## Syllabus for M.Tech Power Electronics & Drives

### Semester I

<table>
<thead>
<tr>
<th>PED – 11</th>
<th>Advanced Mathematics</th>
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<tbody>
<tr>
<td><strong>OPTIMIZATION FUNDAMENTALS</strong>&lt;br&gt;Definition, classification of optimization problems, Unconstrained and constrained optimization, optimality conditions.</td>
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<tr>
<td><strong>LINEAR PROGRAMMING</strong>&lt;br&gt;Simplex Method, Duality, Sensitivity methods.</td>
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<tr>
<td><strong>SIMULATED ANNEALING</strong>&lt;br&gt;Simulated annealing, Evolutionary Programming, Genetic algorithm and Genetic Engineering. Finite Element Based Optimization.</td>
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<tr>
<td><strong>STOCHASTIC PROCESS</strong>&lt;br&gt;Examples, Specifications of Stochastic Process, stationary process, Difference equation, Roots of equations, Probability and random variables</td>
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<td><strong>REFERENCE BOOKS</strong></td>
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<th>PED – 12</th>
<th>Power Converters</th>
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<tr>
<td><strong>IMPROVED P.F. CONVERTERS</strong>&lt;br&gt;Fully controlled and half controlled converters, Controlled freewheeling, sequence control of converters, simultaneous control of converters, PWM converters, power factor improvement techniques</td>
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<td><strong>DC-DC SWITCH MODE CONVERTERS</strong>&lt;br&gt;DC-DC converter systems – control of DC-DC converters, Buck converters – Continuous and discontinuous modes – Boost converters – continuous and discontinuous modes – Buck boost converters – continuous and discontinuous and discontinuous modes. Cuck converters – continuous and discontinuous models – DC-DC converter comparison; ZVS and ZCS resonant converters.</td>
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<tr>
<td><strong>CHOPPERS</strong>&lt;br&gt;Classification of DC chopper circuits – analysis of type A chopper and type B chopper – voltage, current and load commutation of choppers – step up chopper – pulse width modulated AC choppers – Current topologies and Harmonic elimination methods.</td>
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<tr>
<td><strong>INVERTERS</strong>&lt;br&gt;Characteristics – output voltage and waveform control – bridge inverters – single phase and three phase versions – multilevel inverters: diode clamped MLI, flying capacitor MLI, cascade MLI,</td>
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### PED – 13  Analysis of Machines

**INTRODUCTION** – Unified approach to the analysis of electrical machine – basic two-pole machine – Kron’s primitive machine – voltage, power and torque equation – linear transformation from 3-phase to 2-phase - transformation from rotating axes to stationary axes – power invariance – park’s transformation for 3-phase synchronous and induction machines.

**INDUCTION MACHINES** – 3-phase induction machine- generalized model – voltage equation – electric transients in induction machines – applications in speed control of induction machine – induction motor modeling in arbitrary reference frame and in field oriented frame


### REFERENCE BOOKS

2. Krauss, Wasyncsuk and Sudholf, *Analysis of Electrical Machines and Drive Systems*, John Wiley

### PED – 14  Electric Drives

**COMPONENTS OF ELECTRICAL DRIVES** – electric machines, power converter, controllers - dynamics of electric drive - torque equation - equivalent values of drive parameters- components of load torques types of load - four quadrant operation of a motor — steady state stability - load equalization – classes of motor duty- determination of motor rating


synchronous speed operation, introduction to vector control


REFERENCE BOOKS

1. R. Krishnan, Electrical Motor Drives, PHI
2. GK Dubey, Fundamentals of Electrical Drives, Narosa
3. GK Dubey, Power Semi-conductor Controlled Drives, Prentice Hall
4. Bimal K Bose, Modern Power Electronics & AC Drives, PHI
5. S A Nasar, Boldea, Electrical Drives, CRC press
7. W Leohnard, Control of Electric Drives, Springer
8. Murphy and Turnbill, Power Electronic Control of AC motors, Pergamon Press
9. Vedam Subarhmanian, Electric Drives, TMH

PED – 15 DSP & Microcontrollers

INTRODUCTION TO MICROCONTROLLERS – Overview of Microprocessor and peripheral chips, - Intel 8051 - Intel 8096
MICROCONTROLLER – architecture, memory organization, ports, timers, serial port, interrupts, instruction set, assembly language programming
INTRODUCTION TO SIGNAL PROCESSING: Review of Laplace transform, Z transform, Fourier transform. Discrete Fourier transform, Fast Fourier transform, Algorithms and complexity, Introduction to linear optimal filtering
DIGITAL FILTER: Definition and anatomy of a digital filter, Frequency domain description of signals and systems, Typical application of digital filters, Replacing analog filters with digital filters, Filter categories: recursive and non-recursive
DIGITAL FILTER STRUCTURES: The direct form I and II structures, Cascade combination of second order sections, Parallel combination of second order sections, Linear-phase FIR filter structures, Frequency sampling structure for the FIR filter
Effect of Word Length: Round off error, Truncation error, Quantization error, Limit cycle

REFERENCE BOOKS

2. Ramesh S.Gaonker: Microprocessor Architecture, Programming and Applications with the 8085, Penram International Publishing (India).
Note: Minimum 8 experiments are to be performed from the following out of which at least three should be simulation based.

**List of Experiments**

1. IGBT based three phase inverter
2. IGBT based single phase PWM inverter
3. Three phase half wave cycloconverter
4. Simulation of Three phase semi converter
5. Simulation of Three phase fully controlled converter
6. Simulation of single phase dual converter
7. To study speed control of three phase induction motor using three phase voltage source inverter.
8. Simulation of single phase semiconverter for R, RL and RLE load
9. Simulation of three phase semiconverter for R, RL and RLE load
10. Simulation of three phase full bridge inverter at (a) 180 degree mode operation (b) 120 degree mode operation