MINORS IN ELECTRICAL ENGINEERING

SCHEME OF INSTRUCTION AND EVALUATION w.e.f. 2025-2026

S.No.	Code	Course Title	Scheme of Instruction			Contact Hrs/Wk	Scheme of Evaluation			Credits	Sem.
			L	T	P		Hrs	CIE	SEE		
Theory											
1	MR501EE	Electrical Circuits	3	-	-	3	3	40	60	3	V
2	MR601EE	Electrical Machines	3	-	-	3	3	40	60	3	VI
3	MR602EE	Electrical Measurement Techniques	3	-	-	3	3	40	60	3	VI
4	MR701EE	Elements of Electrical Power Systems	3	-	-	3	3	40	60	3	VII
5	MR702EE	Electric Vehicles	3	-	-	3	3	40	60	3	VII
6	MR861EE	MR-Project Work	3	-	-	6	6	50	50	3	VIII
		Total	**18**	**-**	**-**	**21**	**21**	**250**	**350**	**18**	

Course Code	Course Title					Course Type
MR 701 EE	ELEMENTS OF ELECTRICAL POWER SYSTEMS					Core
Prerequisite	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation	Credits
	L	T	P		CIE	SEE	
	3	-	-	3	40	60	3

Course Objectives

- To familiarize students with the structure and components of a typical electrical power system and introduce various conventional and renewable methods of electric power generation.
- To understand the economic aspects of electric power generation including load characteristics, generation cost, and different tariff structures.
- To explain the basic structure and functioning of AC power distribution systems and substation layouts.
- To provide knowledge on overhead line insulators and underground cables, their types, characteristics, and performance.
- To introduce concepts of sustainability and technological advancements in modern power systems, including environmental, economic, and social considerations.

Course Outcomes (POs)

Upon successful completion of the course, students will be able to:

1. Describe the layout of an electrical power system and compare different methods of conventional and renewable energy generation.
2. Analyze the economics of power generation and apply various factors such as demand, load duration curve, and tariffs in practical scenarios.
3. Illustrate the configuration of AC distribution systems and substation arrangements, including selection and design considerations.
4. Identify and evaluate different types of insulators and cables used in power systems, and calculate their electrical parameters.
5. Assess the sustainability of power systems with respect to environmental, economic, and social factors, and recognize the role of emerging technologies like fuel cells and solar PV.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	–	–	–	2	–	–	–	–	2	3	2
CO2	3	3	2	–	–	–	1	–	–	–	2	2	3	2
CO3	3	2	3	–	2	–	2	–	–	–	–	2	3	2
CO4	3	3	2	–	2	–	1	–	–	–	–	2	3	2
CO5	2	2	2	–	1	2	3	2	–	–	–	2	2	3

UNIT-I

Introduction: Typical Layout of an Electrical Power System Present Power Scenario in India. Generation of

Electric Power (Qualitative): Conventional Sources: Hydro station, Steam Power Plant, Nuclear Power Plant and Gas Turbine Plant. Renewable energy Sources: Wind Energy, Fuel Cells, and Solar Energy, Tidal

UNIT-II

Economics of Generation: Introduction, definitions of connected load, maximum demand, demand factor, load factor, diversity factor, Load duration curve, number and size of generator units. Base load and peak load plants. Cost of electrical energy-fixed cost, running cost, Tariff on charge to customer.

UNIT-III

AC Distribution: Introduction, single line diagram of a typical power system, AC distribution, Single phase, 3-phase, 3 phase 4 wire system, bus bar arrangement, Selection of site and layout of substation

UNIT-IV

Overhead Line Insulators: Introduction, types of insulators, Potential distribution over a string of suspension insulators, Methods of equalizing the potential, testing of insulators.

Insulated Cables: Introduction, insulation, insulating materials, Extra high voltage cables, grading of cables, insulation resistance of a cable, Capacitance of a single core and three core cables, Overhead lines versus underground cables, types of cables.

UNIT-V

Sustainability of Power System: environmental sustainability, economic sustainability, social sustainability, concept of power system reliability

Technology Drivers (Qualitative): Technologies associated with Distributed energy Resources (e.g. Fuel cells, Microturbines, Solar PV)

References:

1. Generation, Distribution and Utilization of Electrical Energy, C.L. Wadhwa, New-Age International, Second Edition, 2009.
2. Electrical Power Systems, C.L. Wadhwa, New-Age International, Fifth Edition, 2009.
3. Elements of Power System Analysis, W.D.Stevenson, McGraw Hill, Fourth Edition, 1984.
4. Sustainable Power Systems, Nava Raj Karki, Rajesh Karki, Ajit Kumar Verma, Jaeseok Choi, Springer Singapore, 2017.
5. Modeling and Control of Sustainable Power Systems, Lingfeng Wang, Springer-Verlag Berlin Heidelberg, 2012.
6. Elements of Electrical Power Station Design, M.V.Deshpande, Wheeler Pub., Third Edition, 1998.

Course Code	Course Title					Course Type
MR 702 EE	ELECTRIC VEHICLES					Core
Prerequisite	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-	3	40	60	3

Course Objectives:

To understand the need for sustainable technology.

To understand the basics of electric and hybrid electric vehicles and their working

To obtain the knowledge of various types of electric/hybrid vehicles

To understand the concepts and methods of power transmission in hybrid and electrical vehicle.

To understand the basics of batteries and their role for electric/hybrid vehicle applications

Course Outcomes:

1. Understand the environmental implications and advantages of using EV technology
2. Understand basics of electric vehicles both conceptually and mathematically so that clear understanding from basics physics is achieved.
3. Understand the characteristics of EVs and awareness about energy consumption.
4. Understand different types of Hybrid Electric vehicles technologies available and their applications.
5. Understand the power sources and energy storage principles. Have the knowledge of battery behavior for electric vehicle application.

Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	3			2	3	2				1	1	2
CO2	3	3	3			2	1		1			1	1	2
CO3	3	3	3			2							1	2
CO4	3	3	3			2							1	2
CO5	3	2	2			2	1						1	2

UNIT I: Environmental impact and History of EVs:

Environmental Impact- EV - Advantages - History of EV-History of HEVs- History of Fuel Cell Vehicles

Unit II : Fundamentals of vehicle propulsion:

General description of vehicle movement-Vehicle Resistance -Dynamic Equation - Tire-Ground Adhesion and Maximum Tractive Effort - Power Train Tractive Effort and Vehicle Speed- Vehicle Performance

Unit III: Vehicle Transmission:

Power Plant Characteristics-Configuration of electric vehicles-Performance of Electric Vehicles-Energy Consumption

Unit IV: Hybrid Electric Vehicle:

Concept of Hybrid Electric Drivetrains- Architectures of Hybrid Electric Drivetrains-Series Hybrid-Parallel Hybrid- Concept of Hybridization of the Automobile-Plug-in Hybrid Electric Vehicles - Design and Control Principles of Plug-In Hybrid Electric

Unit V: Power Sources and Energy Storage:

Electrochemical Batteries-Electrochemical reactions-Thermodynamic Voltage-Specific Energy -Specific Power-Energy Efficiency-Battery technologies-Lead-Acid Battery-Nickel- Based Batteries-Lithium-Based Batteries-Ultracapacitors-Features of Ultracapacitors-Basic principles of Ultracapacitors

Suggested Reading:

1. Modern Electric, Hybrid Electric and Fuel Cell Vehicles –Fundamentals, Theory and Design – Mehrdad Ehsani, UiminGao and Ali Emadi - Thrid Edition - CRC Press
2. Electric Vehicle Technology Explained - James Larminie, John Lowry – John Wiley & Sons Ltd, - 2003.
3. Electric Vehicle Battery Systems – Sandeep Dhameja – Newnes - 2002.

MR861EE	MR-Project Work						Core
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	6	50	50	**3**

Course Objectives

1. Prepare the student for a systematic and independent study of the state of the art topics in the field of Electrical and Electronics Engineering.
2. Enhance practical and professional skills.
3. Familiarize tools and techniques of systematic Literature survey and documentation.
4. Encourage to analyze the research data
5. Motivate student to work with innovative and entrepreneurial ideas.

Course Outcomes : On completion of the course, students will be able to

1. To select the complex engineering problems beneficial to the industry and society to develop solutions with appropriate considerations.
2. To apply modern tools and analyze the results to provide valid conclusions.
3. To communicate effectively the solutions with report and presentation following ethics.
4. To work in teams and adapt for the advanced technological changes
5. To apply management principles to complete the project economically

Co-Po matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	-	-	2	2	-	-	-	-	-	3	3
CO2	-	-	-	3	3	-	-	-	-	-	-	-	3	3
CO3	-	-	-	-	-	-	-	3	-	3	-	-	-	-
CO4	-	-	-	-	-	-	-	-	3	-	-	3	2	2
CO5	-	-	-	-	-	-	-	-	-	-	3	-	-	-

Oral presentation is an important aspect of engineering education. The objective of the course is to prepare the student for a systematic and independent study of the state of the art topics in the field of Electrical and Electronics Engineering. Project topics may be chosen by the student with advice and approval from the faculty members.

Students are to be assessed and evaluated as per the following criteria.
Each student is required to:

1. Submit a one-page synopsis in the beginning of semester for display on the notice board (by 2nd week of the commencement of the semester).
2. Give a 20 minutes demo and demonstrate the work through LCD power point presentation followed by a 10 minutes discussion.
3. Submit a report on the project work with list of references and slides used.

- Project reviews are to be scheduled from the 3rd week of the semester to the last week of the semester and any change in schedule should be discouraged.
- Every student has to take up an individual project.
- Allocation and finalization of the projects by department.
- Two reviews – One during 5th week and another during 10th week and final evaluation shall be

conducted during 15th to 16th week.

- Students are required to give Presentations during the reviews.
- Students are required to submit project report.

Distribution of Marks for Continuous Internal Evaluation (CIE) - 50 Marks

Evaluation Criteria	**Maximum Marks**
Literature Review	05
Problem Formulation	05
Design/ Methodology	15
Implementation & Results	15
Presentation & Documentation	10

Distribution of Marks for Semester End Examination (SEE) – 50 Marks

Evaluation Criteria	**Maximum Marks**
Design/ Methodology	10
Implementation & Results	20
Presentation & Documentation	10
Publication in a conference/ Journal (Published / accepted)	10