E.G.S. PILLAY ENGINEERING COLLEGE

(Autonomous)

Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai
Accredited by NAAC with 'A'Grade | Accredited by NBA
NAGAPATTINAM – 611 002

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

Full Time Curriculum and Syllabus

Fourth Year – Eighth Semester

Course Code	Course Name	L	T	P	C	Maximum Marks		
						CA	ES	Total
Theory Course								
1703EE017	Flexible AC Transmission Systems	3	0	0	3	40	60	100
1703EE018	Power Electronics for Renewable Energy Systems	3	0	0	3	40	60	100
1703EE019	Electrical Energy Generation Utilization and Conservation	3	0	0	3	40	60	100
Laboratory Course								
1704EE851	Project Work	0	0	18	9	50	50	100

L – Lecture | T – Tutorial | P – Practical | CA – Continuous Assessment | ES – End Semester

1703EE017	FLEXIBLE AC TRANSMISSION SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. Introduce the reactive power control techniques.
2. Educate on different FACTS devices with their specifications.
3. Provide knowledge on Coordinating emerging FACTS devices

COURSE OUTCOME

After completion of the course, Student will be able to

CO1 Discuss about various FACTS devices used in Reactive power control(K2)

CO2 Apply the characteristics of static Var compensator reactive power control applications(K3)

CO3 Make use of different modes of operation of TCSC for stability studies(K3)

CO4 Investigate the characteristics of voltage source converter based FACTS controllers(K3)

CO5 Correlate the interaction between various FACTS controller using linear control & genetic algorithms(K3)

UNIT I INTRODUCTION TO FACTS DEVICES 9 Hours

Reactive power control in electrical power transmission lines; Uncompensated transmission line - series compensation – Basic concepts of Static Var Compensator (SVC); Thyristor Controlled Series capacitor (TCSC); Unified power flow controller(UPFC).

UNIT II STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS 9 Hours

Voltage control by SVC ; Advantages of slope in dynamic characteristics ;Influence of SVC on system voltage ; Design of SVC voltage regulator –Modeling of SVC for power flow and fast transient stability – Applications: Enhancement of transient stability ; Steady state power transfer ; Enhancement of power system damping.

UNIT III THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) AND APPLICATIONS 9 Hours

Operation of the TCSC – Different modes of operation , Modeling of TCSC ; Variable reactance model ; TSC, TCR; Modeling for Power Flow and stability studies; Applications: Improvement of the system stability limit ; Enhancement of system damping.

UNIT IV VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS 9 Hours

Static Synchronous Compensator (STATCOM) – Principle of operation, V-I Characteristics, Applications: Steady state power transfer, Enhancement of transient stability; Prevention of voltage instability; SSSC- Operation of SSSC and the control of power flow, Modeling of SSSC in load flow and transient stability studies.

UNIT V CO-ORDINATION OF FACTS CONTROLLERS 9 Hours

Controller interactions - SVC – SVC interaction; Co-ordination of multiple controllers using linear control Techniques; Control coordination using genetic algorithms.

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1. Modeling and simulation of power networks
2. Emerging trends in the interaction of FACTS devices.

REFERENCES:

1. R. Mohan Mathur and Rajiv K. Varma, “Thyristor Based FACTS Controller for Electrical Transmission Systems”, Wiley Interscience Publications, 2002
2. Narain G. Hingorani and Laszlo Gyugyi, “Understanding FACTS – Concepts and Technology of Flexible AC Transmission Systems”, Standard Publishers, New Delhi, 2001.
3. K.R.Padiyar,” FACTS Controllers in Power Transmission and Distribution”, New Age International(P) Limited, Publishers, New Delhi, Second Edition 2016 Publication
4. PrabhaKundur, “Power System Stability and Control”, McGraw Hill, 2006.
5. Y.-H. Song and A.T. Johns “Flexible A.C. Transmission Systems (FACTS)”, IET Digital library.

1703EE018	POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To design different power converters namely DC to DC and AC to AC converters For renewable energy systems.
2. To Provide knowledge about the stand-alone and grid connected renewable energy systems.
3. To analyze and comprehend the various operating modes of wind electrical generators and solar energy systems.

COURSE OUTCOME

After completion of the course, Student will be able to

CO1 List the various renewable energy sources and its impacts like wind, ocean, biomass, fuel cell, and hydrogen and hybrid energy system(K2)

CO2 Describe the applications of various generators & power converters like PWM Inverters, Buck Boost converter, AC voltage controller and matrix inverter in solar and WECS(K2)

CO3 Explain the need of hybrid energy systems and its impacts with case studies(K2)

CO4 Explain the stand-alone and grid interactive issues related with solar & WECS. (K2)

CO5 Illustrate P&O, INC and Hybrid algorithms for solar system(K2).

UNIT I INTRODUCTION TO RENEWABLE ENERGY CONVERSION 9 Hours

Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources: Solar, wind, ocean, Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy systems.

UNIT II ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION 9 Hours

Reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG.

UNIT III POWER CONVERTERS 9 Hours

Solar: Block diagram of solar photo voltaic system -Principle of operation: line commutated converters (inversion-mode) - Boost and buck-boost converters- selection of inverter, battery sizing, And array sizing Wind: Three phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid Interactive Inverters-matrix converters.

UNIT IV ANALYSIS OF WIND AND PV SYSTEMS 9 Hours

Stand-alone operation of fixed and variable speed wind energy conversion systems and solar system- Grid connection Issues -Grid integrated PMSG, SCIG Based WECS, grid Integrated solar system.

UNIT V HYBRID RENEWABLE ENERGY SYSTEMS 9 Hours

Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind-PV Maximum Power Point Tracking (MPPT).

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1.Case study on MPPT

2. Case study of hybrid energy system.

REFERENCES:

1. Rashid .M. H "Power electronics Hand book", Academic press, third edition, 2009.
2. Godfrey Boyle, "Renewable energy: power for a sustainable future" Oxford university, third edition, 2012.
3. Ion Bolder, "Variable speed generators", Portland CRC press, second edition, 2015.
4. Rai. G.D, "Non-conventional energy sources", Khanna publisher, New Delhi, fifth edition, 2013.
5. Gray L. Johnson, "Wind energy system", prentice hall Inc. 1995.
6. Andrzej M. Trzynnadlowski, "Introduction to Modern Power Electronics", Second edition, Wiley India Pvt. Ltd, 2012.
7. http://nptel.ac.in/courses/108105058/17.

1703EE019	ELECTRICAL ENERGY GENERATION UTILIZATION AND CONSERVATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To introduce the knowledge in Industrial applications of electric drives.
2. To introduce the energy saving concept by different ways of illumination and understand the different methods of electric heating and electric welding.
3. To study basic concepts and applications of solar photovoltaic power conversion system and comprehend the basic concepts of wind power conversion system.
4. To acquire the knowledge of tariff and economic aspects in power generation.

COURSE OUTCOME

After completion of the course, Student will be able to

CO1 - Recall the tractive effort for the propulsion of train, traction motors, characteristics of traction motor control, track equipment and collection gear.

CO2 - Explain the different light sources and various illumination systems for the lighting schemes

CO3 - Discuss the different methods of electric heating and types of electric welding schemes employed in industries.

CO4 - Explain the concept of solar radiation and Physical principles of the conversion of solar radiation into

CO5 - Describe the aerodynamic forces acting on the blade and basic components of a WECS.

CO6 - Discuss the performance of a flat plate collector and cylindrical parabolic concentrating collector.

UNIT I	ELECTRIC DRIVES AND TRACTION	9 Hours

Fundamentals of electric drive: Types of electric drives - Merits of electric traction - choice of an electric motor - application of motors for particular services - traction motors - electric braking - train movement and energy consumption - traction motor control - track equipment and collection gear; Recent trends in electric traction.

UNIT II	ILLUMINATION	9 Hours

Introduction - definition and meaning of terms used in illumination engineering; Classification of light sources - incandescent lamps, sodium vapour lamps, mercury vapour lamps, fluorescent lamps: Design of illumination systems - Indoor lighting schemes - factory lighting halls - outdoor lighting schemes - flood lighting - street lighting: energy saving lamps, LED.

UNIT III	HEATING AND WELDING	9 Hours

Introduction - advantages of electric heating – modes of heat transfer - methods of electric heating –Types - Resistance heating - Arc furnaces - Induction heating - Dielectric heating - Electric welding – Types - resistance welding - arc welding - power supply for arc welding - radiation welding.

UNIT IV	SOLAR RADIATION, SOLARENERGY COLLECTORS AND WIND ENERGY	9 Hours

Introduction - solar radiation at the Earth's surface - solar radiation geometry; estimation of average solar radiation- flat plate collectors - cover system - concentrating collector - advantages and disadvantages of concentrating collectors - parabolic concentrating collector – Introduction - basic principles of wind energy conversion - site selection considerations – basic components of a WECS (Wind Energy Conversion System) - Classification of WECS.

UNIT V	ENERGY AND ECONOMIC ASPECTS OF GENERATION	9 Hours

Economic aspects of power generation; terms commonly used in system operation; various factors affecting cost of generation; load curves - load duration curves; connected load, maximum load, peak load, base load and peak load power plants, load factor, plant capacity factor, plant use factor, demand factor, diversity factor, cost of power plant, tariffs and types; comparison of site selection criteria, introduction to energy auditing.

	Total:	45 Hours

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1. Solar rooftop PV system calculation for a home
2. Case study on Energy Auditing and Energy Conservation

References:

1. N.V. Suryanarayana, “Utilization of Electric Power”, Wiley Eastern Limited, New Age International Limited, 1993.
2. J.B. Gupta, “Utilization Electric power and Electric Traction”, S.K. Kataria and Sons, 2000.
3. R.K. Rajput, “Utilization of Electric Power”, Laxmi Publications Private Limited., 2007.
4. C.L. Wadhwa, “Generation, Distribution and Utilization of Electrical Energy”, New Age International Pvt. Ltd, 2014.
5. H. Partab, “Utilization of Electrical Energy”, Dhanpat Rai and Co., New Delhi, 2004.

1704EE851 **PROJECT WORK** **L T P C**
0 0 18 9

Course Objectives

1 To develop skills to formulate a technical project.
2 To give guidance on the various tasks of the project and standard procedures.
3 To teach use of new tools, algorithms and techniques required to carry out the projects.
4 To give guidance on the various procedures for validation of the product and analyses the cost effectiveness.
5 To provide guidelines to prepare technical report of the project.

Course Outcomes (COs)

After completion of the course, students will be able to
CO1 Formulate a real world problem, identify the requirement and develop the design solutions
CO2 Identify technical ideas, strategies and methodologies
CO3 Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project
CO4 Perform test and validate through conformance of the developed prototype
CO5 Analysis the cost Effectiveness of the project
CO6 Explain the acquired knowledge through preparation of report and oral presentations

GUIDELINE FOR REVIEW AND EVALUATION

The students may be grouped into 2 to 4 and work under a project supervisor. The device/ system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report has to be submitted by the group with the fabricated model, which will be reviewed and evaluated for internal assessment by a committee constituted by the head of the department. At the end of the semester examination, the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the head of the department.