CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester - B. Tech V **Branch : Electrical Engineering**
Subject: Control System Engineering **Code: C024511(024)**
Total Theory Periods : 36 **Total Tutorial Periods: 12**
Total marks in End semester Exam : 100 **Total Credits: 4**

Course Outcomes: After completing this course students will be able to:

CO Number	Course Outcomes Statements	Knowledge level
CO1	Classify, model and obtain simplified representation in blocks and signal flow graphs.	3
CO2	Appreciate the role of feedback in the systems	3
CO3	Explain the working of different control devices like Servo Motor, Synchros and Tacho Generator.	2
CO4	Analyze the physical systems in time domain and Construct the root locus plot	3
CO5	Determine the stability of systems using frequency response techniques.	3
CO6	Design different compensators for system.	3

UNIT I: Introduction to Control problem (10 Hrs)

Open Loop and closed control systems and their differences; Classification of control systems; Industrial control examples;Mathematical models of Translational and Rotational mechanical systems, thermal systems, liquid level systems, systems with dead time.

Block diagram representation of systems; System representation by Block Diagram and reduction using block diagram algebra; System representation by Signal Flow Graph and gain evaluation using Mason's gain formula.

UNIT II: (8 Hrs)

(a) Feedback Characteristics

Effects of feedback onStability, steady state accuracy, transient accuracy, disturbance rejection, insensitivity to parameter variation.

(b) Control Hardware and their Models

Working and Transfer Function of DC Servo motor, AC Servo motor and their comparison; Synchro Transmitter and Receiver working and applications; Tacho Generators working and applications

UNIT III: Time Response Analysis (10 Hrs)

Standard test signals; Time response of second order systems; Time domain specifications; Steady state response; Steady state errors and error constants; Effects of proportional derivative and proportional integral controllers, the concept of stability; Routh stability criterion; absolute and relative stability.

Root Locus Technique: The root locus concept; construction of root loci; effects of adding poles and zeros to G(s)H(s) on the root loci

UNIT IV: Analysis in Frequency domain (10 Hrs)

Introduction to frequency response analysis and it's specifications; Polar Plots;Nyquist Plots; Application of Nyquist criterion to find the stability, gain and phase margins.

Bode diagrams concepts and construction methods; Determination of stability, gain margin and phase margin using Bode diagram.

UNIT V: Introduction to design (10 Hrs)

Compensator design (Cascade Lag, Cascade Lead, Cascade Lag-Lead) using root locus plots; Compensator design (Cascade Lag, Cascade Lead, Cascade Lag-Lead) using Bode plots.

Text Books:

1. Control Systems M. Gopal: Tata McGraw-Hill, 1997.
2. Modern Control Engineering K. Ogata, PHI, Fourth edition. 2003

Reference Books:

1. Control Systems Engineering: I.J. Nagrath and M. Gopal; New Age Intenational Publishers, Third edition, 2002.
2. Control system Engineering:. K. Bhattacharya, Pearson, Second edition
3. Control Systems:Dhanesh N. Manik, Cengage Learning.
4. Automatic control systems: Benjamin C. Kuo, Prentice Hall of India, 2002.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Branch: Electrical Engineering **Semester: V**
Subject: Power System Analysis **Code: C024512(024)**
Periods per week (L-T-P):(3-1-0) **Credits: 04**
Number of class Test to be conducted: 2 (Minimum) **No. of assignment to be submitted: 02**
Scheme of Examination (Theory): Total Marks-150 [ESE-100, CT-20, TA-30]

COURSE OUTCOMES: After successful completion of this course, the student will able to:

Unit	CO Statement	Knowledge Level
1	Develop reactance diagram and estimate fault current for three phase short circuit fault on Power System.	3
2	Develop sequence networks of power system using the sequence networks of different components like transformers, transmission line, alternators etc.	3
3	Evaluate the fault currents for different unsymmetrical faults on Power System.	5
4	Apply numerical methods to analyze a power system in steady state	3
5	Apply stability criterion to analyze stabilityof Power Systems	3

UNIT I Symmetrical Faults: Single line diagram, per unit quantities,per unit impedance of three phase transformer, expression for three phase power in p.u. impedance diagram and reactance diagram of power system, computation of voltage and current at various locations of power system using reactance diagram, three phase short circuit on power system, Calculation of different current ratings and interrupting capacity of circuit breaker. **[7 Hrs.]**

UNIT II Symmetrical Components: Expression for positive, negative & zero sequence components, existence of sequence components of current & voltages for three phase circuit, expression for three phase power in terms of symmetrical components, sequence networks of unloaded three phase alternator, three phase transmission line and three phase transformers, development of sequence networks of power system. **[7 Hrs.]**

UNIT III Unsymmetrical Faults: Single line to ground fault, line to line fault, double line to ground fault on unloaded generator, unsymmetrical faults through impedance on unloaded generator, unsymmetrical faults on power system, open conductor faults. **[8 Hrs.]**

UNIT IV Power Flow Analysis: Introduction, bus classification, bus admittance matrix, real and reactive power balance equations at a node, load and generator specifications, application of numerical methods for solution of nonlinear algebraic equations – Gauss Seidel and Newton-Raphson methods (Flow chart and computational procedure) for the solution of the power flow equations, computational issues in large-scale power systems. **[7 Hrs.]**

UNIT V Power System Stability: The stability problem, steady-state stability, transient stability, swing equations of a synchronous machine connected to an infinite bus, power angle curve, steady-state stability criterion, equal area criterion of stability, application of equal area criterion, critical clearing angle. **[7 Hrs.]**

Text Books:

1. Elements of power system analysis by W.D. Stevenson (4th Ed. Mc Graw Hill)
2. Power System Engg. by I.J. Nagrath& Kothari (Tata McGraw Hill).

Reference Books:

1. Electrical Power System by Ashfaq Hussain (4th Ed. CBS Pub. & Dist.)
2. Power System Analysis and Design by B.R. Gupta (3rd Ed S. Chand)
3. Power System Engg. by A. Chakrabarti, M.L. Soni,P.V.Gupta, V.S.Bhatnager(6th Ed DhanpatRai& Co.)

CHHATTISGARH SWAMI VIVEKANANDA TECHNICAL UNIVERSITY, BHILAI

Branch: Electrical Engineering **Semester: V**
Subject: Power Electronics **Code: C024513(024)**
Periods per week (L-T-P):(3-1-0) **Credits: 04**
Number of class Test to be conducted: 2 (Minimum) **No. of assignment to be submitted:02**
Scheme of Examination (Theory): Total Marks-150 [ESE-100, CT-20, TA-30]

COURSE OBJECTIVES:
After successful completion of this course, the student will be able to:

Unit	CO Statement	Knowledge Level
1	Describe and compare the operating characteristics of different power semiconductor switching devices.	2
2	Analyze the operation and performance of different types AC to DC Converters.	4
3	Analyze the operation and performance of different types of DC to DC Converters.	4
4	Analyze the operation and performance of different types DC to AC Converters	4
5	Analyze the operation and performance of different types AC to AC Converters	4

UNIT I: Power Semiconductor Devices : Silicon Controlled Rectifier (SCR): Structure, Operation, V-I Characteristics, Switching Characteristics, triggering methods, protection. Modern Power Electronics Devices: Power MOSFET, IGBT Operation and characteristics.

UNIT II :AC to DC Converters: Single Phase Half wave controlled Full Controlled and Half Controlled Converters with R, RL and RLE Load, with and without freewheeling diode, Effect of source inductance, Dual Converters in circulating and Non-Circulating mode, Three Phase Half wave, half and fully controlled Bridge Converter.

UNIT III : DC to DC Converters: Principle of chopper operation, control strategies, Chopper Configuration, Buck, Boost, Buck-Boost Converter, Working principle of Voltage commutated, Current commuted and Load commuted chopper.

UNIT IV : DC to AC Converters: Single phase Voltage Source Inverter, Single phase Current Source Inverter, Voltage& harmonic control, PWM techniques: Multiple PWM, Sinusoidal PWM, modified sinusoidal PWM, PWM with Uni-polar and Bipolar Voltage Switching, three phase voltage source inverters (both120^o mode and 180^o mode).

UNIT V: AC to AC Converters: AC Voltage Controller: Phase Control and Integral Cycle Control, Single phase AC voltage controllers, Sequence Control for output voltage regulation, Three phase a c regulator, Cyclo-converter: Basic principle of operation, step-up and step down single-phase to single-phase cyclo-converter.

Text Books:

1. "Power electronics Circuits, Devices and Applications", Muhammad .H. Rashid, PHI pbs.3rd Edition.
2. "Power Electronics", Dr. P.S. Bhimbra, Khanna Publishers, 3rd Edition.

Reference Books:

1. "Power Electronics Converters, applications and Design" Mohan, Undeland, Robbins, John Wiley& Sons, 3rd Edition.
2. "Power Electronic Systems: Theory and Design", JP Agarwal, 1st edition, Pearson Education.
3. "Power Electronics", M.D.Singh and K.B. Khanchandani, Mc Graw Hill India.
4. "Power Electronics, Principles and Applications", Joseph Vithayathil, McGraw Hill Series, 6th Reprint.
5. "Power Electronics: Converters, Applications and Design", Ned Mohan, Tore. M. Undeland, William. P. Robbins, John Wiley and Sons, Third edition.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

Branch: Electrical Engineering **Semester: V**
Subject: Electrical Measurements & Measuring Instruments **Code : C024514(024)**
Total Theory Periods: 32[2-1] **Credit: 03**
Total Tutorial Periods: 08 **Assignments: Two (Minimum)**
Class Tests: Two (Minimum)
Course Outcomes: At the end of the course, the students should be able to:

CO	CO STATEMENTS	Knowledge Level
1	Make use of suitable methods for the measurement of resistance.	3
2	Derive the balance equations of an AC bridge and evaluate unknown parameters by balancing the bridge.	5
3	Perform amplitude, frequency, and phase measurements using an oscilloscope and to make use of Lissajous figures for phase and frequency measurements.	3
4	Distinguish between the types of measuring instruments and use them for the measurement of Electrical quantities.	4
5	Test and calibrate ammeter, voltmeter, and wattmeter and energy meter.	6

UNIT- I Measurement of Resistance: [08]

Classification of resistances (low, medium and high), measurement of resistance by volt drop method, loss of charge method, Wheatstone's bridge, Kelvin's double bridge, Megger and ohmmeter, AC Potentiometers and their use for calibration of meters (ammeter, voltmeter and wattmeter).

UNIT-II AC Bridges: [08]

Measurement of inductance (self and mutual) and capacitance by AC bridges: Hay's, Maxwell's, Anderson, Desauty'sbridge, Schering bridge, Oven's bridge and Heaviside bridge and its modification, Wein's bridge for measurement of frequency, Wagner earthing device.

UNIT- III Detectors And Magnetic Measurement: [08]

Construction, theory and operation of D'Arsonval andvibration galvanometer, Oscilloscope – Basic Principle, CRT feature, Block diagram of Oscilloscope, Triggered sources, Measurement of frequency and phase by Lissajous Figures.

UNIT-IV Measuring Instruments: [08]

Classification, operation and working principle of PMMC, MI and dynamometer type instruments, controlling, damping and balancing devices, single-phase and three-phase electrodynamometer power factor meter, frequency meters: electrical resonance type, electrodynamometer, ratio-meter type. Phase sequence meter, maximum demand indicator.

UNIT-V Power And Energy Measurement: [08]

Construction and principle of dynamometer and induction type wattmeter, measurement of power in a three-phase circuit by using single-phase wattmeters, wattmeter errors, low power factor wattmeter, testing of wattmeter, single and poly-phase energy meters, testing of energy meters.

Text Books:

1. "A Course In Electrical And Electronics Measurement And Instrumentation", Sawhney, DhanpatRaiPbs.

2. Electrical Measurement and Measuring Instruments", Golding, CBS Publication

3. Electronic Instrumentation, H. S. Kalsi, TMH Publications

Reference books:

1. "A Course In Electrical And Electronics Measurement And Instrumentation", J. B. Gupta, KatariaPbs.

2. "Electric Measurements", Harris, Wiley Publication

3. "Electrical Measurements and Instrumentation, Cooper, TMH Publications

CHHATTISGARH SWAMI VIVEKANANDA TECHNICAL UNIVERSITY, BHILAI

Branch: Electrical Engineering **Semester: V**
Subject: Analog and Digital Communication(Professional-Elective) **Code: C024531(024)**
Periods per week (L-T-P):(3-1-0) **Credits: 04**
Number of class Test to be conducted: 2 (Minimum) **No. of assignment to be submitted:02**
Scheme of Examination (Theory): Total Marks-150 [ESE-100, CT-20, TA-30]

Course Outcomes: After successful completion of this course, the student will be able to:

Course Code	CO Statement	Knowledge Level
1	Explain the modulation process and different types of modulation.	2
2	Analyze the angle modulation and compare different type of angle modulation useful	4
3	Analyze Pulse modulation and multiplexing of signals.	4
4	Explain PCM and Digital modulation, and its mechanism..	2
5	Evaluate the channel capacity and coding efficiency	5

UNIT I Amplitude Modulation: Need of modulation, Amplitude modulation, Single tone and multi tone amplitude modulation, Amplitude Modulation Index, power relation. Generation and detection of AM wave, Suppressed carrier modulation and detection techniques.

UNIT II Angle Modulation: Mathematical equation of frequency modulation (FM), frequency spectrum, phase modulation (PM), relationship between PM and FM, pre-emphasis and de-emphasis, adjacent channel interference, comparison of narrow band and wide band FM, generation of FM.

UNIT III Pulse Modulation System: Sampling theorem, Sampling of Low Pass and band pass signals, Aliasing, Aperture effect, Basic principles of PAM, PWM and PPM, their generation and detection, FDM, TDM, Comparison of TDM and FDM.

UNIT IV PCM and Digital Modulation Techniques: Quantization, PCM, PCM generator, Quantizer, Transmission band width in PCM, PCM receiver, quantization noise/error in PCM, DPCM.

Introduction To Digital Modulation: Types of digital modulation techniques, Fundamentals of binary ASK, PSK and FSK, Generation of BASK, BPSK and BFSK and their coherent detection techniques.

UNIT V Information Theory: Introduction, Sources of information, Contents in DMS, Contents of a symbol, Information rate, Discrete memory less channel,mutual information, Channel capacity, Source coding, Coding efficiency.

Text Books:

1. Principles of Communication Systems –Taub and Shilling, Tata Mc GrawHill.
2. A Text Book of Analog & Digital Communication –P. Chakrabarti, DhanpatRai&Co.

Reference Books:

1. "Electrical Communication Systems", Kennedy,TMH.
2. "Digital Communications" Sanjay Sharma, S.K. Kataria& Sons, NewDelhi

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch**: Electrical Engineering** Semester**: V**
Subject: **Computer System Architecture (Professional-Elective)** Code: C024532(024)
Periods per week (L-T-P):**(3-1-0)** Credits**: 02**
Number of class Test to be conducted: **2 (Minimum)** No. of assignment to be submitted:
Scheme of Examination (Theory): **Total Marks-150 [ESE-100, CT-20, TA-30]**

COURSE OBJECTIVES: After successful completion of this course, the student will able to:

Course Code	CO Statement	Knowledge Level
1	Develop micro operation for a given digital circuit.	3
2	Develop micro operations for various computer instructions.	3
3	Program a basic computer	4
4	Develop micro operations for a give microinstruction.	3
5	Analyse the CPU functioning	4

UNIT I Register Transfer and Micro-Operations:

Register Transfer Language, Register Transfer, Bus and Memory Transfer, three state buffers, memory transfer, micro operations, binary adders, binary adder subtractor, binary incrementer circuits. Logic Micro operations, hardware implementation, Shift micro operations, hardware implementation, Arithmetic and Logical Unit.

UNIT II Basic Computer Organization :

Instruction codes, stored program organization, indirect address. Computer registers, common bus system. Computer instructions, instruction set completeness. Timing and control unit, fetch and decode, determining type of instruction, register reference instructions, memory reference instructions. Input-output configuration, input-output instructions, program interrupt, interrupt cycle.

UNIT III Programming the Basic Computer

Introduction, Machine language, assembly language, rules of the language, translation to binary, Program loops, Programming arithmetic and logic operations, Logic operations, Shift operations.

UNIT IV Micro Programmed Control

Control memory, address sequencing, conditional branching, mapping of an instruction, subroutine, micro-program example, microinstruction format, symbolic microinstructions, fetch routine, symbolic micro-program, binary micro-program, Design of control unit, Micro program sequencer.

UNIT V Central Processing Unit

General register organization, control word, Stack organization, Register stack, memory stack, reverse polish notation, Instruction format, 3-2-1-0 address instructions. Addressing modes, Data Transfer and Manipulation, data transfer instructions, data manipulation instructions, arithmetic instructions, logical and bit manipulation instructions, shift instructions. Program control, status bit conditions, conditional branch instructions, subroutine-call-return instructions.

Text Books:

1. Computer System Architecture by M. M. Mano

2. Computer Architecture and Organization, J.P. Hayes Int'1 student edition, McGraw – Hill.

Reference books:

1. Structured computer organization 3rd Edn by A. Stannabaum.

2. Computer Organization by V.C.Hamacher et al McGraw.

3. Introduction of Digital computer Design by V. Rajaraman & T.Radhakrishnman.

4. Analog computation and simulation by V. Rajaraman PHI

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: Electrical Engineering **Semester: V**
Subject: Power Plant Engineering (Professional Elective) **Code: C024533(024)**
Periods per week (L-T-P):(2-0-0) **Credits: 02**
Number of class Test to be conducted: 2 (Minimum) **No. of assignment to be submitted:02**
Scheme of Examination (Theory): Total Marks-150 [ESE-100, CT-20, TA-30]

COURSE OBJECTIVES: After successful completion of this course, the student will able to:

Course Code	CO Statement	Knowledge Level
1	Illustratethe working of Coal Based Thermal Power Plants	2
2	Explain theGas Turbine and Combined Cycle Power Plants	2
3	Explainthe functioning of Nuclear Power Plants	2
4	Distinguish andclassify Renewable Energy sources.	4
5	Evaluate related to plant economics, and propose pollution control techniques	6

COURSE DETAILS:

Unit 1: Coal Based Thermal Power Plants

Layout of modern coal power plant, super critical boilers, FBC boilers, turbines, condensers, steam and heating rates, subsystems of thermal power plants, fuel and ash handling, draught system, feed water treatment, binary cycles and cogeneration systems

Unit 2: Gas Turbine and Combined Cycle Power Plants

Brayton cycle analysis and optimization, components of gas turbine power plants, combined cycle power plants, Integrated Gasifier based Combined Cycle (IGCC) systems.

Unit 3: Nuclear Power Plants

Basics of nuclear energy conversion, Layout and subsystems of nuclear power plants, Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANDU Reactor, Pressurized Heavy Water Reactor (PHWR), Fast Breeder Reactors (FBR), gas cooled and liquid metal cooled reactors, safety measures for nuclear power plants.

Unit 4: Power from Renewable Energy

Hydroelectric power plants, classification, typical layout and components, principles of Wind, Tidal, Solar PV and Solar Thermal, Geothermal, Biogas and Fuel Cell power systems

Unit 5: Energy, Economic and Environmental Issues of Power Plants

Energy, economic and environmental issues, power tariffs, load distribution parameters, load curve, capital and operating cost of different power plants, pollution control technologies including waste disposal options for coal and nuclear plants.

Text Books:

1. Nag P.K., Power Plant Engineering, 3rd ed., Tata McGraw Hill, 2008.

2. Tanmoy Deb, Electrical Power Generation-Conventional and Renewable, Khanna Publication 2017

3. Elliot T.C., Chen K and Swanekamp R.C., Power Plant Engineering, 2nd ed., McGraw Hill, 1998.

Reference Books:

1. B.R. Gupta, Generation of Electrical Energy,7th edn, S. Chand Publishing, 2017
2. El Wakil M.M., Power Plant Technology, Tata McGraw Hill, 2010

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: Electrical Engineering **Semester: V**
Subject: Electrical Machine Design **Code: C024534(024)**
Periods per week (L-T-P): (2-0-0) **Credits: 02**
Number of class Test to be conducted: 2 (Minimum) **No. of assignment to be submitted: 05**
Scheme of Examination (Theory): Total Marks-150 [ESE-100, CT-20, TA-30]

Course Outcomes: After competition of this course, students will be able to:

Course Code	CO Statement	Knowledge Level
1	Explain mmf calculation and modern trends in design of various types of electrical machines.	2
2	Design core, yoke, windings and cooling systems of transformers.	6
3	Design core and armature for rotating machines.	6
4	Design rotor of rotating machines.	6
5	Design and analyze the computer aided design of electrical machines.	6

UNIT-I

Basic Considerations: Basic concept of design, limitation in design, standardization, modern trends in design and manufacturing techniques, Classification of insulating materials. Calculation of total mmf and magnetizing current. **[06 hours]**

UNIT-II

Design of Transformer: Design of distribution and power transformers, Types, Classification and specifications, Design and main dimensions of core, yoke, winding, tank (with or without cooling tubes) and cooling tubes, Numerical examples. **[06 hours]**

UNIT-III:

Design of rotating machines – I: Output equations of rotating machines, specific electric and magnetic loadings, factors affecting size of rotating machines, separation of main dimensions, election of frame size, Core and armature design of dc and 3-phase ac machines. **[06 hours]**

Unit-IV:

Design of rotating machines – II: Rotor design of three phase induction motors, Design of field system of DC machine and synchronous machines. Estimation of performance from design data . **[06 hours]**

Unit-V:

Computer Aided Design: Philosophy of computer aided design, advantages and limitations.

Computer aided design approaches analysis, synthesis and hybrid methods. Concept of optimization and its general procedure. Flow charts for the design of transformer, dc machine, three phase induction and synchronous machines. **[06 hours]**

Text Books:

1. A.K. Sawhney, “A Course in Electrical Machine Design” Dhanpat Rai & Sons.
2. K.G. Upadhyay “Conventional and Computer Aided Design of Electrical Machines” Galgotia Publications.

Reference Books:

3. M.G. Say, “The Performance and Design of AC Machines” Pitman & Sons.
4. A.E. Clayton and N.N. Hancock, “The Performance and Design of D.C. Machines” Pitman & Sons.
5. S.K. Sen, “Principle of Electrical Machine Design with Computer Programming” Oxford and IBM Publications.
6. A. Shanmugasundaram, G. Gangadharan, R. Palani 'Electrical Machine Design Data Book', New Age International Pvt. Ltd., Reprint 2007.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: Electrical Engineering **Semester: V**
Subject: Control System Engineering Laboratory **Code: C024521(024)**
Periods per week (L-T-P): (0-2-0) **Credits: 01**
Total Lab Periods: 24 **Batch Size: 30**
Maximum Marks in ESE: 40 **Minimum Marks in ESE: 20**

List of Experiments: (At least ten experiments are to be performed by each student)

1. To determine the gain of an open loop and closed loop system.
2. To study the effect of disturbance on an open loop and closed loop system.
3. To determine the transfer function of a DC servomotor.
4. Determination of transfer function of an AC servomotor.
5. Characteristics of synchro-transmitter and receiver pair.
6. To study a potentiometer as an error detector.
7. Study of a basic electrically controlled hydraulic system.
8. To Study the time response of a first and second order system.
9. Study of P, PI controller on second order system
10. Study of PID controller on second order system
11. Study of bode plot of a Type 0,Type I and Type II systems.
12. To study the lag compensator and lead compensator.
13. To study the lag-lead compensator.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: Electrical Engineering **Semester: V**
Subject: Electrical Measurements & Measuring Instrument Laboratory Code: C024522(024)
Periods per week (L-T-P): (0-2-0) **Credits: 01**
Total Lab Periods: 24 **Batch Size: 30**
Maximum Marks in ESE: 40 **Minimum Marks in ESE: 20**

List of Experiments: (At least Ten experiments are to be performed by each student)

1. To determine unknown resistance using Kelvin's Bridge.

2. To determine unknown resistance using Wheatstone Bridge.

3. To determine unknown inductance of a given coil using Maxwell Bridge.

4. To determine the inductance of the given coil using Anderson's Bridge.

5. To determine unknown capacitance of a given capacitor by Desauty's Bridge.

6. To determine capacitance of a given capacitor using Schering Bridge.

7. To determine the inductance using Owen's Bridge.

8. To determine unknown inductance using Hay Bridge.

9. To calibrate a given single phase induction type Energy Meter.

10. To find the phase sequence of the supply by the rotating type phase sequence meter.

11. To find the phase sequence of the supply by the Static type phase sequence meter.

12. To determine the unknown resistance R by Voltmeter-Ammeter Method.

13. To observe the B-H curve and hysteresis loop of agiven transformer core on CRO.

14. Measurement of high resistance by using Meggar.

Equipment/Machines/Instruments/Tools/Software Required:

Bridges, Head Phones, Transformer, Variac, Voltmeter, Ammeter, Multimeters, Resistors, DC Supply, Meggar

Recommended Books:

1. Electrical measurement & measuring instrument by A.K.Sawhney.

2. Electrical measurement & measuring instrument by J.B.Gupta

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: Electrical Engg. **Semester: V**
Subject: Power Electronics Lab **Code: C024523(024)**
Period per week (L-T-P): (0-0-2) / Week **Credit: 01**
Scheme of Examination (Laboratory):Total Marks- 60 [ESE-40, TA- 20]

COURSE OUTCOMES:

CO Statement	Knowledge Level
Determine static characteristics of SCR,MOSFET and IGBT	5
Analyze the operation of various phase controlled rectifiers for different types of load	4
Analyze the operation of step up and step down choppers	4
Analyze the operation of series and parallel inverters	4
Simulate power converter circuits using MATLAB/PSPICE.	3

COURSE DETAILS (At least ten experiments):

1. To study and plot the V-I characteristics of an SCR.
2. To study and plot the drain characteristics of a MOSFET.
3. To study and plot the drain characteristics of a IGBT.
4. To study single-phase half-wave bridge controlled rectifier for R and RL load.
5. To study single-phase full-wave bridge controlled rectifier for R and RL load with and without freewheeling diode.
6. To study of three-phase half-wave controlled rectifier for resistive load.
7. To study of three-phase full-wave controlled rectifier for resistive load.
8. To study step down and step up chopper circuit.
9. To study Voltage commutation chopper circuits.
10. To study current commutation chopper circuits.
11. To study Single Phase series inverter with R and RL loads.
12. To study the bipolar and unipolar switching scheme of a single phase full bridge inverter using MATLAB / PSPICE simulation.
13. To study the three phase VSI for 180/120 mode of conduction using MATLAB / PSPICE simulation.
14. To study single-phase AC voltage control by using TRIAC for R and RL loads.

Apparatus Required:

1. Various Power Electronics Kits.
2. CRO
3. MATLAB/PSPICE

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of the Program: **BTech** Semester: **V**
Subject: **Environmental Studies** Code: C000506(020)
Period per week (L-T-P): **(2-0-0) / Week** Non-Credit
Total Contact Hours: **40** No. of assignments to be submitted: **05**

PREREQUISITE: Knowledge of basic Chemistry, Physics and Mathematics.

COURSE OBJECTIVES:

1. Basic knowledge of environment, ecology, ecosystems, biodiversity and conservation.
2. Fundamentals of natural resources, control, uses and its impact on environment.
3. Human population, growth, growing needs and its impact on society and environment.
4. Types of environmental pollution, legislations, enactment and management.

COURSE DETAILS:

UNIT I: Introduction to environmental studies, ecology and ecosystems (06 hours)

Introduction to environment; Concept and structure of ecology and ecosystem, energy flow; Community ecology; Food chains and webs; Ecological succession; Characteristic features of forest, grassland, desert and aquatic ecosystem; Multidisciplinary nature of environmental studies, scope and importance; Concept of sustainability and sustainable development.

UNIT II: Biodiversity and conservation (06 hours)

Introduction to biological diversity and levels of genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots; Threats to biodiversity, habitat loss, conflicts and biological invasions; In-situ and Ex-situ conservation of biodiversity: Ecosystem and biodiversity services.

UNIT III: Natural resources and environment (08 hours)

Concept of Renewable and non-renewable resources; Land resources, land use change, land degradation, soil erosion; Desertification; Deforestation: causes, consequences and remedial measures; Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state); Energy resources: environmental impacts of energy generation, use of alternative and nonconventional energy sources, growing energy needs.

UNIT IV: Human communities, social issues and environment (08 hours)

Basic concept of human population, growth and communities; Impacts on environment, human health, welfare and human rights; Resettlement and rehabilitation; Environmental natural disaster: floods, earthquake, cyclones, tsunami and landslides; Manmade disaster; Environmental movements; Environmental ethics: role of gender and cultures in environmental conservation; Environmental education and public awareness; Human health risks and preventive measurements.

UNIT V: Environmental pollution, policies, legislations, assessment and practices (12 hours)

Environmental pollution: Causes, effects and controls of air, water, soil, noise and marine pollution; Concept of hazardous and non-hazardous wastes, biomedical and e-wastes; Solid waste management and control measures; Climate change, global warming, ozone layer depletion, acid rain and their societal impacts; Environment laws: Wildlife Protection Act, Forest Conservation Act, Water (Prevention and control of Pollution) Act, Air (Prevention & Control of Pollution) Act, Environment Protection Act, Biodiversity Act, International agreements negotiations, protocols and practices; EIA, EMP.

On completion of each unit, students have to submit one assignment from each unit.

COURSE OUTCOMES (CO):

On completion of the course, students will able to:

1. Interpret and demonstrate the concept of ecology and ecosystem for environmental sustainability.
2. Define and establish the diversified knowledge of biodiversity and its conservation.
3. Explain the uses of natural resources efficiently and its impact on environment.
4. Illustrate and solve the simple and complex social issues relating to human communities.
5. Exemplify and make useful solution to combat the environmental degradation with the aid of national and international legislations and protocols there under.
6. Demonstrate and elucidate the complicated issues and anthropological problems for societal development.

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1. De, A.K., (2006).*Environmental Chemistry*, 6th Edition, New Age International, New Delhi.
2. Bharucha, E. (2013). *Textbook of Environmental Studies for Undergraduate Courses*. Universities Press.
3. Asthana, D. K. (2006).*Text Book of Environmental Studies*. S. Chand Publishing.

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1. Odum, E. P., Odum, H. T., & Andrews, J. (1971).*Fundamentals of ecology*. Philadelphia: Saunders.
2. Basu, M., Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India.
3. Sharma, P. D., & Sharma, P. D. (2005).*Ecology and Environment*. Rastogi Publications.

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