Structure for Minor in Electrical Engineering Certification Programme

Sr. No	Code	Course	Contact Period (Hrs.)			Credits	Continuous Evaluation in terms of Marks						
			L	T	P		Evaluation I	Evaluation II	Theory			Practical & Viva-voce	Total
									TA	ESE	TW		
Semester- V													
1	EE3051M	Electrical Circuit Analysis	3	-	-	3	15	15	10	60	-	-	100
Semester- VI													
2	EE3052M	Electrical Power Systems	3	-	-	3	15	15	10	60	-	-	100
Semester- VII													
3	EE4051M	Electric Machine and Drives	3	-	-	3	15	15	10	60	-	-	100
4	EE4052M	Lab Electric Machine and Drives	-	-	2	1	-	-	-	-	50	-	50
Semester VIII													
5	EE4053M	Control System Design	3	1	-	4	15	15	10	60	-	-	100
6	EE4054M	Seminar	-	-	2	1	-	-	-	-	25	25	50
		Total of Semester V to VIII	12	1	4	15	60	60	40	240	75	25	500

Syllabus for Minor in Electrical Engineering Certification Programme

EE 3051M: ELECTRICAL CIRCUIT ANALYSIS			
Teaching Scheme:		**Examination Scheme:**	
Lectures	: 3 Hrs/Week	Evaluation I	: 15 Marks
Tutorial	: 0	Evaluation II	: 15 Marks
Total Credits	: 3	Teachers Assessment	: 10 Marks
		End Semester Exam	: 60 Marks

Course Description: This course introduces the basic concepts of circuit analysis which is the foundation of all subjects of the Electrical Engineering discipline. The emphasis of this course is laid on the basic analysis of circuits which includes Single phase circuits, network theorems, transient and steady state analysis and network topology.

Prerequisites: Maths-II and Basic Electrical Engineering

Course Objectives:
The objectives of the course are to

1. Provide the student with comprehensive understanding of the basic laws, theorems and methods of analyzing electric circuits.
2. Make students capable of analyzing transient and steady state response of electric circuits.
3. To impart basic knowledge on network analysis using Laplace Transform
4. To evaluate network parameters of a given Electrical network

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

CO1	Solve simple electric circuit using mesh and nodal analysis
CO2	Apply network theorems for the analysis of electric circuits
CO3	Obtain the transient and steady state response of electric circuit
CO4	Use the Laplace transform to find solution of circuit equations
CO5	Analyze two port network and obtain different parameter model

Detailed Syllabus:

Unit I	Basic circuit element: Basic concepts, voltage and current sources sinusoid and phasor, circuit elements, ac power analysis, RMS voltage and currents, network topology, Mesh and Nodal analysis, dot convention for coupled circuits duality
Unit II	Network theorems: Linearity properties and superposition theorem, source transformation, Thevenins theorem, Nortons theorem, maximum power transfer theorem
Unit III	First order and second order circuit: First order RC and RL circuit, Transient and steady state response, Singularity functions, Transient and steady state response of Second order circuit.

Unit IV	Laplace Transform: Definition of Laplace transform, Properties of Laplace transform, inverse Laplace transforms, Laplace transforms of circuit elements, Solution of differential equations and network equations using Laplace transform method, Transformed networks with initial conditions analysis of electrical circuits with applications of step, impulse and ramp functions, shifted and singular functions, The convolution integral
Unit V	Two Port Networks: Impedance parameter, admittance parameters, hybrid parameter and transmission parameters, Interrelations between these parameters, Transfer function, Concepts of poles and zeros, Concept of complex frequency, Driving point and transform impedance and admittances.

Text Books:

1. M.E. Van Valkenburg, "Network Analysis", Prentice Hall, 3rd edition.
2. D.Roy Choudhury,"Networks And Systems" New Age International Publications, 2nd edition.
3. Boylestad Robert L. Charles E., "Introduction to Circuit Analysis", Merril Publishing Company.
4. William H. Hayt Jr., Jack E. Kemmerly, Steven M. Durbin, "Engineering Circuit Analysis", Tata McGraw:Hill,6thedition.

Reference Books:

1. John R. OMalley, "Circuit Analysis", Prentice Hall.
2. Smarajit Ghosh, "Network Theory: Analysis And Synthesis" 1st Edition , Phi Learning Pvt. Ltd.
3. C. L. Wadhwa," Electrical Circuit Analysis: Including Passive Network Synthesis" 2nd edition New age international publishers ltd.-new Delhi

Evaluation I & II:

Class Test I and Class Test II of 15 marks each will be conducted for Evaluation I and Evaluation II respectively.

Teachers' Assessments:

Teachers' Assessment of 10 marks is based on any one of the following components. However, the course co-ordinator has to announce assessment components at the beginning of the course.

1. Tutorial
2. MCQ test
3. Model design & Simulation
4. PPT presentation
5. Quiz
7. Surprise test
8. Design and fabrication of working model
9. Home assignments

EE 3052M: ELECTRICAL POWER SYSTEMS			
Teaching Scheme		**Examination Scheme**	
Lectures	: 3 Hrs/Week	Class Test I	: 15Marks
Tutorial	: 0	Class Test II	: 15 Marks
Total Credits	: 3	Teachers' Assessment	: 10 Marks
		End -Semester Exam	: 60 Marks

Pre-Requisites: NIL

Course Description: -

This course is designed to give students the fundamental knowledge about electrical power system which includes various aspects of generation, transmission and distribution of electrical power.

Course Objectives:

The objectives of the course are to

1. Introduce Electrical Power System
2. Introduce operation of power plants, transmission and distribution line.

Course Outcomes:

After completion of this course students will be able to

CO1. Describe working of various power plants
CO2. Explain the various aspects related to the transmission line.
CO3. Describe components of overhead and underground transmission line
CO4. Calculate of performance parameters of transmission line.
CO5. Explain the various aspects related to substation and distribution system

Detailed Syllabus:

UNIT-I	**Electrical Power Generation:** Introduction to conventional power plants, hydro, Thermal and Nuclear power plants: working principle, classification, functions of various component. Nonconventional Power Generation: Wind, Solar power plant
UNIT-II	**Structure of Electric Power System :** Transmission system, Comparison of DC and AC transmission, Advantages of high transmission voltage, Various system of power transmission, overhead transmission lines and underground cables, conductor material in overhead system, conductor material in underground system, Comparison of various systems of transmission, Elements of a transmission line, Economics of power transmission, Economical choice of conductor size, Economic choice of transmission voltage.

UNIT-III	**Mechanical Design of Transmission Lines:** Main components of over head lines, Conductor materials, Line supports, insulators, Types of insulators, Potential distribution over suspension insulators, String efficiency, Methods of improving string efficiency, Sag in over head lines and sag calculations. Underground Cables: Cable construction, conductors, insulation, types of cable, insulation resistance of cable
UNIT-IV	**Electrical Design of Transmission line**: Resistance of line; influence of skin effect on resistance and proximity effect **,**brief introduction about the inductance and capacitance of transmission line, representation of transmission line as short, medium and long line. Calculation of efficiency and regulation of short and medium transmission line. Corona: Introduction, power loss due to corona, advantages & disadvantages of corona, effect of corona on line design, factors affecting corona, methods of reducing corona effect
UNIT-V	**Distribution Systems:** Introduction, primary & secondary distribution, various methods of distribution, general, radial and ring main systems, introduction to ac and dc distribution systems **Substation:** Classification, layout, substation equipments, , merits & demerits of indoor & outdoor substation, types of bus bar arrangements

Textbooks/ Reference Books:

1. Er. R.K.Rajput, A Text Book of Power System Engineering,Laxmi Publication Pvt. Ltd
2. Mahesh Verma, Power Plant Engineering, Metropolitan Book Co., Pvt. Ltd.
3. L. Wadhawa, Generation, Distribution and Utilization of Electrical Energy, New Age International Publishers
4. I. J. Nagrath and D.P. Kothari, Modern Power System Analysis, Tata McGraw:Hill.
5. W. D. Stevenson, Elements of Power Systems Analysis, McGraw Hill
6. M. V. Deshpande, Elements of Electrical Power, Transmission and Distribution, Tata McGraw:Hill.
7. H. Cotton, Transmission and Distribution of Electrical Energy, ISAAC Pitman & Sons Ltd.
8. Luces M. Faulkenberry and Walter Coffer, Electrical Power Distribution and Transmission, Pearson

Teaching Strategies:

The teaching strategy is planed through the lectures and home assignments.

Teacher's Assessment: Teacher's Assessment of 10 marks is based on one of the /or combination of the few of the following

1. Home Assignments
2. MCQ
3. Quiz
4. Surprise tests
5. Power point presentation

EE4051M: ELECTRIC MACHINES & DRIVES			
Teaching Scheme		**Examination Scheme**	
Lectures	: 3 Hrs/Week	Evaluation I	: 15Marks
Tutorial	: 0	Evaluation II	: 15 Marks
Total Credits	: 3	Teachers Assessment	: 10 Marks
		End-Semester Exam	: 60 Marks

Pre-Requisites: Basics of Electrical Engineering

Course Description:

In this curriculum, students will be explored to fundamentals of electrical machines. They will be also explored to fundamentals, control and operation of AC & DC drives. They are expected to identify the scope of electrical drives in industries.

Course Objectives:

The objective of the course is to give exposure to the students of -

1. Fundamental of electrical machines and drives.
2. Control & operation of AC & DC drives.
3. Various industrial applications of AC and DC drives.

Course Outcomes:

The students will be able to-

CO1: Describe the fundamentals of electrical motors and solve numerical on it
CO2: Describe the fundamentals of electrical drives and solve numerical on it
CO3: Explain and analyze DC motor drives and its control
CO4: Explain and analyze induction motor drives and its control
CO5: Discuss and identify industrial applications of DC and AC drives

Detailed Syllabus:

UNIT-I	**Fundamentals of Electrical Motors:** Construction, Working principles and types of DC motors, 1 phase and 3 phase induction motors
UNIT-II	**Fundamentals of Electrical Drives:** Concept of electrical drives, Fundamental torque equation, Speed Torque conventions & multi-quadrant operation, Equivalent value of drive parameters, Components of load torque, Nature & classification of load torque
UNIT-III	**DC Motor Drives and Control:** Performance characteristics of DC motors, Starting, Braking- Regenerative, Dynamic and Plugging, Controlled rectifier fed DC motor, Chopper fed DC motor

UNIT-IV	**Induction Motor Drives and control:** Performance characteristics of 3-phase induction motors, Starting, Braking-Regenerative, Dynamic and Plugging, Slip power recovery, Control of 3-phase and 1-phase induction motors
UNIT-V	**Industrial Applications:** Important features of Traction drive, Traction motors, Industrial applications of DC and AC drives

Text Books:

1) Ashfaq Hussain, " Electrical Machines" , Second Edition, Dhanpat Rai & Co. India
2) G. K. Dubey, "Fundamental of Electrical Drives", Second Edition. Narosa Publishing House, New Delhi, India
3) B. K. Bose, "Modern Power Electronics and AC Drives", Low Price Edition, Pearson Education Pvt. Ltd. New Delhi, India
4) R. Krishnan, "Electrical Motor Drives: Modeling, Analysis and Control", Low Price Edition, Prentice Hall of India, New Delhi, India

Evaluation I & II:

Class Test I and II of 15 marks each will be conducted for Evaluation I and Evaluation II respectively.

Teachers' Assessments:

Teachers' Assessment of 10 marks is based on any one of the following components. However, the course co-ordinator has to announce assessment components at the beginning of the course.

1. Tutorial
2. MCQ test
3. Model design & Simulation
4. PPT presentation
5. Quiz
6. Surprise test
7. Design and fabrication of working model
8. Home assignment

EE4052M: LAB ELECTRIC MACHINES AND DRIVES	
Teaching Scheme Practical : 2 Hrs/Week Total Credits : 1	**Examination Scheme** Term Work : 50 Marks

Course Objectives:

The objective of the course is to give exposure and hands on training to the students to

1. Understand basic operations of DC motors and AC motors
2. Understand basics and operations of DC and AC motor drives
3. Analyze the performance of DC and AC motor drives

Course Outcomes:

The students will be able to

CO1: Demonstrate basic operations of DC and AC motors
CO2: Demonstrate basic operations of DC & AC motor drives
CO3: Analyze performance of DC and AC drives
CO4: Record the operations and write technical reports
CO5: Work individually and in a team effectively

List of Experiments:

Term work shall consist of record of minimum eight experiments, hardware and/or software based from the following list or designed by course coordinator based on the curriculum of Electrical Machines and Drives

Sr. No.	Details
1	Starting and speed control of DC motor
2	Starting and speed control of 3-phase Induction motor
3	Starting and speed control of 1-phase Induction motor
4	Direction control and speed control of DC motor drives
5	Starting, stopping and accelerating & decelerating time adjustments of DC motor drives
6	Braking and protection of DC motor drives
7	Starting, stopping and accelerating & decelerating time adjustments of 3-phase induction motor drives
8	Braking and protection of 3-phase induction motor drives
9	Study of industrial applications of AC motor drives
10	Study of industrial applications of DC motor drives
11	Industrial visit report based on DC and AC drives
12	Modelling and simulation of DC/AC motor drives to perform given task using any one electrical software

Term Work:

The term work shall consist of performance of above enlisted experiments and submission of technical write up. The term work will be assessed by Course Coordinator.

EE4053M: CONTROL SYSTEM DESIGN			
Teaching Scheme		**Examination Scheme**	
Lectures	: 3 Hrs./Week	Evaluation I	: 15Marks
Tutorial	: 1	Evaluation II	: 15 Marks
Total Credits	: 4	Teachers Assessment	: 10 Marks
		End Semester Exam	: 60 Marks

Pre-requisite: Nil

Course Description: This course is aimed to give exposure to the students about control system design and various industrial and digital control. The course introduces concepts, principles of control system design in time and frequency domain. It also introduces various industrial control like PD,PI and PID etc required for various application. Further it describes state space approach of control system design. Concept of digital control system is also included.

Course Objectives:

The objectives of the course are to

1. Design various compensators in time domain
2. Explain frequency domain specifications and design compensator in frequency domain
3. Describe various industrial controllers
4. Explain state space design of control system.
5. Describe digital control systems

Course Outcomes:

After completing the course, students will able to-

CO1	Analyze and explain compensators of control system in time domain
CO2	Analyze and describe stability, compensators of control system in frequency domain
CO3	Explain various industrial controllers
CO4	Analyze and design control systems using state space approach
CO5	Describe digital control systems

Detailed Syllabus:

UNIT- I	**Design of Control System in Time Domain:** Root Locus, Rules for plotting root-loci, Root contours, Stability analysis using root locus, effect of addition of poles and zeros, Design of Lag compensation, Lead compensation, Lag-Lead compensation using root locus
UNIT- II	**Design of Control System in Frequency-Domain:** Frequency-domain specifications, Correlation between time-and frequency-domain responses, Bode plot, gain- and phase-margin, Effect of gain variation and addition of poles and zeros on Bode plot, Design of Lag compensation, Lead compensation, Lag-Lead compensation using Bode plot
UNIT-III	**Industrial Controllers:** P, PD, PI, PID controllers, tuning methods, Integration wind up, Equivalent controller circuit using operational amplifier, pneumatic and hydraulic controllers, Applications.
UNIT-IV	**State Variable Analysis And Design:** State space representation of LTI continuous time systems, Various forms of state space representation, Solution of state equation, State transition matrix, Eigen values and Eigen vectors, Controllability and observability. Design of controller using pole placement method

UNIT -V	**Digital Control Systems:** Introduction to discrete time systems, The Z transform and the inverse Z transform, Pulse transfer function, Stability using Jury criterion, Bilinear transformation.

Text Books:

1. I.J. Nagrath& M Gopal, “Control Systems Engineering", New Age Publishers Fourth Edition.
2. M. Gopal,”Digital Control Systems”, New Age Publishers Fourth Edition.
3. Norman Nice, “Control System Engineering”, New Age Publishers.

Reference Books:

1. Benjamin Kuo, “Digital Control system”, Oxford.
2. K. Ogata, “Modern Control System”“, Prentice Hall.
3. Lee Stoline,”Applied Non –Linear System”, Prentice Hall.
4. J. Stephanpoulis,”Chemical Process Control: An Introduction to theory and Practice”, Prentice Hall.

Evaluation I & II:

Class Test I and Class Test II of 15 marks each will be conducted for Evaluation I and Evaluation II respectively.

Teachers’ Assessments:

Teachers' Assessment of 10 marks is based on any one of the following components. However, the course co-ordinator has to announce assessment components at the beginning of the course.

1. Tutorial
2. MCQ test
3. Model design & Simulation
4. PPT presentation
5. Quiz
6. Surprise test
7. Design and fabrication of working model
8. Home assignment

EE4054M : SEMINAR	
Teaching Scheme	**Examination Scheme**
Practical : 02 Hrs/Week	Term Work : 25 Marks
Credits : 01	Presentation/Viva-voce : 25 Marks
	Total : 50 Marks

Course Description: The student shall collect, review, compile, comprehend, present research literature and identify the topic of the recent technology in the field of Electrical Engineering. Student will present seminar on the topic and will submit the seminar report.

Course Objectives:

1. To encourage the students to study advanced developments in electrical engineering
2. To encourage the students to show their presentation skills

Course Outcomes:

After completing the course, students will able to:

CO1	Gain knowledge of fast and rapid changing Technology in Electrical Engineering by self learning
CO2	Review, prepare and present technological developments
CO3	Develop student‘s abilities to transmit technical information clearly and test the same by delivery of Seminar
CO4	Show communication, interpersonal and presenting skills
CO5	Show technical report writing skills

Course Contents:

i. Students will select topics on their own and take approval from the guide. The topics may be on any recent trends in the field of the Electrical Engineering and normally beyond the curriculum.

ii. Student would organize preliminary presentations before faculty and other students, in which he/she would explain what is the topic or topics? Why they have chosen this? And what are they going to do in it? Based on this presentation guide would approve or help them in finalization of the topic and would give suggestions for further improvement.

iii. Faculty should ensure that though topic is challenging to students, it should be feasible and within capabilities of the group of students.

iv. It is mandatory that each student will present individually a seminar on approved topic.

v. Students are expected to discuss the progress of seminar to the guide.

vi. At the end of the semester, student is expected to prepare and present seminar on approved topic.

vii. The student has to submit a hard copy of the technical report, in the form of a title page, introduction, body chapters and a conclusion with references, running to not less than 20 pages; this will be evaluated by the faculty coordinator/guide. Original references are highly valued.

viii. At end of the semester students submit a report on his / her topic of seminar.