Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

SCHEME OF TEACHING & EXAMINATION

DEPARTMENT OF ELECTRICAL ENGIERNING

M.Tech in Industrial Drives and Control

(Third Semester)

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<tr>
<th>S. No.</th>
<th>Board of Study</th>
<th>Subject Code</th>
<th>Subject Name</th>
<th>Period per week</th>
<th>Scheme of Exam</th>
<th>Total marks</th>
<th>Credit L+(T+P)/2</th>
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<td>Practical / Theory</td>
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<td>Electrical Engg.</td>
<td>585311(24)</td>
<td>Advanced Electric Drives</td>
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Table – III

Elective – III

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<th>Board of Study</th>
<th>Subject Code</th>
<th>Subject Name</th>
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<tr>
<td>Electrical Engg.</td>
<td>585331(24)</td>
<td>Advanced Instrumentation System</td>
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<td>Electrical Engg.</td>
<td>585332(24)</td>
<td>Industrial control and electronics</td>
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<td>Electrical Engg.</td>
<td>585333(24)</td>
<td>Adaptive Control System</td>
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L – Lecture, T – Tutorial, P – Practical, ESE – End Semester Examination, CT – Class Test, TA – Teacher’s Assessment
Unit I: Phase controlled DC Motor drives: Phase controlled converters steady state analysis of three phase converter controlled DC motor drives, Two quadrant three phase converter controlled DC motor drives. Transfer functions of drive sub systems, Four quadrant DC motor drives, Converter selection and characteristics.

Unit II: Chopper controlled DC motor drives: Principle of operation of the chopper, Circuit for four quadrant operation of DC motor, Steady state analysis of Chopper controlled DC motor drives, Closed loop operation of chopper controlled drives.


Unit IV: Synchronous motor & Brushless DC motor drives: Types of permanent magnet synchronous machines, Vector control of PMSM drives, Control strategies, Flux weakening operation, direct and Indirect, Parameter sensitivity issues, Modeling of PMBDCM Brushless Dc motor, Drive Scheme, Half wave PMDCM drives. Parameter sensitivity issues.

Unit V: Automation using drives: Introduction and various components of automation, different sensors used in automation, Sensor less drives, Recent trends in automation and case study.

Text Books:
3. Electric Motor Drives, Modeling, analysis and control, R. Krishnan, PHI.
4. Murphy J.M.D. and Turnbull F.G., ”Power Electronics Control of AC Motors”, Franklin Book Co

Reference books:
Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Semester - M. Tech. – 3rd

Subject: Advanced Instrumentation System


Unit II : Active Electrical Transducers, Thermoelectric Transducers- Piezo electric phenomenon- Piezo electric materials- Piezo electric torque Transducers- Piezo electric Acceleration transducers-Magnetostrictive phenomenon- Magnetostrictive Acceleration transducers- Hall effect Transducers- Tachometers- variable reluctance tachometers- Electromagnetic Flow meter.

Photoelectric phenomenon- photoconductive Transducers- photovoltaic Transducers- Photo emissive Transducers-

Unit III : Pressure Transducers, Terminology, Units; Manometers – Piezometer, U-Tube Double Column Manometer, Single Column Manometer, UTube Differential Manometer, Double Reservoir Manometer, Advantages and Limitations; Bourdan Gauge, Thermal Conductivity Gauge, Pirani Gauge, Dead Weight, Piston Gauge.


Unit V : Data Acquisition and Transmission Systems, General configurations- single and multichannel DAS- A/D converters (successive approximation and dual slope integration)- sample and hold circuits- Anti alia filters- multiplexers and demultiplexers- Digital multiplexers,

Characteristics of a Telemetry system- landline telemetry- radio telemetry- frequency division multiplexing, time division multiplexing.

TEXT-BOOKS/ REFERENCES:

Unit I: Review of switching regulators and switch mode power supplies: Uninterrupted power supplies- solid state circuit breakers, contactors, relays, Analog Controllers - Proportional controllers, Proportional – Integral controllers, PID controllers, Feed forward control

Unit II: Signal conditioners: Instrumentation amplifiers – voltage to current, current to voltage, voltage to frequency, frequency to voltage converters; Isolation circuits – cabling; magnetic and electro static shielding and grounding.


Digital controller modes: Error, proportional, derivative and composite controller modes.

Unit IV: Programmable logic controller (PLC) basics: Definition, overview of PLC systems, input/output modules, General PLC programming procedures, programming on-off inputs/outputs. Auxiliary commands and functions: PLC Basic Functions: Register basics, timer functions, counter functions.

Unit V: PLC intermediate functions: Arithmetic functions, number comparison functions, Skip and MCR functions, data move systems. PLC Advanced intermediate functions: Utilizing digital bits, sequencer functions, matrix functions. PLC Advanced functions: Alternate programming languages, analog PLC operation.

Text Books
2. Thomas, E. Kissel, 'Industrial Electronics'PHI, 2003

References
<table>
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<tr>
<th>Semester - M. Tech. – 3rd</th>
<th>Specialization</th>
<th>Industrial Drives and Control</th>
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<tr>
<td>Subject: Adaptive Control System</td>
<td>Branch:</td>
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<td>Total Theory Periods: 40</td>
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<td>Total marks in End semester Exam.: 100</td>
<td>Total Tutorial Periods: 12</td>
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<td>Minimum number of class test to be conducted: 02</td>
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Unit I: **Introduction**: Basic concepts and classification, Real-Time Parameter Estimation, Identification techniques; impulse response identification, parameter estimation, learning model approach.

Unit II: **Adaptive control design**: Nodal reference adaptive control, input signal adaptive control. Practical application, adaptive autopilot, Auto-Tuning, Gain Scheduling, Self-tuning regulators.


Unit IV: **Robust and Self-Oscillating Systems**: Practical Issues and Implementation, Commercial Products and Applications, Perspectives on Adaptive Control.

Unit V: **Computer Aided Adaptive Control**: Adaptive controller adjustment – Indirect adaptive control, Direct Adaptive control, Adaptive control schemes – Model Reference Adaptive Controllers (MRAC), Self Tuning Adaptive Controllers (STAC), Adaptive control techniques.

**Text Books:**
1. Adaptive Control, Karl J. Aström, Björn Wittenmark; Pearson Ed.
2. Adaptive Control, Chatterjee & Permar; Oxford University Press.

**Reference Books:**
3. Cerebellum and Adaptive Control (Illustrated), John S. Barlow; Cambridge Univ Pr.
Unit I : Introduction
Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources: Solar, wind, ocean, Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy systems.

Unit II : Electrical Machines for Renewable Energy Conversion
Review of reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG.

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

Unit IV : Analysis of Wind and PV Systems
Stand alone operation of fixed and variable speed wind energy conversion systems and solar system-Grid connection Issues -Grid integrated PMSG and SCIG Based WECS, Grid Integrated solar system

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

Text Books:-
2. Rai. G.D, “Non conventional energy sources”, Khanna publishes,

Reference books: