Chhattisgarh Swami Vivekanand Technical University, Bhilai

SCHEME OF EXAMINATION

M.E. (POWER ELECTRONICS) in the Department of Electrical Engg.

IInd SEMESTER

<table>
<thead>
<tr>
<th>S N</th>
<th>Board of study</th>
<th>Subject code</th>
<th>Subject Name</th>
<th>Periods per week</th>
<th>Scheme of exam</th>
<th>Total Marks</th>
<th>Credit</th>
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<td>L</td>
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<td>P</td>
<td>ESE</td>
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<td>1</td>
<td>Electrical Engg.</td>
<td>562211(24)</td>
<td>Switched mode Power Conversion</td>
<td>3</td>
<td>1</td>
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<td>2</td>
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<td>562212(24)</td>
<td>Power Electronics Drives</td>
<td>3</td>
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<td>3</td>
<td>Electrical Engg.</td>
<td>562213(24)</td>
<td>PWM Converters &amp; Applications</td>
<td>3</td>
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<td>EHV AC &amp; DC</td>
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<td>Elective – 2</td>
<td>3</td>
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<td>-</td>
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<td>6</td>
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<td>562221(24)</td>
<td>Power Modules Lab</td>
<td>-</td>
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<td>3</td>
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<td>Power Electronics Simulation Lab</td>
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<td>15</td>
<td>5</td>
<td>6</td>
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L- Lecture, T- Tutorial, P- Practical, ESE- End Semester Examination, CT- Class Test, TA- Teacher’s Assessment.

Note : Duration of all theory papers will be of Three Hours.

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<th>Table – 2</th>
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Elective – 2

<table>
<thead>
<tr>
<th>Board of Study</th>
<th>Code</th>
<th>Subject</th>
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<tbody>
<tr>
<td>Electrical Engg.</td>
<td>562231(24)</td>
<td>Fuzzy Systems</td>
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<tr>
<td>Electrical Engg.</td>
<td>562232(24)</td>
<td>Optimization Techniques</td>
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</table>

Note (1) – 1/4th of total strength of students subject to minimum of twenty students is required to offer an elective in the college in a Particular academic session.

Note (2) – Choice of elective course once made for an examination cannot be changed in future examinations.
Chhattisgarh Swami Vivekanand Technical University, Bhilai

Semester: M. E. II  
Subject: Switched Mode Power Conversion  
Total Theory Periods: 40  
Total Marks in End Semester Exam.: 100  
Minimum number of class test to be conducted: 02

Branch: Electrical Engg.  
Code: 562211 (24)  
Total Tutorial Periods: 12

Unit : I

Unit : II
Basic concepts of Switched Mode power converters, DC-DC converters Characteristics, constituent elements, operating principles.

Unit : III
Steady state analysis, stress and sizing of elements, control methods, duty ratio, current programmed, frequency programmed and sliding mode control, Dynamic analysis and frequency domain models.

Unit : IV
Classification of resonant converters, Basic resonant circuit concepts, Load resonant converters, Resonant switch converters, Zero voltage switching.

Unit : V
Design of feed back compensators, unity power factor rectifiers, resistor emulation principle and applications to rectifiers.

Reference Book
Chhattisgarh Swami Vivekanand Technical University, Bhilai

Semester: M. E. II
Subject: Power Electronics Drives
Total Theory Periods: 40
Total Marks in End Semester Exam: 100
Minimum number of class test to be conducted: 02

Unit :I

Unit :II
Conventional methods of D.C. motor speed control, single phase and three phase converter fed D.C motor drive. Power factor improvement techniques, four quadrant operation.

Unit :III
Chopper fed drives, input filter design. Step-up chopper for photovoltaic systems. Braking and speed reversal of DC motor drives using choppers, multiphase choppers.

Unit :IV

Unit :V
Speed control of synchronous motors, field oriented control, load commutated inverter drives, switched reluctance motors and permanent magnet motor drives.

Reference Book
Chhattisgarh Swami Vivekanand Technical University, Bhilai

Semester: M. E. II
Subject: PWM Converters And Applications
Total Theory Periods: 40
Total Marks in End Semester Exam.: 100
Minimum number of class test to be conducted: 02

Branch: Electrical Engg.
Code: 562213 (24)
Total Tutorial Periods: 12

Unit : I
AC/DC and DC/AC power conversion, overview of applications of voltage source converters, pulse modulation techniques for bridge converters.

Unit : II
Bus clamping PWM, space vector based PWM, advanced PWM techniques, practical devices in converter; calculation of switching and conduction losses.

Unit : III
Compensation for dead time and DC voltage regulation; dynamic model of a PWM converter, multilevel converters; constant V/F induction motor drives.

Unit : IV
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.

Reference Book
Chhattisgarh Swami Vivekanand Technical University, Bhilai

Semester: **M. E. II**
Subject: **EHV-AC&DC**
Total Theory Periods: **40**
Total Marks in End Semester Exam.: **100**
Minimum number of class test to be conducted: **02**

**UNIT-1**
Sequential impedances of AC systems EHVAC transmission over voltages, insulation design of lightning and switching over voltages, High voltage testing of AC equipments, Reactive Power compensation of EHV AC lines.

**UNIT-2**

**UNIT-3**
**HVDC Converters:** Pulse Number, Choice of Converter Configuration, Simplified Analysis of Graetz Circuit, Converter Bridge Characteristics. Characteristics of a Twelve Pulse Converter, Detailed Analysis of Converters

**HVDC System Control:** Principal 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, Telecommunication Requirements

**UNIT-4**
**Converter Faults and Protection:** Converter Faults, Protection Against Overcurrents, Over voltages in a Converter Station, Surge Arresters, Protection Against Over voltages.

**Smoothing Reactor and DC Line:** Smoothing Reactors, DC Line, Transient over Voltages In DC Line, Protection of DC Line, DC Breakers, Monopolar Operation, Effects of Proximity of AC and DC Transmission Lines

**UNIT-5**
**Reactive Power Control:** Reactive Power Requirements in Steady State, Sources of Reactive Power, Static Var Systems, Reactive Power Control during Transients

**Harmonics and Filters:** Generation of Harmonics, Design of AC Filters, DC Filters, Carrier Frequency and RI Noise

**Text:**

**Reference:**
Unit : I
Different faces of imprecision – inexactness, Ambiguity, Undecidability, Fuzziness and certainty, Probability and fuzzy logic, Intelligent systems.

Unit : II
Fuzzy sets and crisp sets - Intersections of Fuzzy sets, Union of Fuzzy sets, the complement of Fuzzy sets.

Unit : III

Unit : IV
Methodology of fuzzy design - Direct & Indirect methods with single and multiple experts, Adaptive fuzzy control, Rule base design using dynamic response.

Unit : V
Fuzzy logic applications to engineering, Fuzzy decision making, Neuro-Fuzzy systems, Fuzzy Genetic Algorithms.

Reference Book
Unit : I
Linear programming – formulation-Graphical and simplex methods-Big-M method-Two phase method-Dual simplex method-Primal Dual problems.

Unit : II
Unconstrained one dimensional optimization techniques - Necessary and sufficient conditions – Unrestricted search methods- Fibonacci and golden section method- Quadratic Interpolation methods, cubic interpolation and direct root methods.

Unit : III

Unit : IV
Constrained optimization Techniques- Necessary and sufficient conditions – Equality and inequality constraints- Kuhn-Tucker conditions- Gradient projection method- cutting plane method- penalty function method.

Unit : V
Dynamic programming- principle of optimality- recursive equation approach- application to shortest route, cargo-loading, allocation and production schedule problems.

Reference Book
Chhattisgarh Swami Vivekanand Technical University, Bhilai

POWER MODULES LABORATORY

Semester: **M. E. II**
Subject: **Power Modules Laboratory**
Total Practical Periods: **40**
Total Marks in End Semester Exam.: **75**

- Development of various configurations of power modules using SCRs, IGBTs, power transistors and power MOSFETs. Practical converter design considerations- Snubber design, gate and base drive circuits.

- DC to DC converters of various configurations using SCRs, IGBTs, power transistors and power MOSFETs.

- DC to AC converters of various configurations using SCRs, IGBTs, power transistors and power MOSFETs.

- AC to AC converters of various configurations using SCRs, IGBTs, power transistors and power MOSFETs.

- Practical implementation of control techniques for voltage control, speed control and harmonic minimization.

**Reference Book**

1. Solution of transcendental equation by numerical techniques.
4. Simulation of Solid State Circuits by PSpice / MATLAB & SIMULINK.
5. Simulation of Controlled rectifiers by PSpice / MATLAB & SIMULINK.
6. Simulation of Diode rectifiers, using PSpice / MATLAB & SIMULINK.
7. Simulation of AC voltage controllers using PSpice / MATLAB & SIMULINK.
8. Simulation of DC voltage controllers using PSpice / MATLAB & SIMULINK.
9. Simulation of speed control schemes for DC and AC motors.

References