# Shri Shankaracharya Technical Campus, Bhilai

(An Autonomous Institute Affiliated to CSVTU Bhilai)

"ज्ञानादेव तु कैवल्यम्"

## TEACHING AND EXAMINATION SCHEME

## ELECTRICAL & ELECTRONICS ENGINEERING, B. Tech. Sixth Semester

| Sl. No. | Board of Studies (BOS) | Courses(Subject) | Course Code | Period per Week | | | Scheme of Examination | | | Total Marks | Credit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Theory/Lab | | | | |
| | | | | L | T | P | ESE | CT | TA | | |
| 1. | Electrical and Electronics | Power Electronics Device & Circuits | EEE103601 | 2 | 1 | - | 100 | 20 | 30 | 150 | 4 |
| 2. | Electrical and Electronics | Signal& System | EEE103602 | 2 | 1 | - | 100 | 20 | 30 | 150 | 3 |
| 3. | Electrical and Electronics | Power System Analysis | EEE103603 | 2 | 1 | - | 100 | 20 | 30 | 150 | 3 |
| 4. | Electrical and Electronics | Professional Elective-II | (Refer Table-1) | 2 | 1 | - | 100 | 20 | 30 | 150 | 3 |
| 5. | Electrical and Electronics | Open Elective-1 | (Refer Table-2)# | 3 | - | - | 100 | 20 | 30 | 150 | 3 |
| 6. | Electrical and Electronics | Power Electronics Device & Circuits lab | EEE103691 | - | - | 2 | 25 | - | 25 | 50 | 1 |
| 7. | Electrical and Electronics | Introduction to Python Program Lab | EEE103692 | - | - | 2 | 25 | - | 25 | 50 | 1 |
| 8. | Electrical and Electronics | Power System Simulation Lab | EEE103693 | - | - | 2 | 25 | - | 25 | 50 | 1 |
| 9 | Electrical and Electronics | Minor Project-II | EEE103694 | - | - | 2 | 50 | - | 25 | 75 | 1 |
| 10. | Electrical and Electronics | Essence of Indian Knowledge Tradition | EEE103695 | - | - | - | - | - | 25 | 25 | - |
| **Total** | | | | **11** | **4** | **8** | **625** | **100** | **275** | **1000** | **20** |

**Table1 : Professional Elective-II**

| Sl. No. | Board of Studies(BOS) | Course(Subject) | Course Code |
|---|---|---|---|
| 1. | Electrical & Electronics Engg | Communication System | EEE103621 |
| 2. | Electrical & Electronics Engg | Testing & Commissioning of Electrical | EEE103622 |
| 3. | Electrical & Electronics Engg | Computer Organization and Architecture | EEE103623 |
| 4. | Electrical & Electronics Engg | Smart Grid Systems | EEE103624 |
| 5. | Electrical & Electronics Engg | Wireless Power Transmission Technology | EEE103625 |

**Note:**

**(a) Abbreviations used: L-Lecture, T-Tutorial, P-Practical, ESE-End Semester Exam, CT-Class Test, TA-Teacher's Assessment**

**(b) 1/4th of total strength of student subject to minimum of 20 students is required to offer an elective in the department in a Particular academic session.**

**(c) Choice of elective course once made for an examination cannot be changed in future examinations.**

**(d) The duration of end semester examination of all theory papers will be of three hours.**

# Table 2 attached in separate document

| | | | | |
|---|---|---|---|---|
| | | October2022 | 1.00 | Applicable for AY 2022-23Onwards |
| Chairman(AC) | Chairman (BoS) | Date of Release | Version | |

## SYLLABUS

## ELECTRICAL & ELECTRONICS ENGINEERING, B. Tech. Sixth Semester

| Subject Code: EEE103601 | Power Electronics Device & Circuits | L= 2 | T = 1 | P = 0 | Credits= 3 |
|---|---|---|---|---|---|
| Evaluation Scheme | ESE | CT | TA | Total | ESE Duration |
| | 100 | 20 | 30 | 150 | 3 Hours |

| Course Objectives | Course Outcomes |
|---|---|
| 1. To understand and develop the firing circuit requirement for different power semiconductor devices used as switches.<br>2. To understand the concepts of different types of AC-DC, DC-DC & DC-AC controlled converters for Industrial applications.<br>3. To analyze the effect of controlled and uncontrolled converters in Power system and their mitigation.<br>4. To design and develop the commutation circuits for semi controlled power semiconductor devices.<br>5. To understand the rating specification for design and development of the protection circuits for Semiconductor devices. | On successful completion of the course, the student will be able to:<br>**CO1** To gain knowledge of various application of semiconductor switches by understanding their static and dynamic characteristics.<br>**CO2** To understand the performance characteristics of controlled AC-DC converters for R, RL & RLE loads.<br>**CO3** To gain knowledge on basic DC-DC converters and their operation under continuous /discontinuous mode of conduction for RLE loads<br>**CO4** To identify and formulate the requirements for four quadrant operation of DC motor.<br>**CO5** To differentiate and understand the significance of various commutation circuits and their consequence on device stress<br>**CO6** To understand the principle of DC-AC conversion and the different topology for three phase to three phase and single phase to single phase DC-AC conversion. |

**UNIT I** **CO1**

Power Semiconductor Devices: Silicon controlled rectifier (SCR), structure, principle of operation, two transistor analogy, switching characteristics, trigger requirement , series and parallel operation of SCRs, ratings and protection, Triac structure and principle of operation only, Modern semiconductor devices, power BJT, MOSFET, IGBT structure, static characteristics.. **[8hrs]**

**UNIT II** **CO1, CO2**

Phase Controlled Rectifiers: Principle of phase control, performance parameters, single-phase half wave controlled mid -point full controlled converters and half controlled converters for R,RL and RLE load, comparison of controlled converters with and without freewheeling diode, Effect of source

inductance in single-phase. Single phase dual converter in circulating and non circulating mode. Three-phase half wave and fully controlled bridge converter, three-phase semi-converter. **[12hrs]**

**UNIT III** **CO3**

DC to DC Converters: Forced Commutation Techniques for thyristor: Self commutation, Impulse commutation, Resonant pulse commutation and Complementary commutation Principle of chopper operation, controlled strategies, step up chopper, step down chopper, chopper configurations, Performance parameter of step down chopper with R-L-E load for continuous and discontinuous conduction .Working principle of Voltage commutated, Current commuted and Load commuted thyristor chopper, Buck-boost converter.[**10hrs]**

**UNIT IV** **CO4**

DC to AC Converter: Inverter: Classification of inverters, voltage source inverter, current source inverter, Series and modified series resonant thyristor inverter. Performance parameters of single phase half bridge and full bridge inverter for R-L loads, 3-phase inverter-180 degree and 120 degree conduction mode using ideal switches for balanced R load only. Pulse width modulated switching scheme for voltage control. SPWM and modified SPWM of 1-phase inverters, PWM with Unipolar and Bipolar Voltage Switching. (Elementary analysis. **[10hrs]**

**UNIT V** **CO5, CO6**

Cyclo-converters & AC Controllers: Basic principle of operation, step-up and step down single-phase to single-phase cyclo-converter. Principle of On-off and phase control, AC controller circuit configurations, Performance parameters of Single phase bidirectional controllers for R and RL only **[8 hrs]**

**Text Books:**

| S. No. | Title | Authors | Edition | Publisher |
|---|---|---|---|---|
| 1 | Power Electronics Circuits with the 8085 5/e | Muhammad H. Rashid | 4th | PHI Publishing |
| 2 | Power Electronics | P.S. Bhimbra | 3rd | Khanna Publishers |

**Reference Books:**

| S. No. | Title | Authors | Edition | Publisher |
|---|---|---|---|---|
| 1 | Power Electronics converters, applications and Design | Mohan, Undel and, Robbins | 3rd | John Wiley& Sons |
| 2 | A text book of Power Electronics | S.N Singh | 2nd | Dhanpat Rai & Co.(P)Ltd. |
| 3 | An Introduction to Thyristor and its applications | M. Ramamoorty | 2nd | East-West Press |

## SYLLABUS

## ELECTRICAL & ELECTRONICS ENGINEERING, B. Tech. Sixth Semester

| Subject Code EEE103602 | Signals & Systems | L = 2 | T = 1 | P = 0 | Credits = 3 |
|---|---|---|---|---|---|
| Evaluation Scheme | ESE | CT | TA | Total | ESE Duration |
| | 100 | 20 | 20 | 140 | 3 Hours |

| Course Objectives | Course Outcomes |
|---|---|
| 1. Represent and Classify signal and systems.<br>2. Obtain the response of a continuous, linear, time-invariant, causal system by using convolution.<br>3. Utilize the Laplace transform method to solve continuous, linear, time-invariant systems and to obtain transfer functions.<br>4. Convert a continuous-time signal to the discrete-time domain and reconstruct it using the sampling theorem. | On successful completion of the course, the student Will be able to:<br>**CO1**:- Analyze different types of signals.<br>**CO2**:-Analyze different types of systems.<br>**CO3**:- Represent continuous and discrete systems in time and frequency domain using Laplace and Z-Transform.<br>**CO4:**- Students will understand the Fourier series, and Fourier transforms.<br>**CO5:**-Students will understand the process of sampling and the effects of under-sampling. |

**UNIT– I Continuous and Discrete time signals** **CO1**

Representation of continuous and discrete time signals, shifting and scaling properties, Classification of continuous and discrete time signals: Periodic- aperiodic, even – odd, energy and power signals, Deterministic and random signals, continuous and discrete amplitude signals.**[10 Hrs]**

**UNIT– II LTI System:** **CO2**

System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability. Impulse response and step response, convolution, Characterization of causality and stability of linear shift invariant systems. System representation through differential equations.**[10 Hrs]**

**UNIT– III Laplace Transform and Z-Transform:** **CO3**

Laplace Transform: region of convergence, poles and zeros of system, solution to differential equations and system behavior using Laplace Transformation

Z-transform (Single sided and Double sided): z-Transform for discrete time signals and systems-region of convergence, z-domain analysis, Computation of Impulse response and Transfer function using Z-Transform, Characterization using difference equation.**[10 Hrs]**

**UNIT– IV Fourier Series and Fourier Transform** **CO4**

Fourier series representation of continuous and discrete time periodic signals, Continuous time Fourier Transform analysis with examples - properties of the Continuous time Fourier Transform basic Properties, convolution in time and frequency domains, magnitude and phase response. **[10Hrs]**

**UNIT– V Sampling Theorem** **CO5**

The Sampling Theorem and its implications- Spectra of sampled signals. Reconstruction: ideal Interpolator, zero-order hold, first-order hold, and so on. Aliasing and its effects.**[8Hrs]**

**Text Books:**

| S. No. | Title | Authors | Edition | Publisher |
|---|---|---|---|---|
| 1) | Signals and Systems | A.V. Oppenheim, A.S. Willsky and I.T. | 1983 | Prentice Hall India |
| 2) | Signals and Systems | Anand Kumar | 2013 | PHI |
| 3) | Signals and Systems, | Simon Haykin and Barry Van Veen, | 1999 | John Wiley |

**Reference Books:**

| S. No. | Title | Authors | Edition | Publisher |
|---|---|---|---|---|
| 1) | Signals and Systems | I J Nagrarth | 2001 | Tata McGraw Hill |
| 2) | Signals and Linear Systems | Robert A. Gabel, Richard A. Roberts, | 1995 | John Wiley and Sons |
| 3) | Linear Systems and Signals | B. P.Lathi | 2005 | Oxford university Press |

## SYLLABUS

## ELECTRICAL & ELECTRONICS ENGINEERING, B. Tech. Sixth Semester

| Subject Code: EEE103603 | Power System Analysis | L= 2 | T = 1 | P = 0 | Credits= 3 |
|---|---|---|---|---|---|
| Evaluation Scheme | ESE | CT | TA | Total | ESE Duration |
| | 100 | 20 | 30 | 150 | 3 Hours |

| Course Objectives | Course Outcomes |
|---|---|
| 1. This course is an extension of Electrical Power systems course.<br>2. It deals with basic theory of transmission line modeling and their performance analysis.<br>3. A detailed study of Power System stability, Load flow studies and economic power dispatch is part of the curriculum for students. | On successful completion of the course, the student will be able to:<br>**CO1:** Student should be able to make a one line representation of Power System.<br>**CO2:** Student should be able to evaluate fault currents for different faults at different locations in Power System.<br>**CO3:** Students should be able to identify cases of stable and unstable Power Systems.<br>**CO4:** Analyse the steady state and transient stability of power system networks.<br>**CO5:**Analyse the voltage profile of any given power system network using iterative methods. |

**UNIT- I Representation of Power System:** **CO1**

Single line diagram, impedance diagram, reactance diagram, equivalent impedance of three phase transformer, per unit quantities, P.U. impedance of three phase transformer, positive sequence impedance diagram in per unit system, Expression for three phase power in p.u. Systems **[8 hrs]**

**UNIT-II** Symmetrical Components: **CO2**

Expression for positive, negative & zero sequence components, existence of sequence components of current & voltages for three phase circuit, sequence impedance of alternator &transmission line, Sequence network of unloaded generator, zero sequence network of three phase transformers, phase shift in star-delta transformer. **[10 hrs]**

**UNIT- III** Fault Calculations: **CO3**

Single line to ground fault, Line to line fault, Double line to ground fault on unloaded generator, faults through impedance, open conductor faults, unsymmetrical fault on power system, Three phase short circuit on synchronous machine, Three phase short circuit on power system, Calculation of different current ratings and interrupting capacity of circuit breaker. **[12 hrs]**

## SYLLABUS
## ELECTRICAL & ELECTRONICS ENGINEERING, B. Tech. Sixth Semester

**UNIT-** Power System Stability: **CO4**
The stability problem, steady-state stability, transient stability, Swing equation, Equal area criterion of stability, application of equal area criterion, critical clearing angle.**[8 hrs]**

**UNIT-V a)** Economic operation of power systems: **CO5**
Input output curves, criteria for economical distribution of power between generating units in a plant, Expression for transmission line loss in terms of loss formula coefficients, criteria for economical distribution of power between generating plants
b) Load Flow Studies: Bus admittance matrix, formation of load flow equation, Gauss Shield method, Newton Raphson method.**[6hrs]**

**Text Books:**

| S. No. | Title | Authors | Edition | Publisher |
|---|---|---|---|---|
| 1 | Elements of power system analysis | W.D. Stevenson | 4th Ed. | Mc Graw Hill |
| 2 | Power System Engg | J.J. Nagrath& Kothari | 2nd | Tata McGraw Hill |

**Reference Books:**

| S. No. | Title | Authors | Edition | Publisher |
|---|---|---|---|---|
| 1. | Power System Analysis and Design | B.R. Gupta | 3rd | S. Chand |
| 2 | Power System Engg. | BY A. Chakrabarti, M.L. Soni, P.V.Gupta, V.S.Bhatnager | 6th | Dhanpat Rai & Co. |
| 3 | Electrical Power System | Ashfaq Hussain | 4th | CBS Pub. & Dist. |

## SYLLABUS

## ELECTRICAL & ELECTRONICS ENGINEERING, B. Tech. Sixth Semester

| Subject Code EEE103691 | Power Electronics Device & Circuits lab | L = 0 | T = 0 | P = 2 | Credits = 1 |
|---|---|---|---|---|---|
| Evaluation Scheme | ESE | CT | TA | Total | ESE Duration |
| | 25 | -- | 25 | 50 | -- |

### List of Experiments

List of Experiments (At least ten experiments are to be performed by each student)

1. To study and plot the V-I characteristics of an SCR.
2. To study and plot the drain characteristics of a MOSFET.
3. To study and plot the drain characteristics of a IGBT.
4. To study single-phase half-wave bridge controlled rectifier for R and RL load.
5. To study single-phase full-wave bridge controlled rectifier for R and RL load with and without freewheeling diode.
6. To study of three-phase half-wave controlled rectifier for resistive load.
7. To study of three-phase full-wave controlled rectifier for resistive load.
8. To study step down and step up chopper circuit.
9. To study class A/B/C forced commutation chopper circuits.
10. To study Single Phase series inverter with R and RL loads.
11. To study Single Phase parallel inverter with R and RL loads.
12. To study the bipolar and unipolar switching scheme of a single phase full bridge inverter using MATLAB / PSPICE simulation.
13. To study the three phase VSI for 180/120 mode of conduction using MATLAB / PSPICE simulation.
14. To study Single Phase step down cyclo converter for R and RL loads.
15. To study single-phase AC voltage control by using TRIAC for R and RL loads.

## SYLLABUS

## ELECTRICAL & ELECTRONICS ENGINEERING, B. Tech. Sixth Semester

| Subject Code EEE103692 | Introduction to Python programming Lab | L = 0 | T = 0 | P = 2 | Credits = 1 |
|---|---|---|---|---|---|
| Evaluation Scheme | ESE | CT | TA | Total | ESE Duration |
| | 25 | -- | 25 | 50 | -- |

### List of Experiments

1. Write a program to demonstrate different number data types in python (script.py)
2. Write a program to perform different arithmetic operations on numbers in python
3. Write a program to create, concatenate and print a string and accessing sub-string from given string
4. Write a python script to print the current date in the fallowing format “Sun May 29 02:26:23 IST 2017”
5. Write a program to create, append and remove lists in python
6. Write a program to demonstrate working with tuples in python
7. Write a program to demonstrate working with dictionaries in python
8. Write a program to find the largest number among the three input numbers
9. Write a Program to convert temperature in Celsius to Fahrenheit
10. Write a python program to construct the following pattern, using a nested for loop
11. Write a python script that prints prime numbers less than 20
12. Write a python program to find the factorial of a number using recursion

## SYLLABUS
## ELECTRICAL & ELECTRONICS ENGINEERING, B. Tech. Sixth Semester

| Subject Code EEE103693 | Power System Simulation Lab | L = 0 | T = 0 | P = 2 | Credits = 1 |
|---|---|---|---|---|---|
| Evaluation Scheme | ESE | CT | TA | Total | ESE Duration |
| | 25 | -- | 25 | 50 | -- |

### List of Experiments

List of Experiments (At least ten experiments are to be performed by each student)

1. Simulation of different types of controllers (PID, PI, PLL).
2. Simulation for the addition of poles and zeros in a given transfer function.
3. Simulation of different types of filters.
4. Simulation of the performance of a full wave bridge rectifier for RL and RLC load.
5. Simulation of step up and step down choppers.
6. Simulation of chopper controlled DC motor.
7. Simulation and modeling of synchronous machine (Xd, Xd')
8. Write a program for computation of real, reactive power and line loss.
9. Write a program to plot V and inverted V curve.
10. Write a program for transformer parameter calculation.
11. Write a program for transmission line parameter calculation (Z, Y, A, B, C, D).
12. Write a program for load flow solution by Gauss Seidal Method.
13. Write a program for load flow solution by Newton Raphson Method.
14. Write a program for economic load dispatch calculation.
15. To Determine fault location in a cable. Requirements for the Simulation Lab: PSCAD, MiPower, MATLAB/Simulink

## SYLLABUS
## ELECTRICAL & ELECTRONICS ENGINEERING, B. Tech. Sixth Semester

| Subject Code:EEE103621 | Communication Systems | L= 3 | T = 1 | P = 0 | Credits= 4 |
|---|---|---|---|---|---|
| Evaluation Scheme | ESE | CT | TA | Total | ESE Duration |
| | 100 | 20 | 30 | 150 | 3 Hours |

| Course Objectives | Course Outcomes |
|---|---|
| 1. The course provides an introduction to analog and digital communication systems.<br>2. This course responds to the needs of the engineering and technological aspirants. | On successful completion of the course, the student will be able to:<br>**CO1:** Acquire the generalize knowledge of communication system in the present scenario.<br>**CO2**: Develop problem solving skills in complex communication networking.<br>**CO3**: Understand pulse modulation technique and their advantages.<br>**CO4**: Understand digital modulation technique and their advantages over analog modulation techniques.<br>**CO5**: Understand the basics of information theory and coding scheme used in communication. |

**UNIT I** **CO1**

**Amplitude Modulation**: Need of modulation, Amplitude modulation, Amplitude Modulation Index, power relation. AM wave, generation of AM, balanced modular signal side band technique, suppression of unwanted sideband, side band transmission, demodulation, envelop detector, synchronous detector. **[10hrs]**

**UNIT II** **CO1, CO2**

**Angle Modulation**: Mathematical equation of frequency modulation (FM), frequency spectrum, phase modulation (PM), relationship between PM and FM, pre-emphasis and de-emphasis, adjacent channel interference, comparison of narrow band and wide band FM, generation of FM, reactance modulator **[10hrs]**

**UNIT III** **CO3**

**Pulse Modulation System**: Sampling theorem, Sampling of Low Pass and band pass signals, Aliasing, Aperture effect, Basic principles of PAM, PWM and PPM, their generation and detection, FDM, TDM, Comparison of TDM and FDM **[10hrs]**

**UNIT IV** **CO3, CO4**

**Digital Modulation Techniques**: Pulse code modulation signal to quantization noise ratio, DPCM, DM and ADM, Digital transmission through Career Modulation: Fundamentals of Binary ASK, PSK

and FSK; generation and detection of BASK, BPSK and BFSK, Differential phase shift keying **[8hrs]**

**UNIT V** **CO4, CO5**

**Information Theory**: Introduction, Sources of information, Contents in DMS, Contents of a symbol, Entropy, Information rate, Discrete memory less channel, Conditional joint entropies, mutual information, Channel capacity, Source coding, Coding efficiency, Entropy coding. **[9 hrs]**

**TextBooks:**

| S. No. | Title | Authors | Publisher |
|---|---|---|---|
| 1 | Principles of Communication Systems | Taub and Shilling | Tata Mc Graw Hill |
| 2 | A Text Book of Analog & Digital Communication | P. Chakrabarti | DhanpatRai& Co |
| 3 | The 8051 Micro Controller and Embedded Systems Using Assembly and C, Second Edition | Muhammad Ali Mazidi Janice GillispieMazidiRolin D. McKinlay | Second Edition |

**ReferenceBooks:**

| S. No. | Title | Authors | Publisher |
|---|---|---|---|
| 1 | Electrical Communication Systems | Kennedy | TMH |
| 2 | Digital Communications | Sanjay Sharma | S.K. Kataria& Sons, New Delhi |

## SYLLABUS

## ELECTRICAL & ELECTRONICS ENGINEERING, B. Tech. Sixth Semester

| Subject Code: EEE103622 | Testing and Commissioning of Electrical Equipments | L= 2 | T = 1 | P = 0 | Credits= 3 |
|---|---|---|---|---|---|
| Evaluation Scheme | ESE | CT | TA | Total | ESE Duration |
| | 100 | 20 | 30 | 150 | 3 Hours |

| Course Objectives | Course Outcomes |
|---|---|
| 1. To learn the industrial standards in testing and commissioning of electrical equipments.<br>2. To understand the common problems in installing and commissioning of electrical equipments.<br>3. To learn about safety measures and maintenance procedures for various electrical equipments. | On successful completion of the course, the student Will be able to:<br>**CO1:** After studying the subject students will be able to understand the common problems arising while commissioning of electric equipments.<br>**CO2:** They will also be able to learn about the routine tests to be performed and maintenance measures for various equipments.<br>**CO3:** Trouble shooting chart for various electrical equipment's, machines and domestic appliances.<br>**CO4:** Preparation of maintenance schedule of different equipment and machines.<br>**CO5:**Familiar about electrical safety regulations and rules during maintenance |

**UNIT- I Power Transformers:** **CO1**

Insulation resistance measurement and Meggering electrical equipment, temperature effect, polarization index, causes of poor insulation resistance, Drying out of transformer, Checks before paralleling, parallel operation Commissioning checks, Maintenance of transformer, maintenance of bushing and tap changers, Functions of breather, conservator, Troubles, Causes of failures, Ratings, Significance of impedance voltage, voltage regulation , Inspection, Storage, Handling, Transportation, civil works, site facilities, Commissioning tests capitalization of losses, Transformers oil: types, composition, properties, maintenance, testing, filtration, insulation resistance. **[6 hrs]**

**UNIT-II Instrument transformers/Traction, Rectifier Transformer:** **CO2**

Current transformers (CT): applications, accuracy class, magnetization curve, burden, effect of open secondary, terms and definitions, type tests, routine tests on CTs, precautions, typical ratings, Voltage transformer (VT, PT): application, specifications, ratings, connections, accuracy class, and burdens, Types of VT construction. Traction transformers: Types, Special considerations, design and constructional features, Traction transformers for thyristor-controlled locomotives, Rectifier transformers: comparison between rectifier transformer and power transformer, utility factor, design feature of rectifier transformer, transductors. **[8 hrs]**

## SYLLABUS
## ELECTRICAL & ELECTRONICS ENGINEERING, B. Tech. Sixth Semester

**UNIT- III Rotating machines:** **CO3**
Troubles with D.C. Machines and Remedies, Troubles with Commutator, Maintenance of Commutator and Brushes, Troubles with D.C. Motors, Test to detect the causes of the troubles, Earth-fault Test. Testing of Induction Motors: Type Tests, Routine Tests, Commissioning Tests, Degree of Protection, Noise and its Control, Explosion Proof Motor, Installation and commissioning of induction machine and Rotating Machines. **[10 hrs]**

**UNIT-Parameters of Industrial Rotating Machines:** **CO4**
Drying-Out of Electrical Rotating Machines and Insulation Resistance Measurements Steps in drying-Out, Permissible Temp-rise, Log-sheets, Insulation Resistance, Power Required, Period of Drying Out, Polarisation Index, Definition of Degree of Protection and cooling Systems, standard IP codes, Definition, Types, Standard Designations, IC Code, Ratings of Industrial Rotating Machines: Thermal Rating, Operation Duties, Duty factor, Continuous Rating, Intermittent Duty, Short Time Duty STR, DTR, MCR.**[8 hrs]**

**UNIT-V Safety Precautions and live line Maintenance:** **CO5**
Shocks, Safety procedures, Permission to work, Safety Clearances, Procedures, Permit to work, Electric Field and Clearances, Live Line Maintenance, Hot-Line Maintenance, Safety, tools, Degree of Exposures, Biological effects of Electric Field, Electric shock and effects. **[8hrs]**

**Text Books:**

| S. No. | Title | Authors | Edition | Publisher |
|---|---|---|---|---|
| 1 | Testing Commissioning Operation & Maintenance of Electrical | S. Rao | 6th edition | Dhanpat Rai& Sons. |
| 2 | Electrical power equipment maintenance and testing | Paul Gill | 2008 | CRC Press |

**Reference Books:**

| S. No. | Title | Authors | Edition | Publisher |
|---|---|---|---|---|
| 1. | Transformers | | | Bharat Heavy Electrical Limited |

## SYLLABUS

## ELECTRICAL & ELECTRONICS ENGINEERING, B. Tech. Sixth Semester

| Subject Code: EEE103623 | Computer Organization and Architecture | L= 3 | T = 0 | P = 0 | Credits= 3 |
|---|---|---|---|---|---|
| Evaluation Scheme | ESE | CT | TA | Total | ESE Duration |
| | 100 | 20 | 30 | 150 | 3 Hours |

| Course Objectives | Course Outcomes |
|---|---|
| ➢ To learn the industrial standards in testing and commissioning of electrical equipments.<br>➢ To understand the common problems in installing and commissioning of electrical equipments.<br>➢ To learn about safety measures and maintenance procedures for various electrical equipments. | On successful completion of the course, the student Will be able to:<br>**CO1:**Understand the concepts of microprocessors, their principles and practices.<br>**CO2:** Write efficient programs in assembly language of the 8086 family of microprocessors.<br>**CO3:** Organize a modern computer system and be able to relate it to real examples.<br>**CO4:** Develop the programs in assembly language for 80286, 80386 and MIPS processors in real and protected modes.<br>**CO5:** Implement embedded applications using ATOM processor. |

**UNIT- I Introduction to computer organization :** **CO1**

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. **[6 hrs]**

**UNIT-II Memory organization :** **CO2**

System memory, Cache memory - types and organization, Virtual memory and its implementation, Memory management unit, Magnetic Hard disks, Optical Disks. **[6 hrs]**

**UNIT- III Input – output Organization :** **CO3**

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. **[8 hrs]**

**UNIT-IV 16 and 32 microprocessors :** **CO4**

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 **[8 hrs]**

**UNIT-V Pipelining :** **CO5**

Introduction to pipelining, Instruction level pipelining (ILP), compiler techniques for ILP, Data hazards, Dynamic scheduling, Dependability, Branch cost, Branch Prediction, Influence on instruction set. **[8hrs]**

**Text Books:**

| S. No. | Title | Authors | Edition | Publisher |
|---|---|---|---|---|
| 1 | Computer organization | V. Carl, G. Zvonko and S. | 1978 | McGraw Hill |
| 2 | The Intel microprocessors | B. Brey and C. R. Sarma | 2000 | Pearson Education |

**Reference Books:**

| S. No. | Title | Authors | Edition | Publisher |
|---|---|---|---|---|
| 1. | Modern Embedded Computing | P. Barry and P. Crowley | 2012 | Morgan Kaufmann |

## SYLLABUS

## ELECTRICAL & ELECTRONICS ENGINEERING, B. Tech. Sixth Semester

| Subject Code: EEE103624 | Smart Grid Systems | L= 2 | T = 1 | P = 0 | Credits= 3 |
|---|---|---|---|---|---|
| Evaluation Scheme | ESE | CT | TA | Total | ESE Duration |
| | 100 | 20 | 30 | 150 | 3 Hours |

| Course Objectives | Course Outcomes |
|---|---|
| 1. To introduction to Smart Grid technologies and understand various Power quality issues<br><br>2. To understand Renewable Energy and its storage options for smart grid technologies.<br><br>3. To understand Smart Grid measurement & communication technology. | On successful completion of the course, the student Will be able to:<br>**CO1:-** Understand the concept and evolution of smart grid.<br>**CO2:-**Smart grid communication and measurement technologies like Phasor Measurement Unit (PMU), Smart meters, Wide Area Monitoring system (WAMS) etc.<br>**CO3:-**Power quality issues in micro grids like modelling and stability analysis, regulatory standards and economics and basic smart grid concepts.<br>**CO4:-**know about the information and Communication Technology For Smart Grid<br>**CO5:-**Understanding the concept of Distributed Energy Resources. |

**UNIT- I Introduction to Smart grid :** **CO1**

Introduction to Smart Grid: Evolution , Concept ,Definitions, Need , Functions , Opportunities & Barriers of Smart Grid, Difference between conventional & smart grid, Concept of Resilient & Self-Healing Grid, Present development & International policies in Smart Grid.**[8 hrs]**

**UNIT-II Smart Grid Communications and Measurement Technology:** **CO2**

Communication and Measurement -Monitoring, Phasor Measurement Unit (PMU), Smart Meters, Wide area monitoring systems (WAMS) -Advanced metering infrastructure- GIS and Google Mapping Tools, IP-based Systems, Network Architectures.**[10 hrs]**

**UNIT- III Power Quality Management in Smart Grid:** **CO3**

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.**[10 hrs]**

**UNIT-Information and Communication Technology for Smart Grid:** **CO4**

Advanced Metering Infrastructure (AMI), Home Area Network (HAN), Neighbourhood Area Network (NAN), Wide Area Network (WAN). Bluetooth, Zig-Bee, GPS, Wi-Fi, Wi-Max based communication, Wireless Mesh Network, Broadband over Power line (BPL). Adaptive filters and applications. **[10 hrs]**

## SYLLABUS
## ELECTRICAL & ELECTRONICS ENGINEERING, B. Tech. Sixth Semester

**UNIT-V Distributed Energy Resources:** **CO5**

Distributed Energy Resources: Small scale distributed generation, Distributed Generation Technology, Internal Combustion Engines, Gas Turbines, Combined Cycle Gas Turbines, Micro turbines, Fuel Cells, Solar Photovoltaic, Solar thermal, Wind power, Geothermal, - all sources as a DG.**[10hrs]**

**Text Books:**

| S. No. | Title | Authors | Edition | Publisher |
|---|---|---|---|---|
| 1 | Smart Grid Systems: Modeling and Control | N. Ramesh Babu | 1st Edition, 2021 | CRC, Press |
| 2 | Smart Grid: Fundamentals of Design and Analysis | James A. Momoh | 2012 | Wiley-IEEE Press |

**Reference Books:**

| S. No. | Title | Authors | Edition | Publisher |
|---|---|---|---|---|
| 1. | Smart Grid Fundamentals Energy Generation, Transmission and Distribution | Radian Belu | 2022 | CRC Press |

## SYLLABUS

## ELECTRICAL & ELECTRONICS ENGINEERING, B. Tech. Sixth Semester

| Subject Code EEE103625 | Wireless Power Transmission Technology | L = 2 | T = 1 | P = 0 | Credits = 3 |
|---|---|---|---|---|---|
| Evaluation Scheme | ESE | CT | TA | Total | ESE Duration |
| | 100 | 20 | 30 | 150 | 3 Hrs |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| The main objective of the course is to:<br><br>This course explains the fundamental principles and latest advances in wireless power transfer (WPT) and illustrates key applications of this emergent technology. This also imparts knowledge about various mitigation of WPT problem and compensation for inductor power transfer. Demand for safe power transfer and durable operation are the main objective of the course | At the end of the course, the students can:<br>**CO1:** Able to Information about the transformers. Leakage inductance. Circuit compensation principles. Low-order compensations<br>**CO2:** Able to implement the application of power electronics. Knowledge about the Power Converters Fundamentals<br>**CO3:** An understanding of the fundamental principles of WPT for cable-free transfer of power. The method of handling compensation for inductor power transfer.<br>**CO4:** Appropriate compensation in design. Lighting systems. Battery charging profiles. Electric vehicle charging. **CO5:**After the successful completion, student will get idea of demand for safe power transfer and durable operation. |

**UNIT-I** **CO1**

**Basic Circuit Theory**: Review of transformers. Leakage inductance. Circuit compensation principles. Low-order compensations; series and parallel compensations. Resonance and operating frequency. Efficiency equation. **[4 Hrs]**

**UNIT-II** **CO2**

**Power Converters Fundamentals**: Power Converters Fundamentals DC-DC converters. AC-DC converters and inverters.PWM and soft switching principles. Basic topologies with transformers. Input, output and transfer characteristics of power converters. Incorporation of leaky transformer. Control methods. **[5Hrs]**

**UNIT-III** **CO3**

**Compensation Configurations**: Types of compensation for inductor power transfer. Characteristics for various termination requirements. Design for load-independence output voltage and output current. Efficiency optimization. **[12Hrs]**

**UNIT-IV** **CO4**

**Applications**: Circuit requirements for various loading conditions. Characteristics of LED loads, resistors and battery loads. Appropriate compensation design. Lighting systems. Battery charging profiles. Electric vehicle charging. Energy efficiency metric for charging. **[8Hrs]**

**UNIT-V** **CO5**

**Technology Trends**: Demand for safe power transfer and durable operation. Portable and smart devices. Mobile communication devices. IoT devices and systems. Sensors. Solid state lighting development. Battery technologies. Electric vehicle development. Renewable source integration trends. Future trends and demand for wireless power transfer. **[7Hrs]**

**Text Books:**

| S. No. | Title | Authors | Edition | Publisher |
|---|---|---|---|---|
| 1 | Wireless Power Transfer for Electric Vehicles and Mobile Devices | C. T. Rim and C. Mi | 2017 | New York: IEEE Press Wiley |
| 2 | Wireless Power Transfer | J. I. Agbinya | 2015 | River Publishers |

**Reference Books:**

| S. No. | Title | Authors | Edition | Publisher |
|---|---|---|---|---|
| 1 | Elements of Power Electronic | Philip T. Krein | ISBN-10: 0195117018 | Oxford University Press, USA |
| 2 | Design of a single-stage inductive power-transfer converter for efficient EV battery charging | Z. Huang, S. C. Wong, and C. K. Tse | 2017 | IEEE Transactions on Vehicular Technology, vol. 66, no. 7, pp. 5808-5821, July 2017 |
| 3 | Self-oscillating resonant converter with contactless power transfer and integrated current sensing transformer | L. Xu, Q. Chen, X. Ren, S. C. Wong, and C. K. Tse | 2017 | IEEE Transactions on Power Electronics, vol. 32, no. 6, pp. 4839-4851, June 2017 |

## SYLLABUS

## ELECTRICAL & ELECTRONICS ENGINEERING, B. Tech. Sixth Semester

| Subject Code EEE100647 | Hybrid Electric Vehicle | L = 2 | T = 1 | P = 0 | Credits = 3 |
|---|---|---|---|---|---|
| Evaluation Scheme | ESE | CT | TA | Total | ESE Duration |
| | 100 | 20 | 30 | 150 | 3 Hrs |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| The main objective of the course is to:<br>• Basic concepts of electric and hybrid vehicles.<br>• Discussion of various energy storage technologies for their use in electric and hybrid vehicles.<br>• Discussion of electric propulsion system and its constituents. | At the end of the course, the students can:<br>On successful completion of this course, students should be able to:<br>**CO1:**Analyze the working of Electric and Hybrid Electric Vehicle<br>**CO2:**Analyze the various electric drive train and power management scheme<br>**CO3:**Describe the role of Electric Propulsion System in the development of Electric and Hybrid Electric Vehicle<br>**CO4:**Understand the different strategies related to energy storage systems and energy management strategies |

**UNIT-I Classification and Configuration of vehicular technology:** **CO1**

Basics of vehicle performance, vehicle power source characterization, transmission characteristics of conventional vehicles. History electric and hybrid electric vehicles, social and environmental importance of electric and hybrid electric vehicles, impact of modern drive trains on energy supplies. **[6Hrs]**

**UNIT-II** **CO2**

**Hybrid Electric Drive-trains:** Basic concept of hybrid traction, introduction to various hybrid drive train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis. Electric Drive- trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. **[7Hrs]**

**UNIT-III** **CO3**

**Electric Propulsion unit:** Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency. **[10Hrs]**

**UNIT-IV** **CO4**

**Energy Storage:** Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system: Matching the electric

machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems

**[9Hrs]**

**UNIT-V** **CO4**

**Energy Management Strategies:** Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies. Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).

**[8Hrs]**

**Text Books:**

| S. No. | Title | Authors | Edition | Publisher |
|---|---|---|---|---|
| 1 | Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives | C. Mi, M. A. Masrur and D. W. Gao | 2011 | John Wiley & Sons |
| 2 | Electric and Hybrid Vehicles: Design Fundamentals | Iqbal Hussein | 1st edition,2016 | CRC Press (Taylor & Francis group) |

**Reference Books:**

| S. No. | Title | Authors | Edition | Publisher |
|---|---|---|---|---|
| 1 | Electric Vehicle Technology Explained | James Larminie, John Lowry | 2nd edition,2012 | Wiley |
| 2 | Electric and Hybrid Vehicles | T. Denton | 2016 | Routledge |

## SYLLABUS

## ELECTRICAL & ELECTRONICS ENGINEERING, B. Tech. Sixth Semester

| Subject Code EEE100648 | Grid Integration of Renewable Energy | L = 2 | T = 1 | P = 0 | Credits = 3 |
|---|---|---|---|---|---|
| Evaluation Scheme | ESE | CT | TA | Total | ESE Duration |
| | 100 | 20 | 30 | 150 | 3 Hrs |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| The main objective of the course is to:<br>• A strong understanding of power systems, their operation and control focused on the issues related to the integration of distributed renewable generation into the network.<br>• Strong foundation for power system equipments used for integration.<br>• Detailed knowledge about power quality and its management along with approaches for grid stabilization.<br>• Deep understanding about integration techniques for RE sources. | At the end of the course, the students can:<br>On successful completion of this course, students should be able to:<br>**CO1:** Apply advanced knowledge of electrical power system operations and control to analyze the challenges and opportunities for distributed renewable generation in both large interconnected grid and micro grid settings. (Test 1, 2, 3 and 4)<br>**CO2:** Assess renewable energy applications and projects in the context of integration into both the physical and economic electricity markets. (Test 1 and 2)<br>**CO3:** Describe the principles and requirements of the next generation future power network, incorporating distributed generation and storage and demand management. (Test 2 and 3)<br>**CO4:** Understand the principles, power and limitations of complex power networks incorporating distributed generation and storage. (Test 1, 2, 3 and 4) |

**UNIT-I Introduction :** **CO1**

Various techniques of utilizing power from renewable energy sources, concept of nano/micro/mini grid. Need of integrating large renewable energy sources, issues related to integration of large renewable energy sources, rooftop plants. Concept of VPP. **[4 Hrs]**

**UNIT-II** **CO2**

**Power system equipments for grid integration Synchronous generator:** grid, load sharing during parallel operation, stability (swing equation and solution) Induction Generator: working principle, classification, stability due to variable speed and counter measures Power Electronics: need of power electronic equipments in grid integration, converter, inverter, chopper, ac regulator and cyclo converters for AC/DC conversion **[5 Hrs]**

**UNIT-III** **CO3**

**Power quality and management:** THD, voltage sag, voltage swell, frequency change and its effects, network voltage management, frequency management, system protection, grid codes. **[12 Hrs]**

## SYLLABUS
## ELECTRICAL & ELECTRONICS ENGINEERING, B. Tech. Sixth Semester

**UNIT-IV** **CO4**

**Grid stabilization :** Scheduling and dispatch, Forecasting, reactive power and voltage control, frequency control, operating reserve, storage systems, electric vehicles Ancillary services in Indian Electricity Market (regulatory aspect), CERC and CEA orders (technical and safety standards **[8 Hrs]**

**UNIT-V** **CO4**

**Integration of alternate sources of energy :** Introduction, principles of power injection: converting technologies, power flow; instantaneous active and reactive power control approach; integrating multiple renewable energy sources; DC link integration; AC link integration; HFAC link integration; islanding and interconnection. **[7Hrs]**

**Text Books:**

| S. No. | Title | Authors | Edition | Publisher |
|---|---|---|---|---|
| 1 | Integration of Alternative sources of Energy | Felix A. Farret and M. Godoy Simoes | 2006 | IEEE Press – Wiley-Inter science publication, |
| 2 | Grid integration of solar photovoltaic systems | Majid Jamil, M. Rizwan, D.P.Kothari, | 2017 | CRC Press (Taylor & Francis group) |

**Reference Books:**

| S. No. | Title | Authors | Edition | Publisher |
|---|---|---|---|---|
| 1 | Wind Power Integration connection and system operational aspects | B. Fox, D. Flynn L. Bryans, N. Jenkins, M. O' Malley, R. Watson and D. Milborrow | 2007 | IET Power and Energy Series 50 (IET digital library) |
| 2 | Power Electronics: Circuits, Devices, and Applications | M.H.Rashid | 2013 | Pearson Education India |