | | |
| • Discuss the fast computation of DFT and appreciate the FFT processing. | | | | |

**UNIT-I: INTRODUCTION**

Introduction to Digital Signal Processing: Discrete Time Signals &Sequences, conversion continuous to discrete signal, Normalized Frequency Linear Shift Invariant Systems, Stability, a Causality, linear differential equation to difference equation, Linear Constant CoefficieDifference Equations, Frequency Domain Representation of Discrete Time Signals and Systems REALIZATION OF DIGITAL FILTERS: Applications of Z–Transforms, Solution of Differen Equations of Digital Filters, System Function, Stability Criterion, Frequency Response of Sta Systems.

**UNIT-II: DISCRETE FOURIER TRANSFORMS**

Properties of DFT, Linear Convolution of Sequences using DFT, Computation of DFT: Over-Lap Add Method, Over-Lap Save Method, Relation between DTFT, DFS, DFT and Z-Transform. Fast Fourier Transforms: Fast Fourier Transforms (FFT)-Radix-2 Decimation-in-Time and Decimation- in-Frequency FFT Algorithms , Inverse FFT, and FFT with General Radix-N.

**UNIT-III: IIR DIGITAL FILTERS**

Analog filter approximations–Butter worth and Chebyshev, Design of IIR Digital Filters fro Analog Filters, Step and Impulse Invariant Techniques, Bilinear Transformation Method, Spect Transformations, Realization of Digital Filters–Direct, Canonic, Cascade and Parallel Forms.

**UNIT-IV: FIR DIGITAL FILTERS**

Characteristics of FIR Digital Filters, Frequency Response, and Design of FIR Filters: Four Method, Digital Filters using Window Techniques, Frequency Sampling Technique, Comparis of IIR&FIR filters

**UNIT-V: MULTI-RATE DIGITAL SIGNAL PROCESSING**

Introduction, Down Sampling, Decimation, Upsampling, Interpolation, Sampling R Conversion, Conversion of Band Pass Signals, Concept of Resampling, Applications of Mu Rate Signal Processing.

**FINITE WORD LENGTH EFFECTS**: Limit cycles, Over flow Oscillations, Round-off No in IIR Digital Filters, Computational Output Round off Noise, Methods to Prevent Over flo Trade off between Round Off and Overflow Noise, Applications of multi stage signal processin

Dead Band Effects.

**TEXT BOOKS**:

1. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris
   G. Manolakis, Pearson Education/PHI, 2007.

2. Discrete Time Signal Processing–A. V. Oppenheim and R. W. Schaffer, PHI, 2009

**REFERENCE BOOKS**:

1. Fundamentals of Digital Signal Processing–Loney Ludeman, John Wiley, 2009

2. Digital Signal Processing–Fundamentals and Applications–LiTan, Elsevier, 2008

3. Fundamentals of Digital Signal Processing using MATLAB–Robert J. Schilling, Sandra L.Harris, Thomson, 2007

4. Digital Signal Processing-A Practical approach, Emmanuel C. Ifeachor and Barrie W.Jervis,2nd Edition, Pearson Education,2009

| 21EE3272: HIGH VOLTAGE ENGINEERING | | | | |
|---|---|---|---|---|
| | | | | |
| **B.Tech. III Year II Sem** | **L** | **T** | **P** | **C** |
| | **3** | **0** | **0** | **3** |

**Prerequisite:** Power Systems – I, Electro Magnetic Fields.

**Course Objectives:**

- To deal with the detailed analysis of Breakdown occurring in gasses and liquids.
- To deal with the detailed analysis of Breakdown occurring in solid dielectrics.
- To instruct about generation and measurement of High voltage and current.
- To instruct about lightning and switching over voltages.
- To understand High voltage testing methods.

**Course Outcomes:** At the end of this course students will demonstrate the ability to

- Interpret the basic physics related to various breakdown processes in solid and liquid insulating materials.
- Describe the generation of D. C., A.C., & Impulse voltages.
- Describe the measurement techniques of D. C., A.C., & Impulse voltages.
- Discuss lightning and switching over voltages
- Express over-voltages testing methods, and protection against over voltages.

**UNIT - I:**

**Breakdown in Gases:** Ionization processes -Collision, photo ionization, de-ionization processes. Types of Discharge, Gases as insulating materials, Breakdown in Uniform gap, non-uniform gaps, Townsend's theory, Streamer mechanism.

**Breakdown in Liquid and Solid Insulating Materials**: Breakdown in pure and commercial liquids, Solid dielectrics and composite dielectrics, intrinsic breakdown, electromechanical breakdown and thermal breakdown.

**UNIT - II:**

**Generation of High Voltages**: Generation of high voltages-DC Voltages - Voltage Multiplier Circuits - Cascaded Modular Voltage Multipliers - Van tie Graaff Generator, A.C. voltages-Cascade Transformers-resonant transformers - generation of impulse voltages- Standard Impulse Waveshape -generation of impulse currents-high impulse and rectangular.

**UNIT - III:**

**Measurements of High Voltages and Currents**: High Ohmic Series Resistance with Microammeter- Resistance Potential Dividers- Generating Voltmeters, impulse voltage measurement - Series Impedance Voltmeters, Series Capacitance Voltmeter, Capacitance Potential Dividers ,Electrostatic Voltmeters- high direct current measurement method- Hall Generators for Direct Current Measurements, Resistive shunts, Bifilar Strip Shunt, Coaxial Tubular or Park's Shunt- cathode ray oscillographs for impulse voltage and current measurement

**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, Surge modifiers.

| **UNIT - V:** | |
|---|---|
| **High Voltage Testing of Electrical Apparatus and High Voltage Laboratories:** 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 | |

| **TEXT BOOKS:** | |
|---|---|
| 1. M. S. Naidu and V. Kamaraju, "High Voltage Engineering", McGraw Hill Education, 2013. | |
| 2. C. L. Wadhwa, "High Voltage Engineering", New Age International Publishers, 2007. | |
| 3. R. Arora and W. Mosch "High Voltage and Electrical Insulation Engineering", John Wiley & Sons, 2011. | |

| **REFERENCE BOOKS:** | |
|---|---|
| 1. D. V. Razevig (Translated by Dr. M. P. Chourasia), "High Voltage Engineering Fundamentals", Khanna Publishers, 1993. | |
| 2. E. Kuffel, W. S. Zaengl and J. Kuffel, "High Voltage Engineering Fundamentals", Newnes Publication, 2000 | |
| 3. Various IS standards for HV Laboratory Techniques and Testing. | |

| 21EE3273:APPLICATION OF MACHINE LEARNING | | | | |
|---|---|---|---|---|
| **B.Tech. IIIYear II Sem** | **L** | **T** | **P** | **C** |
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**Course Objectives:**

- To prepare students for career in computer science & engineering where knowledge of AI &ML techniques leading to the advancement of research and technology.
- Identify problems where artificial intelligence techniques are applicable.
- To explore the use of Genetic algorithms and Reinforcement learning.
- Judge applicability of more advanced techniques.
- Participate in the design of systems that act intelligently and learn from experience.

**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- Discuss the fundamentals of Artificial Intelligence (AI).
- Discuss the fundamentals of Machine Learning (ML).
- Summarize different classifiers and apply them on various data sets.
- Apply different unsupervised learning algorithms
- Design models to solve the problems in various domains.

**UNIT-I:**

**INTRODUCTION TO AI**: AI definition, categories of AI (Narrow AI, General AI, Super AI) and their applications, Intelligent Agents.
**PROBLEM-SOLVING BY SEARCH:** Problem-Solving Agents, Searching for Solutions, Uninformed Search Strategies: Breadth-first search, Uniform cost search, Depth-first search, Iterative deepening Depth-first search, Bi-directional search, informed (Heuristic)Search Strategies: Greedy best-first search, A*search.

**UNIT-II:**

**INTRODUCTION TO MACHINE LEARNING:** A concept learning task, concept learning as search, find-S: finding a maximally specific hypothesis, version spaces and the candidate elimination algorithm, remarks on version spaces and candidate elimination
**SUPERVISEDLEARNING: Regression-**Linear-Simple, Multiple, Logistic Regression
**Classification**- Naive Bayes Classifier, k-NN classifier, Support Vector Machines -Linear, Non-Linear.

**UNIT-III:**

**Decision Trees-** ID3 (Iterative Dichotomiser3), Random Forest, Ensemble Methods-Bagging, Boosting, Stacking.
**UNSUPERVISED LEARNING:** Measures of Distance, Clustering: K-means, Hierarchical Clustering: Agglomerative and Divisive.

| **UNIT-IV:** |
|---|
| **Artificial Neural Networks**– Introduction, neural network representation, appropriate problems for neural network learning, perceptions, multi-layer networks and the back- Propagation algorithm, Remarks on the Back-Propagation algorithm. |

| **UNIT-V:** |
|---|
| **Genetic Algorithms–**Motivation, Genetic algorithms.<br>**Reinforcement Learning–**Introduction, the learning task, *Q*–learning, non-deterministic, rewards and actions, temporal difference learning. |

**NOTE: Case studies are to be discussed wherever applications are required.**

| **TEXT BOOKS:** | |
|---|---|
| 1. Artificial Intelligence A Modern Approach, Third Edition, Stuart Russell and Peter Norvig, Pearson Education. | |
| 2. Machine Learning –Tom M. Mitchell,- Tata McGraw-Hill. | |

| **REFERENCE BOOKS:** | |
|---|---|
| 1. Rajasekaran, G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications", PHI Learning Pvt.Ltd.,2017. | |
| 2. Reinforcement Learning Algorithms: Analysis and Applications," Boris Belousov, Hany Abdul samad, Pascal Klink, Simone Parisi, and Jan Peters First Edition, Springer. | |

| 21EC3254: MICROPROCESSORS AND MICROCONTROLLERS LAB | | | | |
|---|---|---|---|---|
| | | | | |
| **B.Tech. III Year II Sem** | **L** | **T** | **P** | **C** |
| | **0** | **0** | **2** | **1** |

**Prerequisite:** Digital Electronics, Microprocessors and Microcontrollers

**Course Objectives:**

- To Introduce Assembly Language Program concepts.
- Write ALP for arithmetic and logical operations in 8086 Microprocessor
- Write ALP for arithmetic and logical operations in 8051 Microcontroller
- To Interface I/O devices with 8086 Microprocessor
- To Interface I/O devices with 8051 Microcontroller

**Course Outcomes:** At the end of this course students will demonstrate the ability to

- Identity the assembly level programming in given problem
- .Implement the basic programming for Arithmetic and Logical operations in 8086 Microprocessor
- Implement the basic programming for Arithmetic and Logical operations in 8051 Microcontroller
- Implement interfacing of I/O devices with 8086 Microprocessor
- Implement interfacing of I/O devices with 8051 Microcontroller

| CYCLE 1: | USING 8086 PROCESSOR KITS AND/OR ASSEMBLER |
|---|---|

Assembly Language Programs to 8086 to Perform

1. Arithmetic, Logical, String Operations on 16 Bit and 32-Bit Data.
2. Logical Operations, Rotate, Shift, Swap and Branch Operations.

| CYCLE 2: | USING 8051 MICROCONTROLLER KIT |
|---|---|

Introduction to IDE

1. Assembly Language Programs to Perform Arithmetic (Both Signed and Unsigned) 16 Bit Data Operations, Logical Operations (Byte and Bit Level Operations), Rotate, Shift, Swap and Branch Instructions
2. Time delay Generation Using Timers of 8051.
3. Serial Communication from / to 8051 to / from I/O devices.

| CYCLE 3: | INTERFACING I/O DEVICES |
|---|---|

1. Interfacing stepper motor using 8086.
2. DAC interfaces (generation of Triangular and square wave form) to 8086
3. 8 bit ADC Interface to 8051.
4. LCD Interfacing using 8051

| **TEXT BOOKS:** | |
|---|---|
| 1. Advanced Microprocessors and Peripherals by A K Ray, Tata McGraw-Hill Education, 2006 | |

| **REFERENCE BOOKS:** | |
|---|---|
| 1. The 8051 Microcontroller, Kenneth. J. Ayala, Cengage Learning, 3rd Ed,2004 | |
| 2. Microprocessors and Interfacing, D. V. Hall, MGH, 2nd Edition 2006. | |
| 3. The 8051 Microcontrollers, Architecture and Programming and Applications -K.Uma Rao, Andhe Pallavi, Pearson 2009. | |

| 21EE3251: POWER SYSTEMS LAB | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| **B.Tech. III Year II Sem** | | **L** | **T** | **P** | **C** |
| | | **0** | **0** | **2** | **1** |
| **Prerequisite:** Power System-I, Power System-II, Electrical Machines. | | | | | |
| **Course Objectives:** | | | | | |
| | • Perform testing of CT and PT | | | | |
| | • To find sequence impedances of 3-Φ synchronous machine and Transformer | | | | |
| | • To perform fault analysis on Transmission line models. | | | | |
| | • To calculate the efficiency of string insulator with and without guard ring | | | | |
| **Course Outcomes:** At the end of this course students will demonstrate the ability to | | | | | |
| | • Analyze the characteristics of relays | | | | |
| | • Understand Different protection methods | | | | |
| | • Calculate the efficiency of string insulator | | | | |
| | • Analyze the experimental data and draw the conclusions**.** | | | | |

| Compulsory experiments to be conducted | |
|---|---|
| 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 |

| Any four experiments should be conducted | |
|---|---|
| 1 | Characteristics of Negative Sequence Relay |
| 2 | Equivalent circuit of three winding transformer |
| 3 | Sub-Transient reactance of salient pole synchronous machine |
| 4 | Testing of CT and PT. |
| 5 | Analysis of Ferranti effect on Transmission Lines under light loadings. |
| 6 | Calculation of insulator string efficiency |

| **TEXT BOOKS:** |
|---|
| 1. C.L. Wadhwa: Electrical Power Systems –Third Edition, New Age International Pub. Co., 2001. |
| 2. Hadi Sadat: Power System Analysis –Tata Mc Graw Hill Pub. Co. 2002. |

| **REFERENCE BOOKS:** |
|---|
| 1. D. P. Kothari: Modern Power System Analysis-Tata Mc Graw Hill Pub. Co. 2003 |

| 21EE3252: ELECTRICAL SIMULATION LAB | | | | |
|---|---|---|---|---|
| | | | | |
| **B.Tech. III Year II Sem** | **L** | **T** | **P** | **C** |
| | **0** | **0** | **2** | **1** |

**Prerequisite:** Basic Electrical Engineering, Network Theory and Control Systems.

**Course Objectives:**

- To develop the simulation, Skills.
- To perform the analysis of electrical networks
- To understand the operating principles of various power electronic converters.
- To perform the transient analysis.
- To understand the harmonic analysis and filtering.

**Course Outcomes:** At the end of this course students will demonstrate the ability to

- Apply the simulation skills to analyze the different networks.
- Analyze the behavior of different power electronic converters.
- Apply techniques to calculate different parameters of the circuit using simulation.
- Analyze the Circuit and measure the real and reactive power through simulation
- Analyze the practical behavior of the circuits in simulation environment.

| Any eight experiments should be conducted | |
|---|---|
| 1 | Basic Operations of Matrices. |
| 2 | Mesh and Nodal Analysis of Electrical circuits. |
| 3 | Application of Network Theorems to Electrical Networks. |
| 4 | Simulation of DC circuits. |
| 5 | Transient analysis. |
| 6 | (a)Simulation of single-phase full converter using *R*, *R-L* and *R-L-E* loads. |
| | (b)Simulation of single-phase Semi converter using *R*, *R-L* and *R-L-E* loads. |
| 7 | Simulation of three phase fully controlled converter with *R* and *R-L* loads, with and without freewheeling diode. Observation of waveforms for Continuous and Discontinuous modes of operation. |
| 8 | Simulation of Buck chopper. |

| Any two experiments should be conducted | |
|---|---|
| 9 | (a)Simulation of Single-phase AC voltage controller using *R* and *R-L* loads. |
| | (b)Simulation of Single phase Cyclo-converter with *R* and *R-L* loads. |
| 10 | Study of PWM techniques. |
| 11 | Simulation of single-phase Inverter with PWM control. |
| 12 | Design of Lead-Lag compensator for the given system and with specification using suitable software. |
| 13 | Measurement of active power of three phase circuit for balanced and unbalanced load. |
| 14 | Harmonic analysis of non-sinusoidal waveforms. |
| 15 | Design of Low Pass and High Pass filters. |

| **TEXT BOOKS:** | |
|---|---|
| 1. M. H. Rashid, Simulation of Electric and Electronic circuits using PSPICE – by M/s PHI Publications. | |
| 2. Agam Kumar Tyagi, "MATLAB and SIMULINK for Engineers" OUP Publisher, 2012. | |
| 3. M. Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 1997. | |
| 4. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004. | |

| **REFERENCE BOOKS:** | |
|---|---|
| 1. A. K. Sawhney, "Electrical & Electronic Measurement & Instruments", Dhanpat Rai & Co. Publications, 2005. | |
| 2. Reference guides of related software's | |
| 3. Rashid, Spice for power electronics and electric power, CRC Press | |
| 4. M. H. Rashid, "Power electronics, circuits & devices", 3rd edition, Pearson publications. | |

## 21HS3253: ADVANCED ENGLISH COMMUNICATION SKILLS LAB

| L | T | P | C |
|---|---|---|---|
| - | - | 2 | 1 |

**B. Tech. III Year II Semester**

**Course Objectives:** This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve students' fluency in spoken English
- To enable them to listen to English spoken at normal conversational speed
- To help students develop their vocabulary
- To read and comprehend texts in different contexts
- To communicate their ideas relevantly and coherently in writing
- To make students industry-ready
- To help students acquire behavioral skills for their personal and professional life
- To respond appropriately in different socio-cultural and professional contexts

**Course Outcomes:** At the end of this course students will demonstrate the ability to

- Acquire vocabulary and use it contextually
- Listen and speak effectively
- Develop proficiency in academic reading and writing
- Increase possibilities of job prospects
- Communicate confidently in formal and informal contexts

The following course activities will be conducted as part of the Advanced English Communication Skills Lab:

- Inter-personal Communication and Building Vocabulary – Starting a Conversation – Responding Appropriately and Relevantly – Using Appropriate Body Language – Role Play in Different Situations – Synonyms and Antonyms, One-word Substitutes, Prefixes and Suffixes, Idioms and Phrases and Collocations.
- Reading Comprehension - General Vs Local Comprehension, Reading for Facts, Guessing Meanings from Context, , Skimming, Scanning, Inferring Meaning.
- Writing Skills – Structure and Presentation of Different Types of Writing – Letter Writing/Resume Writing/ e-correspondence/ Technical Report Writing.
- Presentation Skills – Oral Presentations (individual or group) through JAM Sessions/Seminars/PPTs and Written Presentations through Posters/Projects/Reports/ Emails /Assignments… etc.,
- Group Discussion and Interview Skills – Dynamics of Group Discussion, Intervention, Summarizing, Modulation of Voice, Body Language, Relevance, Fluency and Organization of Ideas and Rubrics of Evaluation- Concept and Process, Pre-interview Planning, Opening Strategies, Answering Strategies, Interview through Tele-conference & Video-conference and Mock Interviews.

**Minimum Hardware Requirement:** Soft Skills Laboratory shall have the following infrastructural facilities to accommodate at least 35 students in the lab:

- Spacious room with appropriate acoustics
- Eight round tables with five movable chairs for each table.
- Audio-visual aids
- LCD Projector
- Public Address system
- Computer with suitable configuration.

**Suggested Software:** The software consisting of the prescribed topics elaborated above shouldbe procured and used.

**TEXTBOOKS:**

1. Oxford Advanced Learner's Compass, 8th Edition.
2. DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.

**REFERENCES:**

1. Kumar, Sanjay and Pushp Lata. English for Effective Communication, Oxford University Press, 2015.
2. Konar, Nira. English Language Laboratories – A Comprehensive Manual, PHI Learning Pvt. Ltd., 2011

## 21MC0007: YOGA AND INDIAN PHILOSOPHY

**B.Tech. III Year II Sem**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 0 |

**UNIT-1**
Bhagavad Gita, chapter 2 SankhyaYoga slokas 54-72 about emotional intelligence (Stitaprajnata)
**UNIT-2**
Bhagavad Gita, chapters 3-7
**UNIT-3**
Bhagavad Gita, chapters 8-11
**UNIT-4**
Bhagavad Gita, chapters 12-15
**UNIT-5**
Bhagavad Gita, chapters 16-18
10 quotes from each chapter of ref.(2)

**References:**

1) Bhagavad Gita By Swami Swarupananda, R K Math Publication
2) Vivekananda-His Call to the Nation, R K Math Publication