Syllabus for B. Tech Electrical Engineering 3rd Year V Semester

<table>
<tr><td rowspan="3">Course: Power Systems - I
(Code: EET301)</td><td colspan="2" rowspan="3">Year & Semester:
B. Tech Electrical Engineering
3rd Year V Semester</td><td colspan="3">Total Course Credit: 3</td></tr>
<tr><td>L</td><td>T</td><td>P</td></tr>
<tr><td>2</td><td>1</td><td>0</td></tr>
<tr><td rowspan="2">Evaluation Policy</td><td>Mid-Term</td><td>Internal Assessment</td><td colspan="3">End-Term</td></tr>
<tr><td>30 Marks</td><td>10 Marks</td><td colspan="3">60 Marks</td></tr>
</table>

Course Objective: To understand the structure of Electric power system and its different components.

Course Outcomes (COs): Upon successful completion of the course, student should be able to:

CO1: Understanding the basics of power system generation, transmission, distribution system.

CO2: Classification of overhead line insulators and evaluation of string efficiency.

CO3: Modeling, Design, and Evaluation of various parameters of transmission lines.

CO4: Acquire knowledge of underground cables: construction, methods of laying, grading, and determination of fault location.

CO5: Investigate the concept of corona and its effect online design.

UNIT-I Power System – Introduction

Introduction to Power System - Generation, Transmission & Distribution. Element of DC & AC distribution system – Radial and ring main distributor - Single fed, double fed.

UNIT-II Insulators for Transmission Line

Overhead line Insulator: need & types - Pin, Suspension, Strain, Shackle, Guy etc. Potential distribution - String efficiency - Methods of equalizing potential drop over string insulators.

UNIT-III Overhead Transmission Line

Overhead Transmission Lines Conductors. Transmission line parameters and their evaluations - Resistance, Inductance & Capacitance. Models of Short, Medium & Long Transmission Lines. Skin, Proximity and Ferranti effect. Power transfer capability of a transmission line.

UNIT-III Design of Transmission Line

Electric Power Transmission Towers. Sag evaluation and their calculations. Corona - Visual & Critical voltages - Corona loss - Effect of corona on line design practical considerations.

UNIT-IV Underground Cable

Classification of cables, Cable conductors, Insulating materials, Insulation resistance, electrostatic stress, grading of cables, capacitance calculation, losses and current carrying capacity. Location of faults, methods of laying of underground cables.

Text Books:

1. B.R. Gupta, "Power System Analysis and Design", S. Chand publishers.
2. S.N. Singh, "Electrical Power Generation, Transmission & Distribution", PHI Pvt. Ltd.
3. Weedy and Cory, "Electric Power Systems", John Wiley & Sons.
4. C.L. Wadhwa, "Electric Power Systems", New Age Intl. (P) Ltd.

Reference Books:

1. D. Das, "Electrical Power Systems", New Age Intl. (P) Ltd.
2. Hadi Saadat, "Power System Analysis", Mc Graw Hill.
3. J.J. Grainger and W.D Stevenson, "Power System Analysis", McGraw Hill.
4. Kothari and Nagrath, "Power System Engineering", McGraw Hill Edu. (I) Pvt. Ltd.
5. NPTEL Lecture Series on "Power System Engineering".

<table>
<tr><td rowspan="3">Course: Electric Machines-II (Code: EET302)</td><td colspan="2" rowspan="3">Year & Semester:
B. Tech Electrical Engineering
3rd Year V Semester</td><td colspan="3">Total Course Credit: 4</td></tr>
<tr><td>L</td><td>T</td><td>P</td></tr>
<tr><td>3</td><td>1</td><td>0</td></tr>
<tr><td rowspan="2">Evaluation Policy</td><td>Mid-Term</td><td>Internal Assessment</td><td colspan="3">End-Term</td></tr>
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</table>

Course Objective: To study and understand different types of induction machines and synchronous machines, their construction, operating characteristics and applications.

Course Outcomes (COs): Upon successful completion of the course, students should be able to:

CO1: Understand the principle of operation, constructional details, winding layout, nature of magnetic fields produced by the stator and rotor windings, emf induced and torque development in induction and synchronous machines.

CO2: Develop equivalent circuit of a three-phase induction machine and use it to determine the starting and running performance of an induction machine.

CO3: Carry out performance calculations, investigate methods of starting and speed control of three-phase induction motor.

CO4: Study the operating principle and application of various types of single-phase induction motors and some sub-fractional motors.

CO5: Describe the constructional and operating differences, suitability of salient-pole and cylindrical-rotor synchronous machines, develop circuit model of a synchronous machine and use it to determine the operating performance.

CO6: Analyze the effect of load and excitation changes, active and reactive power control, parallel operation of alternators, starting methods of synchronous motors.

UNIT - I Basic Concepts in Rotating Electric Machines:

Operating principles of induction and synchronous machines, Magneto-motive force and flux distribution due to single-phase concentrated and distributed windings, Magnetic field due to three-phase winding-Rotating magnetic field, Flux per pole.

UNIT – II Three Phase Induction Machine:

Construction of 3-phase induction machine, Types, Emf induced in stator and rotor windings, Torque development and power developed, Equivalent circuit, Torque/speed characteristics, Effect of rotor resistance, Induction motor tests, Starting, Speed control, Effect of harmonic torques, Schrage motor

UNIT - III Single-Phase Induction Motors:

Two-revolving field theory, Torque-speed characteristics, Types of split-phase induction motors, shaded-pole motor, universal motor, repulsion motor.

UNIT - IV Synchronous Machines-1:

Constructional features, Types, emf induced, Effect of distributed winding and short-pitched winding, Harmonic elimination, Armature reaction, Circuit model of a cylindrical-rotor synchronous machine, Phasor diagrams, Synchronous reactance, saturation effect, Compounding curves

UNIT - V Synchronous Machines-2:

Steady-state power-angle characteristics, parallel operation, Operation on infinite bus, Effect of varying power and excitation, V-curves, Synchronous compensator,
Salient-pole synchronous machine, Two-axis theory, power-angle characteristics, Reluctance motor, Damper windings, Excitation systems, Starting of synchronous motor, Synchronous-machine transients, Analysis of sudden 3-phase short circuit.

Text Books:

1. Electrical Machines, I.J Nagrath & D.P Kothari, Tata Mc Graw-Hill.
2. Electrical Machines, P.S. Bimbra, Khanna Publishers.

Reference Books:

1. Electric Machinery, Fitzgerald, Kingslay, Umans, Tata McGraw-Hill
2. Electric Machines, Vincent Del Toro, Prentice Hall
3. Electric Machinery and Transformer, Guru, Hiziroglu, Oxford University press
4. Electric Machinery Fundamentals, Chapman, McGraw-Hill.
5. Electric Machines-Direct and Alternating Current, Charles S Siskind, McGraw-Hill.
6. Theory of Alternating Current Machinery, Alexander S Langsdorf, Tata McGraw-Hill.

<table>
<tr><td rowspan="3">Course: Control Systems-II (Code: EET303)</td><td colspan="2" rowspan="3">Year & Semester:
B. Tech Electrical Engineering
3rd Year V Semester</td><td colspan="3">Total Course Credit: 4</td></tr>
<tr><td>L</td><td>T</td><td>P</td></tr>
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<tr><td>30 Marks</td><td>10 Marks</td><td colspan="3">60 Marks</td></tr>
</table>

Course Outcomes (COs):

Upon successful completion of the course, student should be able to:

CO1: To understand linear algebra and its applications in modern control theory.

CO2: To represent physical systems in continuous State-Space canonical forms.

CO3: To solve the linear time-invariant (LTI) state equation and to access the controllability and observability of LTI state-space systems for stability analysis.

CO4: To design state-feedback controllers and regulators with specific dynamic performance.

Module 1: Revisiting Linear Algebra:
Vector Spaces, subspaces, linear independence, linear span of a set of vectors, basis and dimension of a vector space. Matrices, determinant and inverse. Row-space, column-space, null-space and rank of a matrix. Change of basis and similarity. Block matrices. Cramer's Rule. Eigen values and eigen vectors, characteristic and minimal polynomials, Caley-Hamilton theorem and its applications. Matrix exponential. Systems of linear equations.

Module 2: Introduction to Modern Control Theory:
Linear Time-Invariant (LTI) systems, Mathematical modelling of LTI systems. Classical versus Modern Control. Examples of Second-Order Systems: Electrical and Mechanical systems.

Concept of State, State variable and State model. State variable representations. Conversion of state variable models to transfer function and vice-versa.

Module 3: State Variable Analysis:

Similarity transformations and its properties. First and second companion forms. Jordan's canonical form with state diagrams. Solutions to homogenous and non-homogeneous cases. Computation of matrix exponentials using Laplace transforms and Jordan Normal form, positive definite matrices, quadratic forms.

Module 4: Controllability and Observability

Controllable and reachable subspaces, Physical examples and system interconnection. Controllability matrix (LTI), Eigen vector test of controllability. Stabilizable system. Unobservable and unconstructable subspaces, Physical examples. Duality theorem. Observable decompositions, Detectability, detectability tests.

Module 5: Design using State-Space Analysis:

Introduction to pole placement design. Stability improvements by state-feedback. Necessary and sufficient conditions for arbitrary pole-placement. State-regulator design. Design of state-observers.

Recommended Book:

S. No	**Name of Book**	**Author**	**Publisher & Edition**
1	Linear Control System Analysis and Design	John J. D'Azzo and Constantine H. Houpis	Marcel Dekker, Inc., Fifth edition
2	Control System Engineering	Franklin and Powel	Prentice Hall
3.	Linear System Theory	Joao P. Haspanaha	Princeton University Press,2009.

Course: Power Systems - II (Code: EET350)	**Year & Semester:** B. Tech Electrical Engineering 3rd Year VI Semester		**Total Course Credit: 4**		
			L	T	P
			3	1	0
Evaluation Policy	**Mid-Term**	**Internal Assessment**	**End-Term**		
	30 Marks	10 Marks	60 Marks		

Course Objective: The course is introduced to the students to learn one step advance level of power system which assists to enable better understanding of power system operation and performance analysis with basics of advance power electronics devices.

Course Outcomes (COs): Upon successful completion of the course, student should be able to:

CO1: Acquire and apply the knowledge of Per unit representation of Power system.

CO2: Analysis of balanced faults & unbalanced faults.

CO3: Investigating the concepts of Insulation co-ordination, over voltage, lightning surges, switching surges, and switching operations.

CO4: Analysis of Surge Impedance Loading, performance of transmission lines, interference of power lines with communication circuits.

CO5: Analysis and the basic knowledge of components and operation of power electronics, HVDC & FACTS Technology.

Unit I. Per Unit Representation of Power Systems:
(CO1)(6hr)
Single line diagram, impedance and reactance diagram of a system, per unit calculations, per unit representation of a power system.

Unit II: Fault Analysis (Balanced Faults):
(CO2)(6hr)
Faults, types of faults, symmetrical 3-phase balanced faults – calculation of fault currents, Symmetrical fault analysis using bus impedance matrix.

Unit III: Fault Analysis (Un-symmetrical Faults):
(CO2)(8hr)

Symmetrical components, sequence impedances, sequence networks, unsymmetrical faults –single line to ground, line-to-line, double line to ground faults on unloaded alternators and on power systems.

Unit IV: Insulation Co-ordination:
(CO3) (8hr)
Generation of over-voltages in a power system, lightning phenomena, lightning surges, switching surges-interruption of short circuits and switching operations, switching surges – interruption of capacitive circuits, resonance over voltages, protection of power system components against over voltages – ground wires, lightning arrestors. Concept of insulation coordination, Basic impulse insulation level, standard impulse test wave, volt-time curve, location and rating of lightning arrestors.

Unit V: Surge Performance of Transmission Lines:
(CO4)(6hr)
Traveling waves on transmission lines, open-end line, short-circuited line, line terminated through a resistance, line connected to a cable, reflection and refraction at a T-junction, line terminated through a capacitance, line terminated through an inductance, Attenuation of traveling waves.

Unit VI: Interference of Power Lines with communication Circuit:
(CO4)(2hr)
Electrostatic and Electromagnetic effects.

Unit VII: High Voltage Direct Current Transmission & FACTS Technology:
(CO5)(6hr)
Comparison of HVAC and HVDC transmission lines. Thyristors (brief revision). Basic converter and D.C system operation – rectification, inversion. Complete direction current link. Objective of FACTS. Basic types of FACTS controllers. Introduction to FACTS Devices.

Total contact hours = 42 hr

Suggested Books:

1	Power System Analysis:	J.J. Grainger and W.D Stevenson, Tata McGraw Hill
2	Electrical Power Systems:	C.L. Wadhwa, New age Publication
3	Power Systems Engineering:	Nagrath and Kothari, Tata McGraw hill
4	Power System Analysis	Hadi Saadat, McGraw Hill College

<table>
<tr><td rowspan="3">Course: Power Electronics (Code: EET351)</td><td colspan="2" rowspan="3">Year & Semester:
B. Tech Electrical Engineering
3rd Year VI Semester</td><td colspan="3">Total Course Credit: 4</td></tr>
<tr><td>L</td><td>T</td><td>P</td></tr>
<tr><td>3</td><td>1</td><td>0</td></tr>
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CO1: Understand the need for Power Electronics Devices and Circuits and their basic operation.
CO2: Perform an analysis of driving and control and triggering circuits for Power Electronic converters
CO3: Perform an analysis of AC to DC converters (Single phase and three phase, controlled and uncontrolled), A.C Voltage controllers, DC to DC converters(choppers), and single phase D.C to A.C converters (Inverters) in square wave mode.
CO4: Perform Fourier analysis and knowledge of Power Quality issues associated with power electronic circuits.
CO5: Understand different applications of power electronics.

Module 1:
Introduction to Power Electronics, Power Semi-conductor Devices: Power Diodes, power Transistors, power MOSFETs, IGBTs, GTOs, Thyristors, Basic theory of operation, characteristics, Ratings, Protection and cooling, Recent Advances in Power Semi-conductor Devices, Driving and control circuits

Module 2:
Power Electronic converters: 1-phase / 3 phase rectifier circuits, 1-phase / 3 phase phase-controlled converters (Semi-converters, full–converters and Dual converters). Analysis and performance with passive and active load, Harmonics and power factor, Introduction to power quality.

Module 3:
D.C-to-D.C converters (choppers): Buck, Boost and Buck-Boost type and various chopper configurations.

Module 4:
A.C-to-A.C converters: A.C voltage controllers, Cyclo-converters, Introduction to matrix converters

Module 5:
D.C–to-A.C converters (Inverters): 1-phase VSI in half bridge and full bridge configuration, CSI, Frequency and voltage control, Line-commutated inverters (LCIs). Some typical applications of power Electronics

Text Books

1. Power Electronics by Daniel W Hart, Tata Mc Graw Hill
2. Power Electronic Circuits by IssahBatterseh, Wiley.
3. N. Mohan, T.M. Undeland& W.P. Robbins, Power Electronics: Converter, Applications & Design, John Wiley & Sons, 1989

4. Power Electronics: Circuits, Devices, and Applications by Muhammad H. Rashid. Pearson, 2009

References

1. Power Electronics: Devices, Drivers, Applications, and Passive Components by Barry Williams
2. Modern Power Electronics and AC motor Drives By Bimal K Bose- Pearson Publishers.
3. Referred Journal/Conference publications.

<table>
<tr><td rowspan="3">Subject: Microprocessors (Code: EET352)</td><td colspan="2" rowspan="3">Year & Semester:
B. Tech Electrical Engineering
3rd Year IV Semester</td><td colspan="3">Total Course Credit: 4</td></tr>
<tr><td>L</td><td>T</td><td>P</td></tr>
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Course Outcomes (COs):

CO1: Getting an overview of 8085 Micro-processor and its basic terminology.

CO2: Investigating and understanding of 8085 µp architecture.

CO3: To learn the instruction set, interrupts, and interfacing.

CO4: Introduction to 8086 microprocessor.

Module 1: Overview of Microprocessor:
Basic Terminology, Evolution of Microprocessors, State of Art of µP, Why we study 8085 µP.

Module 2: 8085 µP Architecture, Instruction Set and Programming Techniques:
Pin diagram, Detailed Internal Architecture, State Transition Diagrams, T- states (clock cycles), Machine Cycles, Instruction Cycles, Instruction Formats, Different Addressing Modes, Complete Description of all instructions with macro and micro RTL (Register Transfer language), Programming examples, Simulation of time delays.

Module 3: Interrupts and Serial I/O:
Concept of interrupts, priority of interrupts signals, Software generated interrupts, Hardware generated interrupts, Introduction of Serial I/O with reference to 8085 µP, General concepts.

Module 4: Interfacing and Microprocessor Applications:
Concept of fold back addresses, Memory maps, Memory mapped I/O, Isolated I/O, Interfacing of seven segment LED display, Toggle switches, Keyboard interfacing, Memory interfacing,

Simplification of interfacing circuitry with the help of decoders, General purpose programmable peripheral devices, Interfacing of A/D and D/A conversion devices, Some illustrative examples of Microprocessor Applications.

Module 5: Introduction to 8086 μP:
Introduction to 8086 μP.

Recommended Book:

S. No	**Name of Book**	**Author**	**Publisher & Edition**
1	Microprocessor Architecture Programming and Applications with the 8085	Ramesh S. Goankar	Prentice hall
2	Microprocessors and Programmed Logic	K.L. Short	Prentice hall
3	Microprocessors: Theory and Applications (Intel and Motorola)	M. Rafiquzzaman	Prentice hall

<table>
<tr><td rowspan="3">Course: Digital Signal Processing
(Code: EET353)</td><td colspan="2" rowspan="3">Year & Semester:
B. Tech Electrical Engineering
3rd Year VI Semester</td><td colspan="3">Total Course Credit: 4</td></tr>
<tr><td>L</td><td>T</td><td>P</td></tr>
<tr><td>3</td><td>1</td><td>0</td></tr>
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Course Objective: The primary objective of this course is to provide a thorough understanding and working knowledge of the analysis, design and implementation of discrete-time/digital signal processing systems.

Course Outcomes (COs): Upon successful completion of this course the students will have developed following skills/abilities:

CO1: Mathematically interpret, represent and process discrete-time/digital signals and systems
CO2: Thorough understanding of frequency-domain analysis of discrete-time signals.
CO3: Demonstrate and appreciate effect of sampling of continuous-time signals
CO4: Address practical implementation issues such as computational complexity, hardware resource limitations as well as cost of DSP systems
CO5: Ability to analyze and design DSP systems like FIR and IIR Filters.

UNIT - I Discrete Time Signals & Systems

Sequences & sequence operations, Discrete-time systems, Linear time-invariant systems, impulse response, causality, stability. Frequency-domain representation of discrete-time signals and systems, Fourier transforms, properties, theorems.

UNIT – II Sampling of Continuous-Time Signals

Periodic sampling, frequency- domain representation of sampling, reconstruction of signals, discrete-time processing of continuous–time signals, continuous–time processing of discrete-time signals, changing the sampling rate of DT signals.

UNIT - III Transform Analysis of Linear Time-Invariant Systems

Z- transform, Region of convergence, properties, Inverse Z-transform, Frequency response of LTI systems, system functions, linear constant-coefficient difference equations, FIR and IIR systems, Frequency response.

UNIT - IV Structure of Discrete-Time Systems

Block diagram representation of linear constant-coefficient difference equations, signal-flow graph representation, Basic structures for IIR systems, Transposed forms, Basic network structures for FIR systems.

UNIT - V Filter Design Techniques

Design of discrete-time IIR filters from continuous -time filters. Impulse invariance, bilinear transformation, Butterworth, Chebyshev, Elliptic approximation, low-pass, high-pass, band-pass and band-stop filters, design of FIR filters by windowing, Kaiser, Hamming, Hamming windows.

Text Books:

3. Discrete Time Signal Processing, A.V Oppenheim and R. W Schafer; Prentice Hall International
4. Digital Signal Processing Principles, Algorithms and Applications, John G. Proakis and D.G Manolakis; Prentice Hall International

Reference Books:

7. Introduction to Digital Signal Processing, J.R Johnson; Prentice Hall
8. Theory and Application of Digital Signal Processing, L.R Rabinder and B. Gold; Prentice Hall

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<table>
<tr><td rowspan="3">Subject: Electric Machine Design
(Code: EET354)</td><td colspan="2" rowspan="3">Year & Semester:
B. Tech Electrical Engineering
3rd Year VI Semester</td><td colspan="3">Total Course Credit: 4</td></tr>
<tr><td>L</td><td>T</td><td>P</td></tr>
<tr><td>3</td><td>1</td><td>0</td></tr>
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Course Outcomes (COs):

Upon successful completion of the course, student should be able to:

CO1: To understand the principles of electrical machine design and magnetic circuit calculations

CO2: To study and design of armature winding and D.C machines.

CO3: To understand the design of induction and synchronous machines.

CO4: To study and design of single-phase and three-phase transformers

Module 1:
Principles of Electrical Machine Design:
Considerations in design, design factors, limitations in design, modern trends in design.
Magnetic Circuit Calculations:
Magnetization curves, Magnetic leakage, calculation of mmf for air gap and teeth, effect of saliency.

Module 2:
Armature Winding Design:
Winding design, integrated approach for windings, A.C armature windings, production of emf in windings, mmf distribution of armature windings, eddy current losses in conductors.
Design of D.C Machines:
Output equation, main dimensions, armature design, armature windings, design of commutator and brushes, design of field systems, design of interpoles.

Module 3:
Design of Induction Motors (1-phase and 3-phase):
Output equation, main dimensions, stator winding, stator conductors, shape of stator slots, number of stator slots, stator core, rotor design.

Module 4:
Design of Synchronous Machines:
Output equation, main dimensions, length of air gap, stator.

Module 5:
Design of Single-phase and Three-phase Transformers:
Output equation, core design, winding design, yoke design, design of transformer tank with tubes, design of insulation.

Recommended Book:

S. No	Name of Book	Author	Publisher& Edition
1	Electric Machine Design	A. K. Sawhney	Dhanpat Rai and Sons
2	Electrical Machine Design	R. K. Agarwal	S. S. Kataria and Sons
3	Design of Electrical Machines	Mittal and Mittal	Standard Publishers and Distributors
4	A Text Book of Machine Design	R. S. Khurmi and J.K. Gupta	S. Chand Publishers
5	Electrical Machine Design	V. Rajini and V.S. Nagarajan	Pearson Publications

<table>
<tr><td rowspan="3">Subject: MATHEMATICS-V
Code: MAT311</td><td colspan="2" rowspan="3">Year & Semester:
B. Tech Electrical Engineering
3rd Year V Semester</td><td colspan="3">Total Course Credit: 3</td></tr>
<tr><td>L</td><td>T</td><td>P</td></tr>
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<tr><td>30 Marks</td><td>10 Marks</td><td colspan="3">60 Marks</td></tr>
</table>

Course Outcomes (COs):
Upon successful completion of the course, student should be able to:

CO1: Error estimate and Solve algebraic and transcendental equations using numerical techniques
CO2: Solution of Simultaneous Linear Algebraic Equations
CO3: Construction of Interpolating polynomial and finding intermediate value
CO4: Solve ordinary differential equations by numerical techniques
CO5: Apply Numerical techniques in Electrical engineering problems

Module 1: Errors in Numerical Calculations:(3 lectures)
Floating- point form of numbers, Round-off, Algorithm, Stability, Programming errors, Errors of Numerical Results, Error propagation, Basic error principle, Loss of significant digits.

Module 2: Interpolation:(11 lectures)
Difference Table and its usage. The difference operators Δ,▼ and the operator E. Interpolation Forward, Backward and Shift operators, Central differences, their relations , Existence, Uniqueness of interpolating polynomial, error of interpolation, Interpolation with equal intervals, Newton's advancing difference formula. Newton's backward difference formula. Interpolation with unequal intervals. Newton's divided difference formula. Lagrange's interpolation formula. The central difference operator δ and the over-raging operator μ. Relations between the operators. Gauss forward and backward interpolation formula, Sterling's, Bessel's, Laplace and Everett's formulae.

Module 3: Numerical solution of algebraic and Transcendental Equations: (4 lectures)
Graphic Method, Regula-Fast method, Bolzano's Process of bisection of intervals, Newton-Raphson Method and its geometrical significance.

Module 4: Numerical Integration: (4 lectures)
Numerical Integration, General Quadrature Formula, Simpson's $1/3^{rd}$ and $3/8^{th}$ rules, Weddle's' rule, Hardy's rule, Trapezoidal rule.

Module 5: Numerical Solution of ordinary differential equations:(4 lectures)
Numerical solution of ordinary differential equations, Picard's method. Taylor's series method, Euler's method, Runge Kutta Method.

Module 6: Application of Numerical Methods in Electrical Engineering: (4 lectures)
The Load Flow Problem, NR method for load flow solution in polar coordinates, Use of numerical solution of ordinary differential equation for solving problem of dynamic electrical circuit analysis, transient stability: solution of ordinary differential equations.

Recommended Book:

S. No	Name of Book	Author	Publisher & Edition
1	Numerical Methods for Scientists and Engineering	M.K. Jain, S. R. Iyengar & R.K. Jain	Wiley Eastern Ltd New age international publishers, 7th Edition
2	Mathematical Numerical Analysis	J.B. Scarborough	Oxford and IBH Publishers, 6th Edition
3	Introductory methods in Numerical Analysis	S S S.S. Sastry,	PHI learning Pvt Ltd, 5th Edition
4	Numerical Methods for Mathematics, Sciences and Engg.	J. H. Mathews,	Prentice hall college division, 2nd Edition

<table>
<tr><td rowspan="3">Subject: Power Systems-II Lab
(Code: EEL350)</td><td rowspan="3">Year & Semester:
B. Tech Electrical Engineering
3rd Year VI Semester</td><td colspan="3">Total Course Credit: 1</td></tr>
<tr><td>L</td><td>T</td><td>P</td></tr>
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<tr><td>Evaluation Policy</td><td>Class Assessment

(40 Marks)</td><td colspan="3">End-Term

(60 Marks)</td></tr>
</table>

Course Objective: The course is introduced to the students to enable laboratory scale practical knowledge about power system operation and performance analysis both hardware and software.

Course Outcomes (COs): Upon successful completion of the course, student should be able to:

CO1: Acquire and apply the knowledge of Per unit representation of Power system.

CO2: Analysis of balanced faults & unbalanced faults.

CO3: Investigating the concepts of Insulation co-ordination, over voltage, and switching operations.

Lab. Experiments:

S.No	**Experiments**
1	Per unit representation of a power system.
2	Measurement of positive, negative and zero sequence impedance and currents.
3	Measurement of earth resistance.
4	Measurement of insulation resistance of insulators
5	Transmission line fault analysis
6	Application of software packages in power systems.

Subject: Power Electronics Lab (Code: EEL351)	**Year & Semester:** B. Tech Electrical Engineering 3rd Year VI Semester	**Total Course Credit: 1**		
		L	T	P
		0	0	2
Evaluation Policy	**Class Assessment** (40 Marks)	**End-Term** (60 Marks)		

Course Objective: The course is introduced to the students to enable laboratory scale practical knowledge about power system operation and performance analysis both hardware and software.

Course Outcomes (COs): Upon successful completion of the course, student should be able to:

CO1: Understand the basic concepts of device characteristics and triggering techniques

CO2: Understand the operation of different type of rectifier/converter circuits with different loads

CO3: Understand the operation of choppers, AC voltage controllers and inverters

List of Experiments:

1.	To study the characteristics of Silicon Controlled Rectifier (SCR) and to find its holding and latching current.
2.	To study the resistance triggering technique for SCRs.
3.	To study the RC triggering technique of SCRs.
4.	To study the characteristics of Uni-Junction Transistor (UJT) and to determine its peak and valley points.
5.	To study the half-wave converter circuit at different loads and firing angles.
6.	To study the full wave bridge rectifier circuit and understand its effects on power quality.
7.	To study the single phase semi-converter circuit at different loads and firing angles.
8.	To study the single phase full-converter circuit at different loads and firing angles.
9.	To study the single phase AC voltage controller circuit at different loads and firing angles.
10.	To study the performance of DC-DC buck converter circuit at different duty ratios.
11.	To study the performance of single phase full bridge inverter circuit operating in square wave mode.

Subject: Microprocessor Lab (Code: EEL352)	Year & Semester: B. Tech Electrical Engineering 3rd Year VI Semester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	**Internal Assessment** (40 Marks)	**End-Term** (60 Marks)		

Course Objective:
To familiarize the students with the architecture, working and programming of microprocessors.

Course Outcomes (COs):	
CO1:	Get started with Microprocessor 8085 training kit.
CO2:	To learn logical, arithmetic, counting and sorting programs on 8085.
CO3:	To learn interfacing with ADC converters.

List of Experiments:

S. No.	Name of the experiment
1	Microprocessors (8085) training kit and its working.
2	Programs related to data transfer between registers, between registers and memory
3	Programs related to logic instructions.
4	Programming techniques with additional instructions. Looping, counting and indexing.
5	Programs related to Arithmetic Instructions, 8 bit and 16 bit Addition and Subtraction.
6	Copying Blocks of data from one part of memory to another, conditional copy.
7	Programs related to Counters and time delays
8	Programs related to use of stack and subroutines. Nesting.
9	Interfacing concepts. Switch and LED interfacing. Square wave generation.
10	ADC interfacing.

<table>
<tr><td rowspan="3">Subject: Power Systems-I Lab
(Code: EEL301)</td><td rowspan="3">Year & Semester:
B. Tech Electrical Engineering
3rd Year V Semester</td><td colspan="3">Total Course Credit: 1</td></tr>
<tr><td>L</td><td>T</td><td>P</td></tr>
<tr><td>0</td><td>0</td><td>2</td></tr>
<tr><td>Evaluation Policy</td><td>Class Assessment
(40 Marks)</td><td colspan="3">End-Term
(60 Marks)</td></tr>
</table>

Course Objective:
The main objective of the course is to understand, examine, and evaluate the electrical power system structure and its components.

Course Outcomes (COs):

Upon successful completion of the course, student should be able to:

CO1: Estimate the electrical parameters of A.C. and D.C. distribution system.

CO2: Analyze the Transmission line models.

CO3: Understand the concept of Insulators and underground Cables.

CO4: Perform the power system simulation in software packages.

List of Experiments:

S. No.	**Name of the experiment**
1	Determine the current and voltage circulating in a D.C. distribution network
2	Evaluate the phasor current and voltage for an A.C. distribution network.
3	Determine the generalized constants (A, B, C, D) of a Transmission line system.
4	Determine the Efficiency, Voltage Regulation of a Transmission line system.
5	Study of different types of Insulators.
6	Study of underground Cables and find the charging current.
7	Computer Simulation of Power System.

***Outdoor Activity* (*Optional*):** Measurement of Earth Resistance using Earth Tester.

Course: Electric Machines - II Lab (Code: EEL302)	Year & Semester: B. Tech Electrical Engineering 3rd Year V Semester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	**Class Assessment** 40 Marks	**End-Term** 60 Marks		

Course Objective:
To familiarize the students with the operation and performance of induction and synchronous machines, and perform various tests on them.

Course Outcomes (COs): Upon successful completion of the course, students should be able to:

CO1: Carry out tests to determine the parameters of the equivalent circuit of a three-phase induction motor and determine losses and efficiency.

CO2: To understand and implement various methods of starting and speed control of induction motors.

CO3: Determine the torque-speed characteristics of a three-phase induction motor and ac series motor.

CO4: Conduct tests on synchronous machine to determine its parameters and voltage regulation.

CO5: Determine the compounding and V-curves of synchronous machines.

CO6: Synchronize synchronous generators and control active and reactive power division between them.

List of Experiments: The students will conduct a minimum of 10 experiments out of the following list:

S. No.	Name of the experiment
1	To study the constructional details of an induction machine.
2	To determine the equivalent–circuit parameters of a 3 -phase Induction motor by no-load and blocked rotor tests.
3	To determine the torque- speed characteristics of a 3-phase induction motor.

4	To study the starting of a three-phase SCIM.
5	To study the methods of speed control of a three-phase SCIM.
6	To study the starting and speed control of a WRIM.
7	To study the starting of various types of split-phase motors.
8	To determine the speed characteristics of a Schrage motor.
9	To determine the Torque-speed characteristics of an AC series motor (Universal motor).
10	To study the constructional details of a synchronous machine.
11	To obtain the OCC and SCC of a synchronous machine and determine the synchronous reactance.
12	To determine the voltage regulation of an alternator by actual loading.
13	To obtain the compounding curves of an alternator.
14	To synchronize an alternator with bus bars using lamp method.
15	To synchronize two alternators and study the active and reactive load division between them.
16	To obtain the V-curves of a synchronous motor.

<table>
<tr><td rowspan="3">Course: Electric Machines - II Lab
(Code: EEL302)</td><td rowspan="3">Year & Semester:
B. Tech Electrical Engineering
3rd Year V Semester</td><td colspan="3">Total Course Credit: 1</td></tr>
<tr><td>L</td><td>T</td><td>P</td></tr>
<tr><td>0</td><td>0</td><td>2</td></tr>
<tr><td>Evaluation Policy</td><td>Class Assessment
40 Marks</td><td colspan="3">End-Term
60 Marks</td></tr>
</table>

Course Objective:
To familiarize the students with the operation and performance of induction and synchronous machines, and perform various tests on them.

Course Outcomes (COs): Upon successful completion of the course, students should be able to:

CO1: Carry out tests to determine the parameters of the equivalent circuit of a three-phase induction motor and determine losses and efficiency.

CO2: To understand and implement various methods of starting and speed control of induction motors.

CO3: Determine the torque-speed characteristics of a three-phase induction motor and ac series motor.

CO4: Conduct tests on synchronous machine to determine its parameters and voltage regulation.

CO5: Determine the compounding and V-curves of synchronous machines.

CO6: Synchronize synchronous generators and control active and reactive power division between them.

List of Experiments: The students will conduct a minimum of 10 experiments out of the following list:

S. No.	Name of the experiment
1	To study the constructional details of an induction machine.
2	To determine the equivalent–circuit parameters of a 3 -phase Induction motor by no-load and blocked rotor tests.
3	To determine the torque- speed characteristics of a 3-phase induction motor.
4	To study the starting of a three-phase SCIM.
5	To study the methods of speed control of a three-phase SCIM.
6	To study the starting and speed control of a WRIM.
7	To study the starting of various types of split-phase motors.
8	To determine the speed characteristics of a Schrage motor.
9	To determine the Torque-speed characteristics of an AC series motor (Universal motor).
10	To study the constructional details of a synchronous machine.
11	To obtain the OCC and SCC of a synchronous machine and determine the synchronous reactance.
12	To determine the voltage regulation of an alternator by actual loading.
13	To obtain the compounding curves of an alternator.
14	To synchronize an alternator with bus bars using lamp method.
15	To synchronize two alternators and study the active and reactive load division between them.
16	To obtain the V-curves of a synchronous motor.

<table>
<tr><td rowspan="3">Subject: Computer Aided Simulation of Electrical Systems Lab
(Code: EEL304)</td><td rowspan="3">Year & Semester:
B. Tech Electrical Engineering
3rd Year V Semester</td><td colspan="3">Total Course Credit: 1</td></tr>
<tr><td>L</td><td>T</td><td>P</td></tr>
<tr><td>0</td><td>0</td><td>2</td></tr>
<tr><td>Evaluation Policy</td><td>Class Assessment
(40 Marks)</td><td colspan="3">End-Term
(60 Marks)</td></tr>
</table>

Course Objective:
To familiarize the students with MATLAB/SIMULINK modelling of electrical systems.

Course Outcomes (COs):

Upon successful completion of the course, student should be able to:

CO1: To use MATLAB and SIMULINK Tool Boxes.

CO2: To use Control system (State space), Fuzzy logic & neural network tool boxes.

CO3: To learn the use of MATLAB in analysis of A.C/D.C circuits, Control systems, Electric machines and Transformers.

List of Experiments:

S. No.	**Name of the experiment**
1	Use of MATLAB and SIMULINK Tool boxes
2	Use of MATLAB in: 1. Analysis of D.C Circuits 2. Transient and steady state analysis of A.C/D.C circuits. 3. Analysis of control systems 4. Analysis of Electric Machines and Transformers
3	Use of Control System (State Space), Fuzzy Logic & Neural Network Tool Boxes

Course: Digital Electronics & Logic Design Lab (Code: ECL3xx)	Year & Semester: B. Tech Electrical Engineering 3rd Year V Semester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Class Assessment	End-Term		
	40 Marks	60 Marks		

Objectives: To acquire knowledge and become familiar with the different characterization techniques to analyze, and synthesize the digital logic, combinational and sequential circuits

Course Outcomes:

CO1	Identify relevant information to supplement the Digital Electronics & logic Design course
CO2	Develop competence in Combinational Logic Problem identification and solution
CO3	Develop design capability in the field of combinatorial logic using gates and blocks
CO4	Analysis and design of synchronous and asynchronous sequential circuits

Details of the syllabus:

S. No.	Particulars
1	To verify the truth table of following logic gates: d. AND OR and NOT e. NAND, NOR, XOR and XNOR f. To realize the above gates using discrete active and passive components.
2	To implement XOR and XNOR using universal logic gates.
3	**a.** To verify DeMorgans law using logic gates. **b.** To implement typical Boolean expressions and check their equality.
4	To design and realize:- **a.** Half adder and verify its truth table. **b.** Full adder and verifyits truth table. **c.** Half subtractor and verify its truth table **d.** Full subtractor and verify its truth table.
5	To design a multiplexer/demultiplexer using two input NAND gates
6	To designa4 bit binary to decimal converter.
7	To designamodulo-10 counter.
8	Given a frequency f obtain the waveforms with frequencies f/2,f/5&f/10
9	Design and realize the following flip flops using logic gates. **a.** RS flip flop **b.** JK flip flop **c.** D flip flop **d.** T flip flop
10	Use PLL as: **a.** Frequency multiplier. **b.** Frequency demodulator.

<table>
<tr><td rowspan="3">Course: Communication Systems
(Code: ECT3xx)</td><td colspan="2" rowspan="3">Year & Semester:
B. Tech Electrical Engineering
3rd Year V Semester</td><td colspan="3">Total Course Credit: 3</td></tr>
<tr><td>L</td><td>T</td><td>P</td></tr>
<tr><td>2</td><td>1</td><td>0</td></tr>
<tr><td rowspan="2">Evaluation Policy</td><td>Mid-Term</td><td>Internal Assessment</td><td colspan="3">End-Term</td></tr>
<tr><td>30 Marks</td><td>10 Marks</td><td colspan="3">60 Marks</td></tr>
</table>

Objectives: To analyze various analog modulation & demodulation schemes, to understand operation of AM & FM radio receivers, to perform noise analysis of AM & FM systems, to understand the basics of random process.

Course Outcomes:

CO1 Understanding of basic principles of communication system and Fourier analysis of different signals.
CO2 To understand and analyze various analog modulation and demodulation schemes
CO3 To understand the random processes and different sources, classification of noise effecting the communication system.
CO4 To understand various reception techniques and the performance analysis of different radio receivers in presence of Noise
CO5 To have knowledge of digital communication and digital modulation techniques

Details of the syllabus:

S. No	Particulars
1	Fourier Analysis of Signals; Fourier Transform, Fourier Transform, Signal, Bandwidth, Spectrum of a signal, Power spectral density
2	Frequency translation, Modulation, Advantages of modulation,
3	**Amplitude Modulation**: Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations, Frequency discriminator, Demodulation of AM, Diode detector, Monodyne, Homodyne and Super heterodyne receiver
4	**Angle Modulation:** Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Spectral characteristics of angle modulated signals, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, FM Receiver and Transmitter, Phase-Locked Loop: Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM Systems,
5	**Introduction to Random Process** Random Process, Mean Function, Autocorrelation function, Stationary Process , Wide Sense Stationary Process, White Gaussian Noise (WGN), Random process through LTI (Linear Time Invariant) System.

6	**Noise Analysis**: Signal to Noise Ratio, Noise Figure, Performance of AM &FM Systems in presence of noise, Preemphasis and Deemphasis,
7	**Digital Communication;** Benefits of digital communication, Sampling, quantization, PCM, Digital modulation Techniques viz, ASK, OOK, FSK, QAM .

Recommended Books

1	Principles of Communication Systems	Taub &schling
2	Taub's Principles of Communication Systems	Taub, schling & G Saha
3	Communication systems	Simon Haykins
4	Electronic Communication Systems	G. Kennedy

Course: Digital Electronics and Logic Design (Code: ECT3xx)	**Year & Semester:** B. Tech Electrical Engineering 3rd Year V Semester		**Total Course Credit: 3**		
			L	T	P
			2	1	0
Evaluation Policy	**Mid-Term**	**Internal Assessment**	**End-Term**		
	30 Marks	10 Marks	60 Marks		

Objectives: To study number systems, simplification and implementation of digital functions, design & analysis of various combinational and sequential circuits, memory organization & its implementations.

Course Outcomes:

CO1 To represent numbers in different number systems, binary codes and to perform their conversions and arithmetic operations.

CO2 To understand the Boolean algebra/theorems, K-Map and Q-M method and minimization of logic function using them, design and analysis of various combinational circuits.

CO3 To understand lathes and flip flops and designing various sequential circuits using various flip flops.

CO4 To understand basic concept of PLA, PAL, ADC, DAC, IEEE standards and notations

Details of the syllabus:

S. No.	**Particulars**
1	Review of Binary, octal and hexadecimal number systems. Various types of codes
2	Boolean algebra and Boolean theorems
3	Logic gates and implementation of Boolean functions with different types of logic gates. Circuit equivalence
4	Simplification techniques and minimization by map methods. Tabular method

5	Combination logic and arithmetic circuits. Encoders and Decoders, Multiplexers and Demultiplexers
6	Sequential circuits– state diagrams and state tables, design and analysis of flip flops, registers, counters, Synchronous and Asynchronous operation of sequential circuits. State Machines, Analysis and Design using State Machines
7	Analog to Digital converter, Digital to Analog converter
8	Latches and memory organizations. ROM's, EPROM's and RAM's Dynamic and Static
9	Introduction to PLA's, FPGA
10	IEEE standards and notations

Recommended Books

1	Digital System Design An Integrated Approach	Uyemura
2	Digital Logic & Computer Design	M Morris Mano
3	Digital Electronics	Gupta &Singhal
4	Digital principles and applications	A. P.Malvino
5	Switching Circuits	Marcus