Chhattisgarh Swami Vivekanand Technical University, Bhilai

Scheme of teaching and examination

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

Ist SEMESTER

SN	Board of study	Subject code	Subject Name	Periods per week			Scheme of exam			Total Marks	Credit L+(T+P)/2
				L	T	P	Theory/Practical				
							ESE	CT	TA		
1	Electrical Engg.	562111(24)	Power Converters	3	1	-	100	20	20	140	4
2	Electrical Engg.	562112(24)	Industrial Control Electronics	3	1	-	100	20	20	140	4
3	Electronics & Telecomm.	562113(24)	Microcontroller & Embedded System Design	3	1	-	100	20	20	140	4
4	Electrical Engg.	562114(24)	Modern Control Theory	3	1	-	100	20	20	140	4
5	Refer table-1		Elective - 1	3	1	-	100	20	20	140	4
6	Electrical Engg.	562121(24)	Power Converters Lab	-	-	3	75	-	75	150	2
7	Electrical Engg.	562122(24)	Microcontroller Lab	-	-	3	75	-	75	150	2
TOTAL				**15**	**5**	**6**	**650**	**100**	**250**	**1000**	**24**

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.

Table – I		
Elective – I		
Board of Study	**Code**	**Subject**
Electrical Engg.	562131(24)	Analysis & Design of Artificial Neural Network
Electrical Engg.	562132(24)	Modelling & Analysis of Electrical Machines
Electrical Engg.	562133(24)	Digital Controllers in Power Electronics Application

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.

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Semester: **M. E. I** Branch: **Electrical Engg.**
Subject: **Power Converters** Code: **562111 (24)**
Total Theory Periods**: 40** Total Tutorial Periods: **12**
Total Marks in End Semester Exam. : **100**
Minimum number of class test to be conducted: 02

Unit : I

Analysis of switched circuits- thyristor controlled half wave rectifier – R, L, RL, RC load circuits, classification and analysis of commutation.

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

AC to AC power conversion using voltage regulators, choppers and cyclo-converters, consideration of harmonics.

Text Books:

1. *Ned Mohan, Undeland and Robbin, 'Power Electronics: converters, Application and design', John Wiley and sons.Inc, Newyork,3rd edition 2002.*
2. *Rashid M.H., 'Power Electronics Circuits, Devices and Applications ', Prentice Hall India, New Delhi, 3rd edition 2004.*
3. *P.C Sen.,' Modern Power Electronics ', Wheeler publishing Co, First Edition, New Delhi, 1998.*

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Semester: **M. E. I** Branch: **Electrical Engg.**
Subject: **Industrial Control Electronics** Code: **562112 (24)**
Total Theory Periods**: 40** Total Tutorial Periods: **12**
Total Marks in End Semester Exam. : **100**
Minimum number of class test to be conducted: 02

Unit :I

Review of switching regulators and switch mode power supplies-Uninterrupted power supplies- solid state circuit breakers – programmable logic controllers

Unit :II

Analog Controllers - Proportional controllers, Proportional – Integral controllers, PID controllers, Feed forward control.

Unit :III

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.

Unit :IV

Opto-Electronic devices and control , Applications of opto isolation, interrupter modules and photo sensors – Fibre optics – Bar code equipment, application of barcode in industry.

Unit :V

Stepper motors and servo motors- control and applications. Servo motors – servo motor controllers – servo amplifiers – selection of servo motor – applications of servo motors.

Text Books:

1. Michael Jacob, 'Industrial Control Electronics – Applications and Design', Prentice Hall, 1988.

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

3. James Maas, 'Industrial Electronics', Prentice Hall, 1995.

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Semester: **M. E. I** Branch: **Elect & Telecom. Engg.**
Subject: **Microcontroller & Embedded System Design** Code: **562113(28)**
Total Theory Periods**: 40** Total Tutorial Periods: **12**
Total Marks in End Semester Exam. : **100**
Minimum number of class test to be conducted: 02

UNIT – I

Overview of Embedded System:- Embedded System, Categories of Embedded System, Requirements of Embedded Systems, Challenges and Issues in Embedded Software Development, Applications of Embedded Systems in Consumer Electronics, Control System, Biomedical Systems, Handheld computers, Communication devices.

UNIT – II

Embedded Hardware & Software Development Environment :- Hardware Architecture, Micro-Controller Architecture, Communication Interface Standards, Embedded System Development Process, Embedded Operating systems, Types of Embedded Operating systems.

UNIT – III

8 Bit microcontrollers Architecture on chip peripherals instruction set/programming of Intel MCS51 family (8 bit) microcontroller, Interfacing of 8051 with LCD, ADC, sensors, stepper motor, key board, DAC, Memory interfacing.

UNIT – IV

Real Time & Database Applications :- Real- Time Embedded Software Development, Sending a Message over a Serial Link, Simulation of a Process Control System, Controlling an Appliance from the RTLinux System, Embedded Database Applications using examples like Salary Survey, Energy Meter Readings.

UNIT – V

Microchip PIC16 family PIC16F873 processor features architecture memory organization register file map I/O ports PORTA - PORTB PORTC Data EEPROM and flash program memory Asynchronous serial port SPI mode I2C mode.

Text Books:

1. Programming for Embedded Systems- Dreamtech Software Team, Wiley Dreamtech
2. The 8051 micro controllers , M A Mazidi& Mazidi, Pearson Education
3. Design with PIC micro-controllers: John B Peatman, Pearson Education

Reference books:

1. Fundamentals of Embedded Software where C and Assembly Meet Daniel W Lewis.
2. DS101374: National Semiconductor reference manual.
3. Embedded / Real Time systems: Concepts, Design and programming, Dreamtech Software Team, Jhon Wiley & Sons.

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Semester: **M. E. I** Branch: **Electrical Engg.**
Subject: **Modern Control Theory** Code: **562114 (24)**
Total Theory Periods**: 40** Total Tutorial Periods: **12**
Total Marks in End Semester Exam. : **100**
Minimum number of class test to be conducted: 02

Unit : I - Non-Linear Control Systems
Fundamentals-common nonlinearities (saturation, dead-zone, on-off non-linearity, backlash, Hysteresis) and their describing functions. Describing function analysis of non-linear systems. Phase plane analysis, phase portraits-Singular points characterization-Analysis of non-linear systems using phase plane technique-Existence of limit cycles.

Unit : II - Stability analysis using State Space Technique
Basics, Eigen values, Eigen Vector, canonical forms, Caylay-Hamilton theorem, Computation of state transition matrix, controllability and Observability (Time Variant Systems), Effect of Pole-Zero cancellation in Transfer Function, Stability improvement by state feedback, Necessary and sufficient condition for arbitrary pole placement, Pole placement design, Ackermann's Formula for Pole Placement, design of full and reduced order state observers, design of Servo system, State Feedback with Integral control, Design of compensator.

Unit :III - Lyapunov stability analysis
Introduction - basic concepts, Concept of stability-stability in the sense of Lyapunov-absolute stability, indirect method of Lyapunov and direct method of Lyapunov with four Stability theorems. Lyapunov Stability Analysis of Linear Systems, Lyapunov function, Construction of Lyapunov function for non-linear systems - variable gradient method-Lure problem-Popov's stability criterion.

Unit :IV - Optimal Control Systems:
Introduction. static and dynamic optimization. Parameter Optimization and Optimal Control problems, Performance Index, Calculus of Variations : Euler-Language equation and transversality conditions, Lagrange multipiliers, Pontryagin's maximum principle; theory; Linear regulator problem, matrix Riccati equation and its solution, Kalman filter, linear quadratic gaussian regulator.

Unit :V - Robust Control
Introduction, definition of robust control, classification of robust control, elements of robust control theory, modeling, design objectives and specifications, additive and multiplicative perturbations, plant-controller configuration. Modeling of Parametric Uncertain Systems, robust stability analysis, Boundary crossing theorem, Schur stability test, Hurwitz stability test, robustness under perturbations, small gain theorem, stability margins.

Text Books:
1) Control Systems Engineering : I.J.Nagrath and M. Gopal; New Age International Publishers, 4th Edn.
2) Digital Control and State Variable Methods : M. Gopal; Tata McGraw-Hill, Second edition.
3) Applied Nonlinear Control : Jean-Jacques E. Slotine & Weiping Li; Prentice-Hall., NJ, 1991
4) Robust control – The parametric approach : S P Bhattacharya, L H Keel, H Chapellat; Prentice-Hall, 1995
Reference Books:
1) Modern Control Engineering : Roy Choudhary; PHI.
2) Modern Control Engineering : K. Ogata; PHI, second edition 1991.
3) Control Engineering Theory and Practice : M.N. Bandhopadhyay; PHI
4) Digital Control Systems : Benjamin.C. Kuo; Oxford University Press, Second edition

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Semester: **M. E. I** Branch: **Electrical Engg.**
Subject: **Analysis & Design of Artificial Neural Network** Code: **562131 (24)**
Total Theory Periods**: 40** Total Tutorial Periods: **12**
Total Marks in End Semester Exam. : **100**
Minimum number of class test to be conducted: 02

Unit :I

Pattern classification –Learning and generalisation-structure of neural networks – ADA line and Mada line-perceptrons

Unit :II

Linear separability – Back propagation – XOR function-Back propagation algorithm- Hopfied and Hamming networks- Kohensen's network-Boltzmenn machine-in and out star network – Art 1 and Art 2 nets

Unit :III

Neuro adaptive control applications-ART architecture – Comparison layer – Recognition layer – ART classification process – ART implementation – Examples

Unit :IV

Character recognition networks, Neural network control application, connectionist expert systems for medical diagnosis Self organizing maps

Unit :V

Applications of neural algorithms and systems: In Arts, in Bio-information, in Forecasting, in pattern & image recognition, Hardware implementation of Neural networks.

Text Books:

1. Martin T. Hogan , Howard B.Demuth, M, 'Neural network design' 4th edition,1996.
2. Zuroda, J.M.,'Introduction to Artificial Neural Systems', Jaico publishing house, Bombay, 1994.
3. Zimmermann, H.J., 'Fuzzy set theory and its applications', Allied publishers limited, Madras, 2000.

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Semester: **M. E. I** Branch: **Electrical Engg.**
Subject: **Modeling and Analysis of Electrical Machines** Code: **562132 (24)**
Total Theory Periods**: 40** Total Tutorial Periods: **12**
Total Marks in End Semester Exam. : **100**
Minimum number of class test to be conducted: 02

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 and 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 modeling 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 modeling and self controlled operation; Analysis of Switch Reluctance Motors.

Text Books:

1. *Charles Kingsley,Jr., A.E. Fitzgerald, Stephen D.Umans, 'Electric Machinery', Tata Mcgraw Hill, Fifth Edition, 1992.*
2. *R. Krishnan, 'Electric Motor & Drives: Modeling, Analysis and Control', Prentice Hall of India, 2001.*
3. *Miller, T.J.E,. 'Brushless permanent magnet and reluctance motor drives', Clarendon Press, Oxford, 1989.*

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Semester: **M. E. I** Branch: **Electrical Engg.**
Subject: **Digital controllers in Power Electronics Application** Code: **562133 (24)**
Total Theory Periods**: 40** Total Tutorial Periods: **12**
Total Marks in End Semester Exam. : **100**
Minimum number of class test to be conducted: 02

Unit :I

Introduction to the C2xx DSP core and code generation, The components of the C2xx DSP core, Mapping external devices to the C2xx core , peripherals and Peripheral Interface , System configuration registers , Memory , Types of Physical Memory , memory Addressing Modes , Assembly Programming using C2xx DSP, Instruction Set, Software Tools.

Unit :II

Pin Multiplexing (MUX) and General Purpose I/O Overview, Multiplexing and General Purpose I/O Control Registers .Introduction to Interrupts , Interrupt Hierarchy , Interrupt Control Registers , Initializing and Servicing Interrupts in Software .

Unit :III

ADC Overview , Operation of the ADC in the DSP , Overview of the Event manager (EV) , Event Manager Interrupts , General Purpose (GP) Timers , Compare Units, Capture Units And Quadrature Enclosed Pulse (QEP) Circuitry , General Event Manager Information

Unit :IV

Introduction to Field Programmable Gate Arrays – CPLD Vs FPGA – Types of FPGA , Xilinx XC3000 series , Configurable logic Blocks (CLB), Input/Output Block (IOB) – Programmable Interconnect Point (PIP) – Xilinx 4000 series – HDL programming –overview of Spartan 3E and Virtex II pro FPGA boards- case study.

Unit :V

Controlled Rectifier , Switched Mode Power Converters , PWM Inverters , DC motor control , Induction Motor Control

Text Books:

1. *Hamid.A.Toliyat and Steven G.Campbell " DSP Based Electro Mechanical Motion Control " CRC Press New York , 2004*
2. *XC 3000 series datasheets (version 3.1). Xilinx,Inc.,USA, 1998*
3. *XC 4000 series datasheets (version 1.6). Xilinx,Inc.,USA, 1999*
4. *Wayne Wolf," FPGA based system design ", Prentice hall, 2004*

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Semester: **M. E. I** Branch: **Electrical Engineering**
Subject: **Power Converters Laboratory** Code: **562121 (24)**
Total Practical Periods**: 40**
Total Marks in End Semester Exam. : **75**

Experiments and computer simulations on:

- Single phase, three phase Semi converters and Full converters,
- DC-DC Choppers using SCRs and Self communicating Devices.
- Single phase and three phase inverters using IGBTs,
- AC-AC voltage regulators.
- DC and AC drives

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Semester: **M. E. I** Branch: **Electrical Engineering**
Subject: **MICROCONTROLLER LAB** Code: **562121 (24)**
Total Practical Periods**: 40**
Total Marks in End Semester Exam. : **75**

Minimum 10 Experiments are to be performed:

1. Write a microcontroller 8051 program to transfer the bytes into RAM locations starting at 50H, assuming that ROM space starting at 240H contains CHHATTISGARH by using –
    a) a Counter,
    b) null char for end of string.
2. Write a microcontroller 8051 program to get hex data on the range of 00-FFh from port 0 and convert it to decimal. Save the digits in R7, R6 and R5, where the least significant digit is in R7.
3. Write a microcontroller 8051 program to add two 16 Bit unsigned numbers. Operands are two RAM variables. Results to be in R1-R0 pair.
4. Write a microcontroller 8051 program to subtract an unsigned 16 Bit number from another. Operands are two RAM variables. Results to be in R1-R0 pair.
5. Write a microcontroller 8051 program to add two unsigned 32-bit numbers. Operands are two RAM variables. Results to be in R1-R0 pair.
6. Write a microcontroller 8051 program to add two 16 Bit signed numbers.
7. Write a microcontroller 8051 program to convert a binary number to equivalent BCD
8. Write a microcontroller 8051 program to convert a packed BCD number to two ASCII numbers and place them in R5 and R6.
9. Write a microcontroller 8051 program to calculate the square root of an 8-bit number using iterative method.
10. Write a microcontroller 8051 program to add two floating-point numbers.
11. Write a microcontroller 8051 program to multiply two floating-point numbers.
12. Write a microcontroller 8051 program that generates 2kHz square wave on pin P1.0, 2.5 kHz on pin P1.2 and 25 Hz on pin P1.3.
13. Write a microcontroller 8051 program for counter 1 in mode 2 to count the pulses and display the state o the TL1 count on P2. Assume that the clock pulses are fed to pin T1.
14. Write a microcontroller 8051 program to transfer letter “N” serially at 9600 baud, continuously. Assume crystal frequency to be 11.0592 MHz.
15. Write a microcontroller 8051 program to transfer word “CSVTU” serially at 4800 baud and one stop bit, continuously. Assume crystal frequency to be 11.0592 MHz.
16. Write a microcontroller 8051 program to receive bytes of data serially, and put them in P1. Set the baud rate at 2400 baud, 8-bit data, and 1 stop bit. Assume crystal frequency to be 11.0592 MHz.

List of Equipments/Machine Required:
Microcontroller kit, Interfacing kit, Keyboard, Monitor, SMPS for Microcontroller
Recommended Books:
8051 Programming, Interfacing and Applications, *K.J. Ayala*; Penram Publ.