## M.E. POWER ELECTRONICS AND DRIVES

**Full Time Curriculum and Syllabus**

**Second Year – Third Semester**

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<th>Course Code</th>
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L – Lecture | T – Tutorial | P – Practical | C – Credit | CA – Continuous Assessment | ES – End Semester
OPTIMIZATION TECHNIQUES

1703PE018

PREREQUISITE:
1. Numerical Methods
2. Operational Research

COURSE OBJECTIVES:
1. To introduce the different optimization problems and techniques
2. To study the fundamentals of the linear and non-linear programming problem.
3. To understand the concept of dynamic programming and genetic algorithm technique

UNIT I INTRODUCTION TO OPTIMIZATION 7 Hours

UNIT II LINEAR PROGRAMMING 6 Hours
Linear programming definition - Pivotal reduction of general system of equations - Simplex algorithms - Two phases of the simplex method - Revised simplex method - Duality in linear programming.

UNIT III NONLINEAR PROGRAMMING (ONE DIMENSIONAL) 5 Hours
Unimodal function – Elimination methods - Unrestricted and exhaustive search, Dichotomous search, Fibonacci method - Interpolation methods - Direct root method.

UNIT IV NONLINEAR PROGRAMMING 15 Hours
Constrained Optimization - Direct methods - The Complex method - Cutting plane method - Methods of feasible directions and determination of step length - Termination criteria, determination of step length.

UNIT V DYNAMIC PROGRAMMING AND HEURISTIC TECHNIQUES FOR OPTIMIZATION 12 Hours

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR:
Applications of AI techniques in waveform estimation for a Power Electronic Circuit.

COURSE OUTCOMES:
- On the successful completion of the course, students will be able to
  - CO1 Explain different classifications of optimization problems and techniques.
  - CO2 Understand the linear programming concepts.
  - CO3 Know the application of non-linear programming in optimization techniques.
  - CO4 Understand the fundamental concepts of dynamic programming.
  - CO5 Explain about Genetic algorithm and its application to optimization in power system.

REFERENCES:
PREREQUISITE:
1. Power System Operation and Control.

COURSE OBJECTIVES:
1. To understand the fundamentals of SCADA.
2. To analyze the SCADA Components, Communication, Monitoring and Control.
3. To analyze the application of SCADA in power System

UNIT I  INTRODUCTION TO SCADA  9 Hours
Evolution of SCADA, SCADA definitions, SCADA Functional requirements and Components, SCADA Hierarchical concept, SCADA architecture, General features, SCADA Applications, Benefits.

UNIT II  SCADA SYSTEM COMPONENTS  9 Hours
Remote Terminal Unit (RTU), Interface units, Human- Machine Interface Units (HMI), Display Monitors/Data Logger Systems, Intelligent Electronic Devices (IED), Communication Network, SCADA Server, SCADA Control systems and Control panels.

UNIT III  SCADA COMMUNICATION  9 Hours
SCADA Communication requirements, Communication protocols: Past, Present and Future, Structure of a SCADA Communications Protocol, Comparison of various communication protocols, IEC61850 based communication architecture, Communication media like Fiber optic, PLCC etc. Interface provisions and communication extensions, synchronization with NCC, DCC.

UNIT IV  SCADA MONITORING AND CONTROL  9 Hours
Online monitoring the event and alarm system, trends and reports, Blocking list, Event disturbance recording, Control function: Station control, bay control, breaker control and disconnector control.

UNIT V  SCADA APPLICATIONS IN POWER SYSTEM  9 Hours
Applications in Generation, Transmission and Distribution sector, Substation SCADA system Functional description, System specification, System selection such as Substation configuration, IEC61850 ring configuration, SAS cubicle concepts, gateway interoperability list, signal naming concept. System Installation, Testing and Commissioning.

TOTAL: 45 Hours

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR:
SCADA Design for 66/11KV and 132/66/11KV or 132/66 KV any utility Substation and IEC 61850 based SCADA Implementation issues in utility Substations

COURSE OUTCOMES:
On the successful completion of the course, students will be able to

CO1  Explain the fundamentals of SCADA.
CO2  Describe the system components of SCADA.
CO3  Elucidate the SCADA communication.
CO4  Explain the monitoring and control of SCADA.
CO5  Describe the applications of SCADA in power system.

REFERENCES:
1. Stuart A. Boye: SCADA-Supervisory Control and Data Acquisition, Instrument Society of America Publications,USA,2004
4. David Bailey, Edwin Wright, Practical SCADA for industry, Newnes, 2003
1703PE001  RECENT TRENDS IN POWER CONVERSION TECHNOLOGY  L  T  P  C  3  0  0  3

PREREQUISITE:
1. Power Electronics.

COURSE OBJECTIVES:
1. To analyze the recent DC – DC converters.
2. To analyze the recent AC – AC converters.
3. To analyze the PWM techniques, Control Techniques, Harmonics Mitigating techniques and applications.

UNIT I  SWITCHING TECHNIQUES  8 Hours

UNIT II  DC – DC CONVERTERS  10 Hours

UNIT III  ADVANCES IN INVERTERS  11 Hours
Multilevel concept – Diode clamped – Flying capacitor – Cascade type multilevel inverters – Hybrid multi level inverter- FFT analysis- Comparison of multilevel inverters - applications of multilevel inverter in welding - Principle of operation of impedance source inverter- applications – UPS – Induction heating. Concept of Multi stage power conversion in adjustable speed drives - renewable energy systems

UNIT IV  MATRIX CONVERTER  8 Hours

UNIT V  HARMONIC MITIGATIONS  8 Hours

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR:
Applications of Matrix converter in Special Machine.

COURSE OUTCOMES:
On the successful completion of the course, students will be able to

CO1  Explain the SVPWM and SVM techniques.
CO2  Describe the operation of Dc – Dc converter and its applications in photovoltaic systems.
CO3  Elucidate the Multi level and hybrid multi level concepts and its application.
CO4  Describe the various recent matrix converters and its applications.
CO5  Understand the harmonics mitigating techniques.

REFERENCES:
PREREQUISITE :
Environmental Studies

COURSE OBJECTIVES:
1. To impart knowledge on the atmosphere and its present condition, global warming and eco-
   legislations.
2. To detail on the sources of air, water and noise pollution and possible solutions for mitigating
   their degradation.
3. To elaborate on the technologies available for generating energy from waste.

UNIT I  INTRODUCTION  9 Hours
Global atmospheric change – green house effect – Ozone depletion - natural cycles - mass and energy transfer

UNIT II  AIR POLLUTION  9 Hours
Pollutants - sources and effect – air pollution meteorology – atmospheric dispersion – indoor air quality
 - control methods and equipments - issues in air pollution control – air sampling and measurement.

UNIT III  WATER POLLUTION  9 Hours
Water resources - water pollutants - characteristics – quality - water treatment systems – waste water treatment
 - treatment, utilization and disposal of sludge - monitoring compliance with standards.

UNIT IV  WASTE MANAGEMENT  9 Hours
Sources and Classification – Solid waste – Hazardous waste - Characteristics – Collection and Transportation

UNIT V  OTHER TYPES OF POLLUTION FROM INDUSTRIES  9 Hours
Noise pollution and its impact - Oil pollution - pesticides - instrumentation for pollution control - water
pollution from tanneries and other industries and their control – environment impact assessment for various

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :
Case study on environmental pollution near Marg Port – Karaikal due to coal handling process

COURSE OUTCOMES:
On the successful completion of the course, students will be able to

CO1 Explain the causes of atmospheric changes.
CO2 Describe the effects of air pollution and its control measures.
CO3 Understand the sources of water pollution and process involved in waste water management.
CO4 Explain the process of power generation from different wastes.
CO5 Describe the sources and effects of pollution from industries and its impacts on environment

REFERENCES:
1. Arcadio P Sincero and G.A. Sincero, Environmental Engineering – A Design Apporach, Prentice Hall of
   India Pvt Ltd, New Delhi, 2002.
3. G.Masters, Introduction to Environmental Engineering and Science Prentice Hall of India Pvt Ltd, New
   Delhi, 2003.
   1998.
5. H.Ludwig, W.Evans, Manual of Environmental Technology in Developing Countries, International Book