SIDDARTHA INSTITUTE OF SCIENCE AND TECHNOLOGY::PUTTUR
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Course Structure for M.Tech. POWER ELECTRONICS- R19 Regulations

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

I M.Tech. - I Semester

S.No.	Course Code	Subject	L	T	P	C
1	19HS0823	Research Methodology and IPR	2	-	-	2
2	19HS2101	Electric Drives Systems	3	0	0	3
3	19EE2102	Modelling and Analysis of Electrical Machines	3	0	0	3
4	19EE2103 19EE2104 19EE2105	Programme Elective-I Advanced Power Electronic Circuits Optimal and Adaptive Control Power Quality	3	0	0	3
5	19EE2107 19EE2108 19EE2109	Programme Elective-II Static VAR Controllers and Harmonic Filtering PWM converters and Applications Energy Management	3	0	0	3
6	19EE2110	Power Electronics Simulation Lab	0	0	4	2
7	19EE2111	Industrial Automation Lab (Virtual Lab)	0	0	4	2
8	19HS0818	Audit Course- I English for Research PaperWriting	2	0	0	0
Contact Periods / Week			**16**	**0**	**8**	
			Total/Week 24			
Total Credits						**18**

L= Lecture; T= Theory; P= Practical;

I M.Tech. - II Semester

S.No.	Course Code	Subject	L	T	P	C
1	19EE2112	Power Electronic Converters	3	0	0	3
2	19EE2113	Digital Control of Power Electronic and Drive Systems	3	0	0	3
3	19EE2114 19EE2115 19EE2116	Programme Elective-III Switched Mode and Resonant Converters Industrial Load Modelling and Control Advanced Digital Signal Processing	3	0	0	3
4	19EE2117 19EE2118 19EE2119	Programme Elective-IV Advanced Microcontroller based Systems Distributed Generation Smart Grids	3	0	0	3
5	19EE2120	Mini Project	0	0	4	2
6	19EE2121	Power Converters Lab	0	0	4	2
7	19EE2122	Industrial Electric Drives Lab (Virtual Lab)	0	0	4	2
8	19HS0829	Audit Course- II Constitution of India	2	0	0	0
Contact Periods / Week			**14**	**0**	**12**	
			Total/Week 26			
Total Credits						**18**

L= Lecture; T= Theory; P= Practical;

IIM.Tech. - I Semester

S.No.	Course Code	Subject	L	T	P	C
1	19EE2123 19EE2124 19EE2125	Programme Elective-I SCADA Systems and Applications FACTS and Custom power Devices HVDC Transmission Systems	3	0	0	3
2	19HS0824 19ME3121 19ME3021 19CE1028 19ME3022 19EE2128	Open Elective-I Business Analytics Industrial Safety Advances in Operations Research Cost Management of Engineering Projects Composite Materials Waste to Energy	3	0	0	3
3	19EE2126	Phase-I Dissertation	0	0	20	10
Contact Periods / Week			**6**	**0**	**20**	
			Total/Week 26			
Total Credits						**16**

L= Lecture; T= Theory; P= Practical;

II M.Tech. - II Semester

S.No.	Course Code	Subject	L	T	P	C
1	19EE2127	Phase-II Dissertation	0	0	32	16
Contact Periods / Week				**0**	**32**	
			Total/Week 32			
Total Credits						**16**

L= Lecture; T= Theory; P= Practical;

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I M.Tech. - I Sem (PE)

L	T	P	C
2	0	0	2

(19HS0823) RESEARCH METHODOLOGY AND INTELLECTUAL PROPERTY RIGHTS

Course outcomes:

At the end of this course, students will be able to:

- *Understand research problem formulation. Analyze research related information Follow research ethics*
- *Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.*
- *Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.*
- *Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.*

UNIT I

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT II

Effective literature studies approaches, analysis Plagiarism, Research ethics,

UNIT III

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT IV

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT V

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

TEXT BOOKS:

1. *Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"*

2. *Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"*
3. *Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners" Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.*
4. *Mayall , "Industrial Design", McGraw Hill, 1992. Niebel , "Product Design", McGraw Hill, 1974.*
5. *Asimov , "Introduction to Design", Prentice Hall, 1962.*
6. *Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.*
7. *T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008*

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I M.Tech. - I Sem (PE)

L	T	P	C
3	0	0	3

(19EE2101) ELECTRIC DRIVES SYSTEMS

Course Objectives:

- *Understand Basic electrical drives and their analysis.*
- *Learn Design of controller for drives.*
- *Understand Scalar control of electrical drives.*

Course Outcomes:

Students will be able to:

- *Model and simulate electric drive systems*
- *Design modulation strategies of power electronics converters, for drives application*
- *Design appropriate current/voltage regulators for electric drives*
- *Select and implement the drives for Industrial Process*
- *Implement various variable speed drives in Electrical Energy Conversion System*

UNIT- I

Dynamics of Electric Drives: Fundamentals of torque equation, Speed torque convention and Multi-quadrant operation, components of load torques.

UNIT- II

Classification of load torques steady state stability, Load equation, Speed control and drive classification, closed loop control of drives.

UNIT- III

DC motor Drives-Modeling of DC machines, Steady state characteristics with armature and speed control. Phase controlled DC motor drives, chopper controlled DC motor drives.

UNIT- IV

Poly-phase induction machines- Dynamic modeling of induction machines, Small signal equations, control characteristics of induction machines, Phase-controlled induction machines, Stator voltage control, Slip energy recovery scheme, frequency control and vector control of induction motor drives.

UNIT -V

Traction motor: Starting, Speed-Time characteristics, braking. Stepper motor, Servo motor and their Applications.

TEXT BOOKS:

1. *G.K. Dubey, "Power semiconductor controlled Drives", Prentice Hall international, New Jersey, 1989.*
2. *R. Krishnan, "Electric motor drives modeling, analysis and control", PHI-India-2009.*
3. *G. K. Dubey, "Fundamentals of electric Drives, Narosa Publishing House", 2nd edition, 2011.*

REFERENCES:

1. *W. Leonhard, "Control of Electrical drives", Springer, 3rd edition, 2001.*
2. *P.C. Krause, "Analysis of Electric Machine", Wiley-IEEE press 3rd edition.*
3. *K. Bose, "Modern Power Electronics and AC Drives", Prentice Hall publication, 1st Edition, 2001.*

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I M.Tech. - I Sem (PE)

L	T	P	C
3	0	0	3

(19EE2102) MODELING AND ANALYSIS OF ELECTRICAL MACHINES

Course Objectives:

- *To understand the operation of an electrical machine mathematically.*
- *To understand how a machine can be represented as its mathematical equivalent.*
- *To develop mathematical model of AC & DC machines and perform transient analysis on them*

Course Outcomes:

Students will be able to:

- *Knowledge about the dynamic behavior rotating machines.*
- *Able to understand equivalent circuit of synchronous machines.*
- *To understand various practical issues of different machines.*

UNIT-I

Principles of Electromagnetic Energy Conversion, General expression of stored magnetic energy, Co-energy and force/torque, example using single and doubly excited system

UNIT-II

Basic Concepts of Rotating Machines-Calculation of air gap MMF per phase, machine inductance using physical machine data; Voltage and torque equation of dc machine.

UNIT-III

Three phase symmetrical induction machine and salient pole synchronous machines in phase variable form, Application of reference frame theory to three phase symmetrical induction and synchronous machines, Dynamic direct and quadrature axis model in arbitrarily rotating reference frames.

UNIT-IV

Determination of Synchronous machine dynamic equivalent circuit parameters, Analysis and dynamic modelling of two phase asymmetrical induction machine and single phase induction machine.

UNIT-V

Special Machines - Permanent magnet synchronous machine, Surface permanent magnet (square and sinusoidal back emf type) and interior, permanent magnet machines, Construction and operating principle, dynamic modelling and self-controlled operation. Analysis of Switch Reluctance Motors, Brushless D.C. Motor for space Applications Recent trends.

TEXT BOOKS:

1. Charles Kingsle, Jr., A.E. Fitzgerald, Stephen D.Umans, “Electric Machinery”,
2. Tata McGraw Hill, R. Krishnan, “Electric Motor & Drives: Modelling, Analysis and Control”

REFERENCES:

1. Prentice Hall of India Miller, T.J.E., “Brushless Permanent Magnet and Reluctance Motor Drives”.
2. Clarendon PressP.C.Krause “Analysis of Electric Machine” Wiley IEEE Press 3rd Edition.

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I M.Tech. - I Sem (PE)

L	T	P	C
3	0	0	3

(19EE2103) ADVANCED POWER ELECTRONIC CIRCUITS

Course Objectives:

- *Understand the operation of advanced power electronic circuit topologies.*
- *Understand the control strategies involved.*
- *Learn few practical circuits, used in practice.*

Course Outcomes:

Students will be able to:

- *Knowledge about analysis and design of Load Commutated CSI and PWM CSI Learn analysis and design of series Inverters.*
- *Acquire knowledge about analysis and design of Switched Mode Rectifiers,APFC,*
- *DC-DC converters &Resonant converters*

UNIT-I

Special Inverter Topologies - Current Source Inverter. Ideal Single Phase CSI operation, analysis and waveforms - Analysis of Single Phase Capacitor Commutated CSI. Series Inverters. Analysis of Series Inverters. Modified Series Inverter. Three Phase Series Inverter

UNIT- II

Switched Mode Rectifier - Operation of Single/Three Phase bilateral Bridges in Rectifier Mode. Control Principles. Control of the DC Side Voltage. Voltage Control Loop. The inner Current Control Loop. Single phase and three phase boost type APFC and control, three phase utility interphases and control

UNIT- III

Buck, Boost, Buck-Boost SMPS Topologies . Basic Operation- Waveforms - modes of operation – Output voltage ripple

UNIT-IV

Push-Pull and Forward Converter Topologies - Basic Operation . Waveforms - Voltage Mode Control. Half and Full Bridge Converters . Basic Operation and Waveforms- Flyback Converter . discontinuous mode operation . waveforms . Control - Continuous Mode Operation . Waveforms

UNIT-V

Introduction to Resonant Converters. Classification of Resonant Converters. Basic Resonant Circuit Concepts. Load Resonant Converter. Resonant Switch Converter. Zero Voltage Switching Clamped Voltage Topologies. Resonant DC Link Inverters with Zero Voltage Switching. High Frequency Link Integral Half Cycle Converter.

TEXT BOOKS:

1. *Ned Mohan et.al "Power electronics: converters, applications, and design" John Wiley and Sons, 2006*
2. *Rashid "Power Electronics" Prentice Hall India 2007.*
3. *G.K.Dubey et.al "Thyristorised Power Controllers" Wiley Eastern Ltd., 2005, 06.*

REFERENCES:

1. *Dewan & Straughen "Power Semiconductor Circuits" John Wiley & Sons., 1975.*
2. *G.K. Dubey & C.R. Kasaravada "Power Electronics & Drives" Tata McGraw Hill., 1993.*
3. *IETE Press Book Power Electronics Tata McGraw Hill, 2003*
4. *Cyril W Lander "Power Electronics" McGraw Hill., 2005.*

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L	T	P	C
3	0	0	3

(19EE2104) OPTIMAL AND ADAPTIVE CONTROL

Course Objectives:

- *To know the operation of closed and open loop optimal control.*
- *Understand the adaptive control strategies.*
- *Learn dynamic programming method*

Course Outcomes:

Students will be able to:

- *Knowledge in the mathematical area of calculus of variation so as to apply the same for solving optimal control problems.*
- *Problem formulation, performance measure and mathematical treatment of optimal Control problems.*
- *Acquire knowledge on solving optimal control design problems by taking into*
- *consideration the physical constraints on practical control systems.*
- *To obtain optimal solutions to controller design problems taking into consideration the Limitation on control energy in the real practical world.*

UNIT-I

Optimal control problem, Fundamental concepts and theorems of calculus of variations Euler-Lagrange equation and external of functional.

UNIT-II

Variational approach to solving optimal control problems, Hamiltonian and different boundary conditions for optimal control problem

UNIT-III

Linear regulator problem, Potryangin's minimum principle, Dynamic programming Principle of optimality and its applications to optimal control problem.

UNIT-IV

MIT rule – Determination of adaptation gain - Lyapunov theory –Design of MRAS using Lyapunov theory – Relations between MRAS and STR- Case Study. (9) PROPERTIES OF ADAPTIVE SYSTEMS: Nonlinear dynamics, Analysis of Indirect discrete time self-tuners, Stability of direct discrete time algorithms, Averaging, Application of averaging techniques, averaging in stochastic systems, robust adaptive controllers.

UNIT-V

Nonlinear dynamics, Analysis of Indirect discrete time self-tuners, Stability of direct discrete time algorithms, Averaging, Application of averaging techniques, averaging in stochastic systems, robust adaptive controllers.

TEXT BOOKS:

1. *Donald E. Kirk, "Optimal Control Theory, An introduction." Prentice Hall Inc., 2004*
2. *A.P. Sage, "Optimum Systems Control", Prentice Hall, 1977*
3. *HSU and Meyer , "Modern Control, Principles and Applications," McGraw Hill, 1968*

REFERENCES:

1. *Yoan D. Landu, "Adaptive Control" (Model Reference Approach), Marcel Dekker. 1981*
2. *Ioannou P A and Sun J, "Robust Adaptive Control", Prentice Hall, 1996*

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3	0	0	3

(19EE2105) POWER QUALITY

Course Objectives:

- *Understand the different power quality issues to be addressed*
- *Understand the recommended practices by various standard bodies like IEEE, IEC,etc. on*
- *voltage & frequency, harmonics*
- *Understanding STATIC VAR Compensators*

Course Outcomes:

Students will be able to:

- *Acquire knowledge about the harmonics, harmonic introducing devices and effect of harmonicson system equipment and loads*
- *develop analytical modeling skills needed for modeling and analysis of harmonics innetworks and components*
- *Introduce the student to active power factor correction based on static VAR compensators andits control techniques*
- *Introduce the student to series and shunt active power filtering techniques for harmonics*

UNIT-I

Power quality-voltage quality-overview of power quality Phenomena classification of power quality issues-power quality measures and standards-THD-TIF-DIN-C message weights-flicker factor transient phenomena-occurrence of power quality problems power acceptability curves-IEEE guides, standards and recommended practices.

UNIT-II

Individual and total harmonic distortion RMS value of a harmonic waveform-Triplex harmonics-important harmonic introducing devices-SMPS- Three phase power converters- arcing devices saturable devices-harmonic distortion of fluorescent lamps-effect of power system harmonics on power system equipment and loads.

UNIT-III

Modelling of networks and components under non-sinusoidal conditions transmission and distribution systems Shunt capacitors-transformers-electric machines-ground systems loads that cause power quality problems power quality problems created by drives and its impact on drive.

UNIT-IV

Passive Compensation Passive Filtering, Harmonic Resonance Impedance Scan Analysis- Active Power Factor Corrected Single Phase Front End, Control Methods for Single Phase APFC Three Phase APFC and Control Techniques, PFC Based on Bilateral Single Phase and Three Phase Converter

UNIT-V

SVC and STATCOM Active Harmonic Filtering-Shunt Injection Filter for single phase, three-phase three-wire and three-phase four wire systems d-q domain control of three phase shunt active filters uninterruptible power supplies constant voltage transformers series active power filtering techniques for harmonic cancellation and isolation.

Dynamic Voltage Restorers for sag swell and flicker problems.

TEXT BOOKS:

1. *G.T. Heydt, "Electric power quality", McGraw-Hill Professional, 2007*
2. *Math H. Bollen, "Understanding Power Quality Problems", IEEE Press, 2000*
3. *J. Arrillaga, "Power System Quality Assessment", John Wiley, 2000*

REFERNCES:

1. *J. Arrillaga, B.C. Smith, N.R. Watson & A. R.Wood,"Power system Harmonic Analysis", Wiley,1997*

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L	T	P	C
3	0	0	3

(19EE2107) STATIC VAR CONTROLLER AND HARMONIC FILTERING

Course Objectives:

- *Understand the various static converters*
- *Understand the static converter control strategies*
- *Understand the active and reactive power compensation and their control*
- *Understand harmonic filtering and its control design*

Course Outcomes

Students will be able to:

- *Acquire knowledge about the fundamental principles of Passive and Active Reactive Power Compensation*
- *Schemes at Transmission and Distribution level in Power Systems.*
- *To introduce the student to various single phase and three-phase Static VAR Compensation schemes and their controls*
- *To develop analytical modelling skills needed for modelling and analysis of such Static VAR*

UNIT-I

Steady-State Reactive Power Control in Electric Transmission Systems. Reactive Power Compensation and Dynamic Performance of Transmission Systems.

Sags, Swells, Unbalance, Flicker, Distortion. Current Harmonics. Sources of Harmonics in Distribution Systems and their Effects.

UNIT-II

Shunt Compensators. SVCs of Thyristor Switched and Thyristor Controlled types and their control, STATCOMs and their control. Series Compensators of Thyristor Switched and Controlled Type and their Control. SSSC and its Control, Sub-Synchronous Resonance and damping.

UNIT-III

Single Phase and Three Phase Converters and Standard Modulation Strategies (Programmed Harmonic Elimination and SPWM). GTO Inverters. Multi-Pulse Converters and Interface Magnetics. Multi-Level Inverters of Diode Clamped Type

UNIT-IV

Single Phase Shunt Current Injection Type Filter and its Control. Three Phase Three-wire Shunt Active Filtering and their control using p-q theory and d-q modeling. Three phase four wire shunt active filters. Hybrid Filtering using Shunt Active Filters. Dynamic Voltage Restorer and its control.

UNIT-V

Series Active Filtering in Harmonic Cancellation Mode. Series Active Filtering in Harmonic Isolation Mode. V-I and power oscillation characteristics

TEXT BOOKS:

1. Ned Mohan et.al, "Power Electronics", John Wiley and Sons, 2006.

2. G. Massobrio, P. Antognet," Semiconductor Device Modeling with Spice", McGraw-Hill, Inc., 1988.

REFERENCE BOOKS:

1. B. J. Baliga," Power Semiconductor Devices",Thomson, 2004

2. V. Benda, J. Gowar, D. A. Grant," Power Semiconductor Devices. Theory and Applications",JohnWiley& Sons1994.

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I M.Tech. - I Sem (PE)

L	T	P	C
3	0	0	3

(19EE2108) PWM CONVERTERS AND APPLICATIONS

Course Objectives:

- *Understand the concepts and basic operation of PWM converters, including basic circuit operation and design.*
- *Understand the steady-state and dynamic analysis of PWM converters along with the applications like solid state drives and power quality*.

Course Outcomes:

Students will be able to:

- *Knowledge concepts and basic operation of PWM converters, including basic circuit operation and design*
- *Learn the steady-state and dynamic analysis of PWM converters along with the applications like solid state drives and power quality*
- *Able to recognize and use the following concepts and ideas:Steady-State and transient modelling and analysis of power converters with various PWM techniques.*

UNIT-I

AC/DC and DC/AC power conversion, Overview of applications of voltage source converters and current source converters, Pulse width modulation techniques for bridge converters,

UNIT-II

Bus clamping PWM, Space vector based PWM, Advanced PWM techniques, Practical devices in converter.

UNIT-III

Calculation of switching and conduction power losses, Compensation for dead time and DC voltage regulation, Dynamic model of PWM converter

UNIT-IV

Multilevel converters, Constant V/F induction motor drives, Estimation of current ripple and torque ripple in inverter fed drives, Line-side converters with power factor compensation

UNIT-V

Active power filtering, Reactive power compensation, Harmonic current compensation Selective harmonic elimination PWM technique for high power electric drives.

TEXT BOOKS:

1. *Mohan, Undeland and Robbins, "Power Electronics: Converters, Applications and Design", John's Wiley and Sons*
2. *Erickson RW, "Fundamentals of Power Electronics", Chapman and Hall*

REFERENCES

1. *Vithyathil. J, "Power Electronics: Principles and Applications", McGraw Hill.*
2. *D. Grahame Holmes "Pulse Width Modulation for Power Converters" IEEE PRESS*

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I M.Tech. - I Sem (PE)

L	T	P	C
3	0	0	3

(19EE2109) ENERGY MANAGEMENT

Course Objectives:

- *Acquire the background required for engineers to meet the role of energy managers and to acquire the skills and techniques required to implement energy management.*
- *Identify and quantify the energy intensive business activities in an organization.*
- *Knowledge about standard methodologies for measuring energy in the workplace and energy audit instruments.*

Course Outcomes

Students will be able to:

- *Acquire the background required for engineers to meet the role of energy managers and to acquire the skills and techniques required to implement energy management.*
- *Identify and quantify the energy intensive business activities in an organization.*
- *Knowledge about standard methodologies for measuring energy in the workplace and energy audit instruments.*
- *Knowledge about energy efficient motors, load matching and selection of motors.*
- *Acquire knowledge about reactive power management, capacitor sizing and degree of Compensation*

UNIT-I

Electric motors-Energy efficient controls and starting efficiency, Motor Efficiency and Load Analysis- Energy efficient /high efficient Motors-Case study, Load Matching and selection of motors. Variable speed drives; Pumps, and Fans-Efficient Control strategies, Optimal selection and sizing – Optimal operation and Storage; Case study.

UNIT-II

Feeder/cable loss evaluation, Case study Reactive Power management-Capacitor Sizing-Degree of Compensation-Capacitor losses Location-Placement Maintenance, Case study.

UNIT-III

Methodologies-Types of Industrial loads- Optimal Load, scheduling-case study, Lighting- Energy efficient light sources-Energy conservation in Lighting Schemes, Electronic ballast-Power quality issues-Luminaries, Case study.

UNIT-IV

Optimal operation of cogeneration plants-case study, Electric loads of Air conditioning & Refrigeration-Energy conservation, measures- Cool storage types Optimal operation case study.

UNIT-V

Gysers-Solar Water Heaters, Power Consumption in Compressors Energy conservation measures Electrolytic Process, Computer Controls- software – EMS

TEXT BOOKS

1 Giovanni Petrecca, "Industrial Energy Management: Principles and Applications", The Kluwerinternational series -207, 1999

2. Anthony J. Pansini, Kenneth D. Smalling, "Guide to Electric Load Management", Pennwell Pub;(1998)

REFERENCES

1. Handbook on Energy Audit and Environment Management, Y P Abbi and Shashank Jain, TERI, 2006

2. Handbook of Energy Audits Albert Thumann, William J. Younger, Terry Niehus, 2009

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I M.Tech. - I Sem (PE)

L	T	P	C
0	0	4	2

(19EE2110) POWER ELECTRONICS SIMULATION LAB

1. Write program and simulate dynamical system of following models:
   (a) I/O Model (b) State variable model also identifies time domain specifications of each.
2. Obtain frequency response of a given system by using various methods:
   (a) General method of finding the frequency domain specifications (b) Polar plot
   (c) Bode plot Also obtain the Gain margin and Phase margin.
3. Determine stability of a given dynamical system using following methods: (a) Root locus
   (b) Bode plot (c) Nyquist plot (d) Liapunov stability criteria
4. Transform a given dynamical system from I/O model to state variable model and vice versa.
   (a) Obtain model matrix of a given system, obtain it's diagonalize form if exists or obtain
   (b) Jordon Canonical form of system.
5. Write a program and implement linear quadratic regulator
6. Design a compensator for a given systems for required specifications.
7. Conduct a power flow study on a given power system.
8. Design a PID controller.
9. Conduct a power flow study on a given power system network using Guass-Seidel iterative method.
10. Develop a program to solve Swing Equation.
11. Develop a Simulink model for a single area load frequency problem and simulate the same.
12. Develop a Simulink model for a two-area load frequency problem and simulate the same.
13. Design a PID controller for two-area power system and simulate the same.
14. PSPICE Simulation of Single phase full converter using RL and E loads.
15. PSPICE Simulation of Three phase full converter using RL and E loads.
16. PSPICE Simulation of Single phase AC Voltage controller using RL load.
17. PSPICE Simulation of Three phase inverter with PWM controller.
18. PSPICE Simulation of resonant pulse commutation circuit.
19. PSPICE Simulation of impulse commutation circuit.

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L	T	P	C
0	0	4	2

(19EE2111) INDUSTRIAL AUTOMATION LAB

(Virtual Lab)

LIST OF EXPERIMENTS

1. Study hardware and software platforms for DCS
2. Simulate analog and digital function blocks
3. Study, understand and perform experiments on timers and counters
4. Logic implementation for traffic Control Application
5. Logic implementation for Bottle Filling Application
6. Tune PID controller for heat exchanger using DCS
7. FBD for autoclavable laboratory fermenter
8. Develop graphical user interface for the fermenter plant

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I M.Tech - I Sem (PE)

L	T	P	C
2	0	0	0

(19HS0818) ENGLISH FOR RESEARCH PAPER WRITING

Course objectives:

Students will be able to:

1. *Understand that how to improve your writing skills and level of readability.*
2. *Learn about what to write in each section.*
3. *Understand the skills needed when writing a Title.*
4. *Ensure the good quality of paper at very first-time submission.*

UNIT-I

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

UNIT-II

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts and Introduction.

UNIT-III

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT-IV

Key skills needed when writing a Title, key skills needed when writing abstract, key skills needed when writing an Introduction, skills when writing a Review of the Literature.

UNIT-V

Skills needed when writing the Methods, skills needed when writing the Results, skills needed when writing the Discussion, skills needed when writing the Conclusions.

REFERENCES:

1. *Goldbort R (2006) Writing for Science, Yale University Press.*
2. *Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press*
3. *Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's Books.*
4. *Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht. Heidelberg London, 2011.*

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L	T	P	C
3	0	0	3

(19EE2112) POWER ELECTRONIC CONVERTERS

Course Objectives:

- *Understand the concepts and basic operation of SCR,UJT and Commutation.*
- *Understand the various conversion techniques*

Course Outcomes:

Students will be able to:

- *To understand the various power semiconductor devices*
- *To know the various conversion techniques of power semiconductor devices and its applications*

UNIT- I

Thyristors – Silicon Controlled Rectifiers (SCR's) – BJT – Power MOSFET – Power IGBT and their characteristics and other thyristors – Basic theory of operation of SCR – Static characteristics Turn on and turn off methods- Dynamic characteristics of SCR - Turn on and Turn off times -Salient points. Two transistor analogy – SCR - UJT firing circuit —– Series and parallel connections of SCR's – Snubber circuit details – Specifications and Ratings of SCR's, BJT, IGBT - Numerical problems – Line Commutation and Forced Commutation circuits.

UNIT- II

Single-Phase and Three-Phase AC to DC converters: Half controlled configurations-operating domains of three phase full converters and semi-converters, Reactive power considerations.

UNIT- III

Analysis and design of DC to DC converters, Control of DC-DC converters: Buck converters, Boost converters, Buck-Boost converters, Cuk converters.

UNIT -IV

Single phase and three phase inverters, Voltage source and Current source inverters, Voltage control and harmonic minimization in inverters.

UNIT -V

Inverters – Single phase inverter – Basic series inverter, parallel inverter - operation and waveforms - Three phase inverters (180, 120 degrees conduction modes of operation) - Voltage control techniques for inverters, Pulse width modulation techniques - Numerical problems

TEXT BOOKS

1. *Ned Mohan, Undeland and Robbin, "Power Electronics: converters, Application and Design", John's Wiley and sons. Inc, Newyork.*
2. *M.H.Rashid, "Power Electronics", Prentice Hall of India 1994.*

SIDDARTHA INSTITUTE OF SCIENCE AND TECHNOLOGY: PUTTUR
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I M.Tech. -II Sem (PE)

L	T	P	C
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(19EE2113) DIGITAL CONTROL OF POWER ELECTRONICS AND DRIVES SYSTEMS

Course Objectives:

- *To impart knowledge on operation and performance of induction Motor, Synchronous motors and brushless DC motor and their speed control techniques*

Course Outcomes:

Students will be able to:

- *Design static Scherbius and Kramer drives to implement slip power recovery schemes*
- *Implement synchronous motor drives with fixed frequency and variable frequency sources*
- *Implement speed control schemes for Brushless D.C. motors and Permanent Magnet Synchronous motors*

UNIT I Introduction to Induction motor Drives: Induction machine Torque production, Equivalent circuit analysis – Speed-Torque Characteristics with Variable voltage, constant frequency operation, Variable frequency operation, constant v/f operation, Variable stator current operation ,Induction motor characteristics in constant torque and field weakening regions

UNIT II Scalar control of Induction motor drives: Voltage fed inverter control, Open loop volts/Hz control, speed control slip regulation, speed control with torque and flux control, current controlled voltage fed inverter drive, current-fed inverter control, Independent current and frequency control, Speed and flux control in Current-Fed inverter drive, Volts/Hz control of Current-fed inverter drive, Efficiency optimization control by flux program

UNIT III Slip power recovery Induction motor drives: Static Kramer Drive, Phasor diagram, Torque expression, Speed control of a Kramer Drive, Static Scherbius Drive, modes of operation, Wound field machine, equivalent circuit, developed torque, salient pole machine characteristics, synchronous reluctance machine, sinusoidal PM machines, trapezoidal PM machines

UNIT IV Control of Wound-field Synchronous motor and SRM drives: Brush and brushless dc excitation, LCI drives and its control, scalar and vector control of cycloconverter drives, current vector control of SyRM drive, constant de-axis control, fast torque response control, maximum torque/ampere control, maximum power factor control.

UNIT V Control of PM Synchronous motor and BLDC drives: Vector control of PMSM**,** control strategies, Constant torque angle control, Unity power factor control Constant mutual flux linkage control, flux weakening operation, PMBDCM drive scheme, dynamic simulation, commutation-torque ripple, phase advancing, normalized system equations, Half wave PMBDCM drives.

TEXT BOOKS:

1. *N. Mohan, Power Electronics- Converters, Applications and Design, 3rd Ed., John Wiley & Sons, 2003.*
2. *G. K. Dubey, Fundamentals of Electrical Drives, Narosa Publishing House, 2003*.

REFERENCES:

1. *M. Rashid, Power Electronics- Circuits, Devices and Applications, 3rd Ed., Prentice Hall, 2004.*
2. *B. K. Bose, Modern Power Electronics and AC Drives, Pearson Education, 2003.*
3. *A. M. Trzynadlowski, Introduction to Modern Power Electronics, John Wiley & Sons, 1998.*
4. *M. Rashid, Power Electronics Handbook, Academic Press-Elsevier, 2001*.

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I M.Tech. - II Sem (PE)

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(19EE2114) SWITCHED MODE AND RESONANT CONVERTERS

Course Objectives:

- *To understand different types of converters*
- *To understand different switch mode topologies & control methods*
- *To understand different resonant converter topologies*

Course Outcomes:

- *Acquire knowledge about the principles of operation of non-isolated and isolated hard-switched DC-DC converters*
- *Acquire knowledge on various loss components in a switched mode converter and choice of switching frequency with a view towards design of such converters*

UNIT-I

Buck, Boost, Buck-Boost SMPS Topologies, Basic Operation-Waveforms - modes of operation - switching stresses, Switching and conduction losses. Optimum switching frequency, Practical voltage, current and power limits - design relations, Voltage mode control principles, Push-Pull and Forward Converter Topologies - Basic Operation, Waveforms, Flux Imbalance Problem and Solutions.

UNIT-II

Transformer Design. Output Filter Design. Switching Stresses and Losses, Forward Converter Magnetics. Voltage Mode Control, Half and Full Bridge Converters. Basic Operation and Waveforms, Magnetics, Output Filter, Flux Imbalance, Switching Stresses and Losses, Power Limits, Voltage Mode Control.

UNIT-III

Classification of Resonant Converters. Basic Resonant Circuit Concepts, Load Resonant Converter, Resonant Switch Converter, Zero, Voltage Switching Clamped Voltage Topologies. Resonant DC Link Inverters with Zero Voltage Switching, High Frequency Link Integral Half Cycle Converter, and Fly back Converter- discontinuous mode operation, waveforms, control, Magnetics- Switching Stresses and Losses, Disadvantages – Continuous Mode Operation, waveforms, control, design relations.

UNIT-IV

Voltage Mode Control of SMPS- Loop Gain and Stability Considerations, Error Amp– frequency Response and Transfer Function, Trans-conductance Current Mode Control of SMPS, Current Mode Control Advantages, Current Mode vs. Voltage Mode. Current Mode Deficiencies, Slope Compensation, Study of a typical Current Mode PWM Control IC UC3842. Modelling of SMPS.

UNIT-V

DC Transformer, Voltage Mode SMPS Transfer Function, General Control Law Consideration, MI Generation and Filtering in SMPS - Conducted and Radiated Emission Mechanisms in SMPS, Techniques to reduce Emissions, Control of Switching Loci, Shielding and Grounding, Power Circuit

Layout for minimum EMI,EMI Filtering at Input and Output, Effect of EMI Filter on SMPS Control Dynamics, Introduction to Resonant Converters.

TEXT BOOKS:

1. *Abraham I Pressman, "Switching Power Supply Design," McGraw Hill Publishing Company, 2001.*
2. *Daniel M Mitchell, "DC-DC Switching Regulator Analysis," McGraw Hill Publishing Company-1988.*

REFERENCES:

1. *Ned Mohan et.al, "Power Electronics," John Wiley and Sons 2006.*

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I M.Tech. - II Sem (PE)

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(19EE2115) INDUSTRIAL LOAD MODELLING AND CONTROL

Course Objectives:

- *To understand the energy demand scenario*
- *To understand the modeling of load and its ease to study load demand industrially*
- *To know Electricity pricing models*
- *Study Reactive power management in Industries*

Course Ooutcomes:

Students will be able to:

- *Knowledge about load control techniques in industries and its application.*
- *Different types of industrial processes and optimize the process using tools like LINDO and LINGO.*
- *Apply load management to reduce demand of electricity during peak time.*
- *Apply different energy saving opportunities in industries*

UNIT-I

Demand Side Management-Industrial Load Management. Load Curves-Load Shaping Objectives-Methodologies, Barriers; Classification of Industrial Loads- Continuous and Batch processes -Load Modelling.

UNIT-II

Dynamic and spot pricing –Models. Direct load control- Interruptible load control. Bottom up approach- scheduling- Formulation of load models- Optimization and control algorithms.

UNIT-III

load profiling- Modelling., Cool storage-Types- Control strategies., Optimal operation-Problem formulation- Case studies., Selection of Schemes Optimal Operating Strategies.

UNIT-IV

Operating and control strategies- Power Pooling, Operation models. Energy banking-Industrial Cogeneration, Reactive power management in industries-controls-power quality impacts.

UNIT-V

Constraints-Problem formulation- Case study, Integrated Load management for Industries, impacts, application of filters Energy saving in industries.

TEXT BOOKS:

1. *C.O. Bjork "Industrial Load Management - Theory, Practice and Simulations", Elsevier, the Netherlands, 1989.*
2. *C.W. Gellings and S.N. Talukdar, "Load management concepts," IEEE Press, New York, 1986, pp. 3-28.*

REFERENCES:

1. *Y. Manichaikul and F.C. Schweppe," Physically based Industrial load", IEEE Trans. on PAS, April 1981.*
2. *H. G. Stoll, "Least cost Electricity Utility Planning", Wiley Interscience Publication, USA, 1989.*

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I M.Tech. - II Sem (PE)

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(19EE2116) ADVANCED DIGITAL SIGNAL PROCESSING

Course Objectives:

- *To understand the difference between discrete-time and continuous-time signals*
- *To understand and apply Discrete Fourier Transforms (DFT)*

Course Outcomes :

Students will be able to:

- *Knowledge about the time domain and frequency domain representations as well analysis of discrete time signals and systems*
- *Study the design techniques for IIR and FIR filters and their realization structures.*
- *Acquire knowledge about the finite word length effects in implementation of digital filters.*
- *Knowledge about the various linear signal models and estimation of power spectrum of Stationary random*

UNIT-I

Analog to digital and Digital to Analog conversion, sampled and Hold circuit, Continuous time Fourier Transforms, Discrete time signals and systems, Discrete time Fourier transform, its properties and applications, Fast Fourier Transform (in time domain and Frequency domain), IDFT and its properties.

UNIT-II

Definition and properties, Rational z-transforms, Region of convergence of a rational z-Transform, The inverse z-Transform, z-Transform properties, Computation of the convolution sum of finite, length sequences, The transfer function.

UNIT-III

Block Diagram representation, Equivalent structures, Basic FIR Digital Filter structures, Basic IIR Digital Filter structures, Realization of Basic structures using MATLAB, All pass filters, Computational complexity of Digital filter structures.

UNIT-IV

Preliminary considerations, Bilinear transformation method of IIR Filter design, Design of low pass IIR Digital filters, Design of High pass, Band pass and band stop IIR digital filters, Spectral Transformations of IIR filter, IIR digital filter design using MATLAB, Computer aided design of IIR digital filters.

FIR digital filter design: Preliminary considerations, FIR filter design based on windowed Fourier series, Computer aided design of Equiripple Linear phase FIR filters, Design of Minimum phase FIR filters, FIR digital filter design using MATLAB, Design of computationally efficient FIR digital filters.

UNIT-V

The quantization process and errors, quantization of Fixed point numbers, Quantization of floating point numbers, Analysis of coefficient quantization effects, Analysis of arithmetic round off errors, Low sensitivity digital filters, Reduction of product round off errors using error feedback, Round off errors in FFT algorithms.The basic sample rate alteration devices, Multi rate structures for sampling rate conversion, Multistage design of decimator and interpolator, The Polyphase decomposition, Arbitrary rate sampling rate converter, Nyquist Filters and some applications of digital signal processing.

TEXT BOOKS:

1. *Digital Signal Processing, S.K. Mitra, Tata McGraw,Hill, Third Edition, 2006.*
2. *Principle of Signal Processing and Linear Systems, B.P. Lathi, Oxford International Student Version, 2009*
3. *Continuous and Discrete Time Signals and Systems, M. Mondal and A Asif, Cambridge, 2007*

REFERENCES:

1. *Digital Signal Processing, Fundamentals and Applications, LiTan-Indian reprint,Elsevier,2008.*
2. *Discrete-Time Signal Processing, Alan V. Oppenheim, Ronald, W. Schafer, and John R.Buck, Pearson Education, 2008.*

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I M.Tech. - II Sem (PE)

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(19EE2117) ADVANCED MICRO-CONTROLLER BASED SYSTEMS

Course Objectives:

- *To understand the architecture of advance microcontrollers*
- *To understand the applications of these controllers*
- *To get some introduction to FPGA*

Course Outcomes

Students will be able to:

- *To learn how to program a processor in assembly language and develop an advanced processor based system.*
- *To learn configuring and using different peripherals in a digital system.*
- *To compile and debug a Program.*
- *To generate an executable file and use it*.

UNIT – I

Basic Computer Organization, Accumulator based processes-Architecture-Memory Organization-I/O Organization.

UNIT – II

Intel 8051, Intel 8056- Registers, Memories, I/O Ports, Serial Communication, Timers, Interrupts, Programming, Intel 8051 – Assembly language programming-Addressing-Operations-Stack & Subroutines, Interrupts-DMA.

UNIT – III

PIC 16F877- Architecture Programming, Interfacing Memory/ I/O Devices, Serial I/O and data communication.

UNIT – IV

Digital Signal Processor (DSP) - Architecture – Programming, Introduction to FPGA.

UNIT – V

Microcontroller development for motor control applications, Stepper motor control using micro controller.

TEXT BOOKS:

1. *John.F.Wakerly: "Microcomputer Architecture and Programming", John Wiley and Sons 1981.*
2. *Ramesh S.Gaonker: "Microprocessor Architecture, Programming and Applications with The 8085", Penram International Publishing (India), 1994.*
3. *Raj Kamal: "The Concepts and Features of Microcontrollers", Wheeler Publishing, 2005.*

REFERENCES:

1. *Kenneth J. Ayala, "The 8051 microcontroller", Cengage Learning, 2004.*
2. *John Morton," The PIC microcontroller: your personal introductory course", Elsevier, 2005.*
3. *Dogan Ibrahim," Advanced PIC microcontroller projects in C: from USB to RTOS with The PIC18F Series", Elsevier, 2008.*
4. *Microchip datasheets for PIC16F877.*

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I M.Tech. - II Sem (PE)

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(19EE2118) DISTRIBUTED GENERATION

Course Objectives:

- *To understand renewable energy sources.*
- *To gain understanding of the working of off-grid and grid-connected renewable energy generation schemes*

Course outcomes

Students will be able to:

- *To understand the planning and operational issues related to Distributed Generation.*
- *Acquire Knowledge about Distributed Generation Learn Micro-Grids*

UNIT-I

Need for Distributed generation, Renewable sources in distributed generation and current scenario in Distributed Generation, Planning of DGs. Sitting and sizing of DGs optimal placement of DG sources in distribution systems.

UNIT-II

Grid integration of DGs Different types of interfaces, Inverter based DGs and rotating machine based interfaces, Aggregation of multiple DG units, Technical impacts of DGs.

UNIT-III

Transmission systems Distribution Systems De-regulation Impact of DGs upon protective relaying, Impact of DGs upon transient and dynamic stability of existing distribution systems, Steady-state and Dynamic analysis.

UNIT-IV

Aspects of DGs Market facts, Issues and challenges Limitations of DGs, Voltage control techniques. Reactive power control, Harmonics Power quality issues, Reliability of DG based systems, Transients in micro-grids, Protection of micro-grids, Case
Studies, Advanced topics.

UNIT-V

Types of micro-grids: autonomous and non-autonomous grids Sizing of micro-grids, Modelling & analysis of Micro-grids with multiple DGs. Micro-grids with power electronic interfacing units.

TEXT BOOKS:

1. *H. Lee Willis, Walter G. Scott, "Distributed Power Generation – Planning and Evaluation", Marcel Decker Press.*
2. *M.GodoySimoes, Felix A.Farret, "Renewable Energy Systems – Design and Analysis with Induction Generators", CRC press.*

REFERENCES:

1. *Stuart Borlase. "Smart Grid: Infrastructure Technology Solutions" CRC Press*

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I M.Tech. - II Sem (PE)

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(19EE2119) SMART GRIDS

Course Objectives:

- *Understand concept of smart grid and its advantages over conventional grid.*
- *Know smart metering techniques.*
- *Learn wide area measurement techniques.*
- *Understanding the problems associated with integration of distributed generation & its solution through smart grid*

Course Outcomes:

Students will be able to:

- *Appreciate the difference between smart grid & conventional grid.*
- *Apply smart metering concepts to industrial and commercial installations.*
- *Formulate solutions in the areas of smart substations, distributed generation and wide area measurements.*
- *Come up with smart grid solutions using modern communication technologies*

UNIT-I

Evolution of Electric Grid Concept of Smart Grid, Definitions Need of Smart Grid, Self-Healing Grid Present development. Introduction to Smart Meters, Real Time Prizing, Smart Appliances, Automatic Meter Reading(AMR), Outage Management System(OMS), Plug in Hybrid Electric Vehicles(PHEV), Vehicle to Grid, Smart, Sensors, Home & Building Automation, Smart Substations, Substation Automation, Feeder Automation .

UNIT-II

Intelligent Electronic Devices (IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System (WAMS), Phase Measurement Unit (PMU)

UNIT-III

Need & applications of micro-grid, formation of micro-grid, Issues of interconnection, protection & control of micro-grid. Plastic & Organic solar cells, thin film solar cells, Variable speed wind generators, fuel-cells, micro-turbines, Captive power plants, Integration of renewable energy sources

UNIT-IV

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

UNIT-V

Home Area Network (HAN), Neighbourhood Area Network (NAN), Wide Area Network (WAN), Bluetooth, ZigBee, GPS, Wi-Fi, Wi-Max based communication, Wireless Mesh Network, Basics of CLOUD Computing & Cyber Security for Smart Grid, Broadband over Power line (BPL), IP based protocols

TEXT BOOKS:

1. *Ali Keyhani, "Design of smart power grid renewable energy systems", Wiley IEEE, 2011*
2. *Clark W. Gellings, "The Smart Grid: Enabling Energy Efficiency and Demand Response", CRC Press, 2009*
3. *Janaka Ekanayake, Nick Jenkins, KithsiriLiyanage, "Smart Grid: Technology and Applications", Wiley 2012*

REFERENCES:

1. *Stuart Borlase, "Smart Grid: Infrastructure, Technology and solutions "CRC Press*
2. *A.G.Phadke, "Synchronized Phasor Measurement and their Applications", Springer*

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I M.Tech. - II Sem (PE)

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(19EE2121) POWER CONVERTERS LAB

1. Speed Measurement and closed loop control using PMDC motor.
2. Thyristorised drive for PMDC Motor with speed measurement and closed Loop control.
3. IGBT used single 4 quadrant chopper drive for PMDC motor with speed measurement and closed loop control.
4. Thyristorised drive for 1Hp DC motor with closed loop control.
5. 3-Phase input, thyristorised drive, 3 Hp DC motor with closed loop
6. 3-Phase input IGBT, 4 quadrant chopper drive for DC motor with closed Loop control equipment.
7. Cyclo-converter based AC Induction motor control equipment.
8. Speed control of 3 phase wound rotor Induction motor.
9. Single-phase fully controlled converter with inductive load.
10. Single phase half wave controlled converter with inductive load.

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I M.Tech. - II Sem (PE)

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(19EE2122) INDUSTRIAL ELECTRIC DRIVES LAB
(Virtual Lab)

1 PLC Timer Instruction

2. PLC Counter Instruction

3. Garbage Shutter opening and closing using PLC

4. Container Filling Operations Limiter using PLC

7. Motor forward and reverse Process Using PLC

5. Simultaneous output interlock using PLC

6. Maximum Simultaneous direction control using PLC

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(19HS0829) CONSTITUTION OF INDIA

I M.Tech. - II Sem (PE)

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Course Objectives:

Students will be able to:

1. *Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.*
2. *Address the growth of Indian opinion regarding modern Indian intellectuals 'constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.*
3. *Address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.*

Course Outcomes:

Students will be able to:

- *Explain the key concepts of political economy*
- *Analyze the significant developments in the political ideologies*
- *Describe the salient features of the constitution of India interpret, integrate and critically*
- *Analyze the political economy of Indian international relations and gain knowledge in Judiciary system*
- *Apply their knowledge and skills acquired to write civil service examinations*

UNIT I

Meaning of the Constitution Law

UNIT II

Historical Perspective of the Constitution of India
Salient features and characteristics of the Constitution of India

UNIT III

Scheme of the fundamental rights
The scheme of the Fundamental Duties and its legal status
The Directive Principles of State Policy – Its importance and implementation
Federal structure and distribution of legislative and financial powers between the Union and the States

UNIT IV

Parliamentary Form of Government in India – The constitution powers and status of the President of India.
Amendment of the Constitutional Powers and Procedure.

The historical perspectives of the constitutional amendments in India.
Emergency Provisions : National Emergency, President Rule, Financial Emergency

UNIT V

Local Self Government – Constitutional Scheme in India.
Scheme of the Fundamental Right to Equality.
Scheme of the Fundamental Right to certain Freedom under Article19
Scope of the Right to Life and Personal Liberty under Article21

TEXT BOOKS:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition,2015

REFERENCES:

1. *M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis,2014.*
2. *D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.*

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II M.Tech.– I Sem (PE)

L	T	P	C
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(19EE2123) SCADA SYSTEM AND APPLICATIONS

Course Objectives:

- To understand PLC and its functions.
- To understand SCADA and its functions
- To know SCADA communication.
- To get an insight into its application

Course Outcomes

Students will be able to:

- Describe the basic tasks of Supervisory Control Systems (SCADA) as well as their typicalapplications**.**
- Acquire knowledge about SCADA architecture, various advantages and disadvantages of eachsystem.
- Knowledge about single unified standard architecture IEC 61850.
- To learn about SCADA system components: remote terminal units, PLCs, intelligent electronic devices, HMI systems, SCADA server.
- Learn and understand about SCADA applications in transmission and distribution sector, industries etc.

UNIT-I

PLC basics: PLC system, I/O modules and interfacing, CPU processor, programming equipment, programming formats, construction of PLC ladder diagrams, devices connected to I/O modules

UNIT-II

Introduction to SCADA , Data acquisition systems, Evolution of SCADA, Communication technologies, Monitoring and supervisory functions, SCADA applications in Utility Automation, SCADA System Components.

UNIT-III

Need of computer control of power systems, concept of energy control center (or) load dispatch center and the functions, system monitoring, data acquisition and control, system hardware configuration, SCADA and EMS functions, network topology, state estimation, security analysis and control, operating states.

UNIT-IV

SCADA System Components: Schemes- Remote Terminal Unit (RTU), Intelligent Electronic Devices (IED), Programmable Logic Controller (PLC), Communication Network, SCADA Server, SCADA/HMI Systems.

UNIT-V

Utility applications- Transmission and Distribution sector -operations, monitoring, analysis and improvement. Industries - oil, gas and water. Case studies,

Implementation, Simulation Exercises.

TEXT BOOKS

1. Stuart A. Boyer: "SCADA-Supervisory Control and Data Acquisition", Instrument Society of America Publications,USA,2004
2. Gordon Clarke, Deon Reynders: "Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems", Newnes Publications, Oxford, UK,2004
3. William T. Shaw, "Cybersecurity for SCADA systems", PennWell Books, 2006
4. David Bailey, Edwin Wright, "Practical SCADA for industry", Newnes, 2003
5. Michael Wiebe, "A guide to utility automation: AMR, SCADA, and IT systems for electric power", PennWell 1999

REFERENCES:

1. P.Kundur ; "Power System Stability and Control", EPRI Publications, California 1994.
2. Nagrath, I.J. and Kothari D.P., 'Modern Power System Analysis', TMH, New Delhi, 1980
3. D.P.Kothari & J.S.Dhillon, Power System Optimization, PHI, 2004

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II M.Tech. - I Sem (PE)

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(19EE2124) FACTS AND CUSTOM POWER DEVICES

Course Objectives:

- To learn the active and reactive power flow control in power system
- To understand the need for static compensators
- To develop the different control strategies used for compensation

Course Outcomes:

Students will be able to:

- Acquire knowledge about the fundamental principles of Passive and Active Reactive Power Compensation Schemes at Transmission and Distribution level in Power Systems.
- Learn various Static VAR Compensation Schemes like Thyristor/GTO Controlled.
- Reactive Power Systems, PWM Inverter based Reactive Power Systems and their controls.
- To develop analytical modeling skills needed for modeling and analysis of such Static VARSystems

UNIT-I

Reactive power control of dynamic power unbalances in Power System - Power flow control Constraints of maximum transmission line loading Benefits of FACTS Transmission line compensation Uncompensated line -Shunt compensation, Series compensation Phase angle control Reactive power compensation Shunt and Series compensation principles Reactive compensation at transmission and distribution level

UNIT-II

Static versus passive VAR compensator, Static shunt compensators: SVC and STATCOM

Operation and control of TSC, TCR and STATCOM –Compensator control Comparison between SVC and STATCOM

UNIT-III

TSSC, SSSC -Static voltage and phase angle regulators TCVR and TCPAR Operation and Control, Applications, Static series compensation GCSC, TSSC, TCSC and Static synchronous series compensators and their Control

UNIT-IV

SSR and its damping Unified Power Flow Controller, Circuit Arrangement, Operation and control of UPFC, Basic Principle of P and Q control, Independent real and reactive power flow control-Applications.

UNIT-V

Modelling and analysis of FACTS Controllers Simulation of FACTS controllers Power quality problems in distribution systems, harmonics, loads that create harmonics modelling, harmonic propagation, series and parallel resonances

Mitigation of harmonics passive filters, active filtering – shunt, series and hybrid and their control

TEXT BOOKS:

1. K R Padiyar, “FACTS Controllers in Power Transmission and Distribution”, New Age International Publishers, 2007
2. X P Zhang, C Rehtanz, B Pal, “Flexible AC Transmission Systems- Modelling and Control”, SpringerVerlag, Berlin, 2006

REFERENCES:

1. N.G. Hingorani, L. Gyugyi, “Understanding FACTS: Concepts and Technology of Flexible ACTransmission Systems”, IEEE Press Book, Standard Publishers and Distributors, Delhi, 2001.
2. K.S.Sureshkumar, S.Ashok, “FACTS Controllers & Applications”, E-book edition, Nalanda DigitalLibrary, NIT Calicut, 2003

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II M.Tech.– I Sem (PE)

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(19EE2125) HVDC TRANSMISSION SYSTEMS

Course Objectives:

- To introduce students with the concept of HVDC Transmission system
- To familiarize the students with the HVDC converters and their control system.
- To expose the students to the harmonics and faults occur in the system and their prevention.

Course Outcomes:

Students will be able to:

- Choose intelligently AC and DC transmission systems for the dedicated application(s).
- Identify the suitable two-level/multilevel configuration for high power converters.
- Select the suitable protection method for various converter faults.

UNIT-I

HVDC Transmission system: Introduction, comparison of AC and DC systems, applications of DC transmission, types of DC links, Layout of HVDC Converter station and various equipments. HVDC Converters, analysis of bridge converters with and without overlap, inverter operation, equivalent circuit representation of rectifier and inverter configurations

UNIT-II

Pulse number, Choice of converter configuration, Simplified analysis of Graetz circuit, Converter bridge characteristics, Characteristics of a twelve-pulse converter, Detailed analysis of converters with and without overlap.

UNIT-III

General, Principles of DC link control, Converter control characteristics, System control hierarchy, Firing angle control, Current and extinction angle control, Starting and stopping of DC link, Power control, Higher level controllers

UNIT-IV

Harmonics in HVDC systems, harmonicas elimination, AC & DC filter, Interaction between HVAC & DC systems –voltage interaction, harmonic instability problems and DC power modulation.

Multi-terminal DC link and systems; series, parallel and series parallel systems, their operation and control.

UNIT-V

Transient over voltage in HVDC systems: Over voltages due to disturbance on DC side, over voltages due to DC and AC side line faults. Converter faults and protection in HVDC systems: Converter faults, over current protection-valve group and DC line protection. Over voltage protection of converters, surge arresters

TEXT BOOKS:

1. K.R.Padiyar: High Voltage Direct current Transmission, Wiely Eastern Ltd.
2. J.Arillaga: H.V.D.C.Tranmission peter peregrilnus ltd., London UK 1983

REFERENCES:

1. E.W.Kimbark: Direct current Transmission, Wiely inter Science-New york.
2. E.Uhlman: Power Transmission by Direct Current Springer Verlag, Berrlin

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(19HS0824) BUSINESS ANALYTICS

Course Objective:

- To understand the management and administration, functions of management, formal and informal organization, staffing, creativity and innovation, process of communication.

Course Outcomes:
Students will be able to:

- Design, device, and query relational databases for operative data.
- Design, implement, populate and query data warehouses for informational data.
- To integrate very large data sets to make business decisions.
- Evaluate the use of data from acquisition through cleansing, warehousing, analytics, and visualization to the ultimate business decision.
- Evaluate the key concepts of business analytics.
- Determine when to implement relational versus document oriented database structures.

UNIT-I
Introduction to Descriptive analytics, Descriptive Statistics, Probability Distributions, Inferential Statistics through hypothesis tests, Permutation & Randomization Test

UNIT-II
Regression, ANOVA (Analysis of Variance), Machine Learning Introduction and ConceptsDifferentiating, algorithmic and model based frameworks, Regression: Ordinary Least Squares, Ridge Regression, Lasso Regression, K Nearest Neighbors', Regression &Classification

UNIT-III
Supervised Learning with Regression and Classification techniques- Bias-Variance Dichotomy, Model Validation Approaches, Logistic Regression, Linear DiscriminantAnalysis, Quadratic Discriminant Analysis, Regression and Classification Trees, Support Vector Machines, Ensemble Methods: Random Forest, Neural Networks, Deep learning

UNIT-IV
Unsupervised Learning and Challenges for Big Data Analytics- Clustering, Associative Rule Mining, Challenges for big data analytics

UNIT-V
Prescriptive analytics Creating data for analytics through designed experiments, creating data for analytics through Active learning, creating data for analytics through Reinforcement learning, Graph Visualization, Data Summaries, Model Checking & Comparison

TEXT BOOKS:

1. Hastie, Trevor, et al. The elements of statistical learning.Vol.2.No. 1. New York: springer,2009.
2. Montgomery, Douglas C., and George C. Runger. Applied statistics and probability for engineers. John Wiley & Sons, 2010
3. Bekkerman et al. Scaling up Machine Learning

REFERENCES:

1. Tom White "Hadoop: The Definitive Guide" Third Edition, O"reilly Media, 2012.
2. AnandRajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
3. Vincent Granville, Developing Analytic Talent: Becoming a Data Scientist, wiley, 2014.
4. Jeffrey Stanton & Robert De Graaf, Introduction to Data Science, Version 2.0, 2013.

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(19ME3121) INDUSTRIAL SAFETY

COURSE OBJECTIVES*:*

1. *To learn about mechanical and electrical hazards.*
2. *To learn about Fundamentals of Maintenance Engineering.*
3. *To learn about Wear and Corrosion and their prevention.*
4. *To know about Fault Tracking*
5. *To learn about Periodic and preventive maintenance.*

COURSE OUTCOMES:

Students undergoing this course are able to

1. *Understand the points of factories act 1948 for health and safety.*
2. *Understand the cost & its relation with replacement economy.*
3. *Understand the concepts of Wear and Corrosion Prevention*
4. *Understand the concepts of sequence of fault finding activities*
5. *Understand the Program and schedule of preventive maintenance of mechanical and electrical equipment.*
6. *Understand the Periodic Maintenance of Equipments*

UNIT-I

Industrial Safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and fire fighting, equipment and methods.

UNIT-II

Fundamentals of Maintenance Engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT-III

Wear and Corrosion and their Prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT-IV

Fault Tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT-V

Periodic and Preventive Maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Text Books:

1. *Higgins & Morrow, Maintenance Engineering Handbook, Da Information Services.*
2. *H. P. Garg, Maintenance Engineering, S. Chand and Company.*

Reference Books:

1. *Audels, Pump-hydraulic Compressors, Mcgrew Hill Publication.*
2. *Winterkorn, Foundation Engineering Handbook,Chapman & Hall London.*

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(19ME3021) ADVANCES IN OPERATIONS RESEARCH

COURSE OBJECTIVES:

On successful Completion of this course the student will be able to

1. *Enumerate the fundamentals of Linear Programming*
2. *Learn classical optimization techniques*
3. *Develop the best strategy of Game and identifying the Queuing theory.*
4. *Understand about sequence and optimum Duration of the Project*
5. *Develop the importance of Replacement models and Inventory control*

COURSE OUTCOMES

On successful Completion of this course the student will be able to

1. *Create mathematical models of the real time situations.*
2. *Implement Transportation and Assignment problems to solve in real time industry*
3. *choose the best strategy of Game and capable of identifying the suitable queuing theory*
4. *Enumerate fundamental techniques and apply it to solve various optimization areas*
5. *Investigate, study, Apply knowledge in Replacement models and*
6. *Understand the Inventory control Models*

UNIT-I

Introduction to OR and Linear Programming-OR definition–Types of Operations Research models; Linear Programming- Problem Formulation, Graphical Method, Simplex Method, Big-M Method, Degeneracy - Problems

UNIT-II

Transportation Problem – Formulation; Initial Basic Feasible Solution-North-West Corner Rule, Least Cost Method, Vogel‘s Approximation Method, Modified Distribution (MODI) Method, Unbalanced Transportation - Problems

Assignment Problem – Formulation, Optimal Solution -Traveling Salesman problem.

UNIT-III

Game Theory - Introduction – Minimax (Maxi mini) Criterion and Optimal Strategy, Saddle Point, Solution of Games with Pure Strategy and Mixed Strategies – 2 X 2 Games – Dominance Principle.

Queuing Theory- Introduction to queuing system–Service Channel, Arrival Pattern, Size of Population, Service Pattern, Queue Discipline, Customer Behavior, Probability Distribution-Birth & Death Process, Simple Problems on Single Service channel only.

UNIT-IV

Sequencing –Terminology - Johnson's Algorithm for n-jobs x 2 Machines and n-jobs x 3 machines models - Problems

PERT & CPM: Introduction, Difference between PERT and CPM, Terminology- Activities, Events, Predecessor, Early Start, Early Finish, Late Start & Late Finish Times, Earliest Occurrence and Latest Occurrence of the Event, Total Float, Free Float, Independent Float; CPM- Deterministic Model; PERT- Probabilistic Model, Critical Path, Optimal Project Duration, Least Possible Project Duration- Problems.

UNIT-V

Replacement – Failure Mechanism of Items**,** Types of Replacements- Individual Replacement policy, Group Replacement policy, Replacement of items fail suddenly – problems

Inventory - Necessity for maintaining inventory, inventory costs, classification of fixed order quantity inventory models, selective inventory management techniques.

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TEXT BOOKS:

1. *S D. SHARMA Operations Research KNRN Publications. 17th edition 2015*
2. *Hamdy A Taha , Operations Research Pearson Publications, 9 th edition 2015*

REFERENCES BOOKS

1. Manohar Mahajan Operations Research, Dhanpat Rai &Co 2016
2. Er. Prem kumar Guptha & Dr.D.S.Hira Operations Research, Schand publications 2012.
3. *R Panneerselvam Operations Research PHI, 2nd edition, 2012.*

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(19CE1028) COST MANAGEMENT OF ENGINEERING PROJECTS

Course Objectives:

- To study fundamentals of engineering project economics
- To understand dynamics of money over time
- To understand the significance of Benefit & Cost Analysis

Course Outcomes:

Student can access the present value and future value for money

- Student can apply the principals of Benefit & Cost Analysis and
- Break-Even comparison
- Student can calculate the depreciation cost for construction equipment and can estimate the cost for construction equipment
- Can prepare profit and loss, balance sheets etc

UNIT – I

Engineering economics : Basic principles – Time value of money, Quantifying alternatives for decision making, Cash flow diagrams, Equivalence- Single payment in the future (P/F, F/P), Present payment compared to uniform series payments (P/A, A/P), Future payment compared to uniform series payments (F/A, A/F), Arithmetic gradient, Geometric gradient.

UNIT – II

Comparison of alternatives: Present, future and annual worth method of comparing alternatives, Rate of return, Incremental rate of return, Break-even comparisons, Capitalized cost analysis, Benefit-cost analysis.

UNIT – III

Depreciation, Inflation and Taxes: Depreciation, Inflation, Taxes.

Equipment economics: Equipment costs, Ownership and operating costs, Buy/Rent/Lease options, Replacement analysis.

UNIT – IV

Cost Estimating: Types of Estimates, Approximate estimates – Unit estimate, Factor estimate, Cost indexes, parametric estimate, and Life cycle cost.

UNIT – V

Financial management: Construction accounting, Chart of Accounts, Financial statements – Profit and loss, Balance sheets, Financial ratios, Working capital management.

TEXT BOOKS

1. Blank, L. T. and Tarquin, A. J., “Engineering Economy”, Fourth Edition, WCB/McGraw-Hill, 1998.
2. Bose, D. C., “Fundamentals of Financial management”, 2nd ed., PHI, New Delhi, 2010.

REFERENCE BOOKS:

1. Boyer, C. B. and Merzbach, U. C., “A History of Mathematics”, 2nd ed., John Wiley & Sons, New York, 1989.

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(19ME3022) COMPOSITE MATERIALS

COURSE OBJECTIVES

1. *To understand the mechanical behavior of composite materials*
2. *To get an overview of the methods of manufacturing composite materials.*
3. *To know the fundamentals of composite materials.*
4. *To understand the fabrication and process of composites.*
5. *To recognize the applications of composite materials.*

COURSE OUTCOMES

Upon completion of this course, the students will have an overview of

1. *Fundamental concept of composite materials.*
2. *Different types of composite materials.*
3. *Fabrication and processing of composite materials.*
4. *MMC & CMC*
5. *Mechanical behavior of composite materials.*
6. *Application of composite materials .*

UNIT-I:

Introduction To Composites: Fundamentals of composites – need– enhancement of properties – classifications —Introduction to Reinforcement composites–types. Applications. Fiber production techniques for glass, carbon and ceramic fibers –Resin materials-Types.

UNIT-II:

Polymer Matrix Composites: Fabrication of PMC's ,Fabrication of Fibers, Plastic Fiber Forms, Pre-pregs, Molding Compounds-Processes, Lay-Ups, Filament Winding, Pultrusion, and Recycling. Matrix – Reinforcement Interface, Wettability.

UNIT-III:

MMC&CMC : Fabrication of MMC'S, Liquid Infiltration- Casting, Solid State Processes-Diffusion Bonding &In Situ Technique. Fabrication of CMC's, Hot-Pressing, Infiltration, In Situ Chemical reaction Techniques. CVD& CVI, Sol-gel.

UNIT-IV:

Mechanics of Composites: Basic assumptions of laminated anisotropic plates, symmetric laminates, angle ply laminates, cross ply laminates, laminate structural moduli, evaluation of lamina properties, determination of lamina stresses, maximum stress and strain criteria, Von -Mises Yield criterion for isotropic materials, generalized Hill's criterion for anisotropic materials, Tsai-Hill's criterion for composites, prediction of laminate failure, thermal analysis of composite laminates

UNIT-V :

Applications Of Composites: Applications of advanced composite materials. Environmental effects in Composites, Green composites, Synthesis and Properties of Nano composites. Surface Composites & Surface metal matrix composites: Need, Synthesis, Properties and applications.

TEXT BOOKS:

1. Mathews F. L. and Rawlings R. D., "*Composite Materials: Engineering and Science*", 1st Edition, Chapman and Hall, London, England, 1994.
2. Chawla K. K., "*Composite materials*", Second Edition, Springer – Verlag, 1998.

REFERENCES:

1. Clyne, T. W. and Withers, P. J., "*Introduction to Metal Matrix Composites*", Cambridge University Press, 1993.
2. Strong, A.B., "*Fundamentals of Composite Manufacturing*", SME, 1989.
3. Sharma, S.C., "*Composite materials*", Narosa Publications, 2000.

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(19EE2128) WASTE TO ENERGY

Course Objectives:

- To study fundamentals of industrial waste conversion devices
- To understand Manufacture of pyrolytic oils and gases, yields and applications
- To understand the Equilibrium and kinetic consideration in gasifier operation
- Tounderstand the Thermo chemical conversion

Course Outcomes:

Students will be able to:

- To study fundamentals of industrial waste conversion devices
- To understand Manufacture of pyrolytic oils and gases, yields and applications
- To understand the Equilibrium and kinetic consideration in gasifier operation
- Tounderstand the Thermo chemical conversion

UNIT-I

Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors.

UNIT-II

Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods -Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT-III

Gasifiers – Fixed bed system – Downdraft and updraft gasifiers –Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT-IV

Biomass stoves – Improved chullahs, types, some exotic designs, fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT-V

Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

TEXT BOOKS:

1. Non-Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.

2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.

REFERENCES:

1. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.