Department of Electrical and Electronics

Number of programmes where syllabus revision was carried out

SL. NO.	COURSE CODE	COURSE OFFERED
1	SEEA3026	Smart Grid
2	:SEEA3028	Electric Vehicle

SEEA3026	SMART GRID	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand various aspects of smart grid.
- To Study about Smart Grid technologies, different smart meters and advanced metering infrastructure.
- To familiarize the power quality management issues in Smart Grid.
- To familiarize the high performance computing for Smart Grid applications.

UNIT 1 INTRODUCTION TO SMART GRID **9 Hrs.**

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, Concept of Resilient & Self Healing Grid, Present development & International policies in Smart Grid, Diverse Prospective from experts and global Smart Grid initiatives.

UNIT 2 SMART GRID ARCHITECTURE **9 Hrs.**

Components and Architecture of Smart Grid Design –Review of the proposed architectures for Smart Grid. The fundamental components of Smart Grid designs – Transmission Automation – Distribution Automation –Renewable Integration

UNIT 3 SMART METERS AND ADVANCED METERING INFRASTRUCTURE **9 Hrs.**

Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit(PMU), Intelligent Electronic Devices(IED) & their application for monitoring & protection.

UNIT 4 POWER QUALITY MANAGEMENT IN SMART GRID **9 Hrs.**

Power Quality & EMC in Smart Grid, Power Quality issues of Gridconnected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

UNIT 5 HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS **9 Hrs.**

Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over Power line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Understand the concepts of Smart Grid and its present developments.
CO2 - Describe the various Smart Grid technologies.
CO3 - Knowledge about different smart meters and advanced metering infrastructure.
CO4 - Realize the power quality management in Smart Grids.
CO5 - Understand the concepts of various network.
CO6 - Outline of Cloud Computing for Smart Grid applications.

TEXT / REFERENCE BOOKS

1. Stuart Borlase “Smart Grid: Infrastructure, Technology and Solutions”,CRCPress2012.
2. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, JianzhongWu, Akihiko Yokoyama, “Smart Grid: Technology and Applications”,Wiley, 2012.
3. Vehbi C. Güngör,DilanSahin, TaskinKocak, SalihErgüt, Concettina Buccella, Carlo Cecati, and GerhardP. Hancke, “Smart Grid Technologies: Communication Technologies and Standards”, IEEE Transactions On Industrial Informatics, Vol. 7, No. 4, November 2011.
4. Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang “Smart Grid – The New and Improved Power Grid: A Survey”, IEEE Transaction on Smart Grids,Vol.14,No.4,pp.944-980,2012.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks:100 **Exam Duration:3 Hrs.**

PART A: 10 Question of 2 marks each – No choice **20 Marks**
PART B: 2 Questions from each unit of internal choice; each carrying 16 marks **80 Marks**

SEEA3028	Electric Vehicle	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the concept of conventional vehicle
- To acquire the knowledge about the electric vehicle
- Apply the control of control techniques for motors
- To understand the transmission system used in electric vehicle
- To acquire the knowledge about the battery charging system

UNIT 1 VEHICLE FUNDAMENTALS **9 Hrs.**

General Description of Vehicle Movement, Vehicle Resistance, Dynamic Equation, Tire–Ground Adhesion and Maximum Tractive Effort, Power Train Tractive Effort and Vehicle Speed-Vehicle Power Plant and Transmission Characteristics-Vehicle Performance-Braking Performance-Performance of Electric Vehicles.

UNIT 2 ELECTRIC VEHICLE FUNDAMENTALS **8 Hrs.**

EV Types, EV Configurations, Energy Sources, Motors Used, Charging Systems, Power Conversion Techniques, Technological Problems, Control Algorithms, Trends and Future Developments

UNIT 3 ELECTRIC TRAIN **9 Hrs.**

Series Hybrid Electric Drive Train Design-Sizing of the Major Components- The Hybrid Electric Vehicle-Energy Use in Conventional Vehicles-Energy Savings Potential of Hybrid Drive trains-HEV Configurations-Series Hybrid System-Parallel Hybrid System-Series-Parallel System-Complex Hybrid System.

UNIT 4 ELECTRIC PROPULSION SYSTEM **10 Hrs.**

DC motor drive-Chopper control of DC motor drive- multi-quadrant control of Chopper fed drive Induction motor drive-constant v/f control-power electronics control-FOC-VSI for FOC. PMBLDC motor drive-basic principle – construction-classification-performance and control of PMBLDC machine. SRM drive-basic magnetic structure-SRM drive converter-modes of operation-generating modes of operation.

UNIT 5 BATTERY STORAGE AND CHARGING **9 Hrs.**

Batteries-Overview-Types of battery-Fuel Cell-Super capacitor -Flywheel. Charging, standards and infrastructure-Wireless power transfer-Solar charging case study. Case studies-General motor EV-1 and Tesla roadster

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Apply Vehicle concept to electric vehicle
CO2 - Analyze the power conversion technique of electric vehicle
CO3 - Examine the performance of different electric drive train
CO4 - Select the appropriate electric motor for electric propulsion system
CO5 - Select a suitable battery for electric vehicle
CO6 - Analyze the recent technique used in modern electric vehicle

TEXT / REFERENCE BOOKS

1.M. Ehsani, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2005 Suggested Reading.
2.Tom Denton, Electric and Hybrid vehicle routledge,2016.
3.Husain, Electric and Hybrid Electric Vehicles, CRC Press, 2003
4. Un-Noor, F., Padmanaban, S., Mihet-Popa, L., Mollah, M.N. and Hossain, E., 2017. A comprehensive study of key electric vehicle (EV) components, technologies, challenges, impacts, and future direction of development. Energies, 10(8), p.1217.

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END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks:100 **Exam Duration:3 Hrs.**

PART A: 10 Question of 2 marks each – No choice **20 Marks**
PART B: 2 Questions from each unit of internal choice; each carrying 16 marks **80 Marks**