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

## SCHEME OF TEACHING AND EXAMINATION

## B.E. VI SEMESTER ELECTRICAL ENGINEERING

| S. No. | Board of Studies | Subject Code | Subject | Periods per week | | | Scheme of Exam Theory/Practical | | | Total Marks | Credit L+(T+P)/2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | ESI | CT | TA | | |
| 1 | Electrical Engg. | **324651(24)** | Power System Analysis | 3 | 1 | - | 80 | 20 | 20 | 120 | 4 |
| 2 | Electrical Engg. | **324652(24)** | Electrical Machines -III | 4 | 1 | - | 80 | 20 | 20 | 120 | 5 |
| 3 | Electrical Engg. | **324653(24)** | Power Electronics | 4 | 1 | - | 80 | 20 | 20 | 120 | 5 |
| 4 | Electrical Engg. | **324654(24)** | Instrumentation Techniques | 3 | 1 | - | 80 | 20 | 20 | 120 | 4 |
| 5 | Electrical Engg. | **324655(24)** | Principles of Digital Signal Processing | 3 | 1 | - | 80 | 20 | 20 | 120 | 4 |
| 6 | *Refer Table -1* | | Professional Elective- I | 3 | 1 | - | 80 | 20 | 20 | 120 | 4 |
| 7 | Electrical Engg. | **324661(24)** | Power System Analysis Lab | - | - | 3 | 40 | - | 20 | 60 | 2 |
| 8 | Electrical Engg. | **324662(24)** | Electrical Machines -III Lab | - | - | 3 | 40 | - | 20 | 60 | 2 |
| 9 | Electrical Engg. | **324663(24)** | Power Electronics Lab | - | - | 3 | 40 | - | 20 | 60 | 2 |
| 10 | Electrical Engg. | **324664(24)** | Instrumentation Techniques Lab | - | - | 3 | 40 | - | 20 | 60 | 2 |
| 11 | Management | **300665(76)** | Managerial Skills | - | - | 2 | - | - | 40 | 40 | 1 |
| 12 | Electrical Engg. | --------- | Library/Industry Institute Interaction | - | - | 1 | - | - | - | - | - |
| **Total** | | | | **20** | **6** | **15** | **640** | **120** | **240** | **1000** | **35** |

**L:** Lecture **T:** Tutorial **P:** Practical
**ESE:** End Semester Examination **CT:** Class Test **TA:** Teachers' Assessment

**Note:** Industrial Training of eight weeks is mandatory for B.E. students. It is to be completed in two equal parts. The first part must have been completed in summer after IV semester. The second part to be completed during summer after VI semester after which students have to submit a training report which will be evaluated by college teachers during B.E. VII semester.

**Table - 1 Professional Electives – I**

| S. No. | Board of Studies | Subject Code | Subject |
|---|---|---|---|
| 1. | Electrical Engg. | **324671(24)** | Fibre Optics |
| 2. | Electrical Engg. | **324672(24)** | Computer Aided Design of Electrical Machine |
| 3. | Electrical Engg. | **324673(24)** | Process Control |
| 4. | Electrical Engg. | **324674(24)** | Computer System Architecture |
| 5. | Electrical Engg. | **324675(24)** | Power System Planning & Reliability |
| 6. | Electrical Engg. | **324676(24)** | Cyber Security |

**Note (1) –** $1/4^{th}$ of the 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

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|---|---|---|---|
| Branch: | **Electrical Engineering** | Semester: | **VI** |
| Subject: | **Power System Analysis** | Code: | **324651(24)** |
| Total Theory Periods: | **40** | Total Tutorial Periods: | **12** |
| No. of class Tests to be conducted: | **2 (Minimum)** | No. of assignments to be submitted: | **2 (Minimum)** |
| ESE Duration: | **Three Hours** | Maximum Marks in ESE: **80** | Minimum Marks in ESE: **28** |

**Objective:**
This course is an extension of Electrical Power systems course. It deals with basic theory of transmission line modelling and their performance analysis. A detailed study of Power System stability, Load flow studies and economic power dispatch is part of the curriculum for students.

**Outcomes:**
1. Student should be able to make a one line representation of Power System.
2. Student should be able to evaluate fault currents for different faults at different locations in Power System.
3. Students should be able to identify cases of stable and unstable Power Systems.

**UNIT I** **Representation of Power System:** Single line diagram, impedance diagram, reactance diagram, equivalent impedance of three phase transformer, per unit quantities, P.U. impedance of three phase transformer, positive sequence impedance diagram in per unit system, Expression for three phase power in p.u.

**UNIT II** **Symmetrical Components:** Expression for positive, negative & zero sequence components, existence of sequence components of current & voltages for three phase circuit, sequence impedance of alternator & transmission line, Sequence network of unloaded generator, zero sequence network of three phase transformers, phase shift in star-delta transformer.

**UNIT III** **Fault Calculations:** Single line to ground fault, Line to line fault, Double line to ground fault on unloaded generator, faults through impedance, open conductor faults, unsymmetrical fault on power system, Three phase short circuit on synchronous machine, Three phase short circuit on power system, Calculation of different current ratings and interrupting capacity of circuit breaker.

**UNIT IV**
**a)** **Economic operation of power systems:** Input output curves , criteria for economical distribution of power between generating units in a plant, Expression for transmission line loss in terms of loss formula coefficients, criteria for economical distribution of power between generating plants
**b)** **Load Flow Studies:** Bus admittance matrix, formation of load flow equation, Gauss Siedel method, Newton Raphson method.
**c)**

**UNIT V** **Power System Stability:** The stability problem, steady-state stability, transient stability, Swing equation, Equal area criterion of stability, application of equal area criterion, critical clearing angle.

**Text Books:**

1. Elements of power system analysis By W.D. Stevenson ( 4th Ed. Mc Graw Hill)
2. Electrical Power System by Ashfaq Hussain (4th Ed. CBS Pub. & Dist.)


**Reference Books:**

1. Power System Analysis and Design by B.R. Gupta (3rd Ed S. Chand )
2. Power System Engg. By I.J. Nagrath & Kothari (Tata McGraw Hill)
3. Power System Engg. BY A. Chakrabarti, M.L. Soni,P.V.Gupta, V.S.Bhatnager( 6th Ed Dhanpat Rai & Co.)

# Chhattisgarh Swami Vivekanand Technical University, Bhilai

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|---|---|---|---|
| Branch: | **Electrical Engineering** | Semester: | **VI** |
| Subject: | **Electrical Machine - III** | Code: | **324652(24)** |
| Total Theory Periods: | **48** | Total Tutorial Periods: | **12** |
| No. of class Tests to be conducted: | **2 (Minimum)** | No. of assignments to be submitted: | **2 (Minimum)** |
| ESE Duration: | **Three Hours** | Maximum Marks in ESE: **80** | Minimum Marks in ESE: **28** |

**Course Objectives:**

1. To study the importance of transformation of variables in three phase AC machines.
2. To study the construction and operation of single phase induction motor.
3. To study the construction and operation of ac commutator motors.

**Course Outcomes:** At the end of the course the students should be to :

1. Transform three phase variables to two axis variables.
2. Analyze the performance of single phase induction motor with the help of its equivalent circuit.
3. Understand the construction and principles of operation of different types of special motors.

**UNIT I** **Theory of Ideal Synchronous Machines:** The ideal synchronous machine, synchronous machine inductances, transformation to direct and quadrature axis variables, basic machine relation in *dq0* variables, steady state analysis using *dq0*, transient analysis, three-phase short circuit, transient power angle characteristics, Effect of additional rotor circuits.

**UNIT II** **Theory of Ideal Poly-Phase Induction Machines:** The ideal induction machine, transformation to *dq* variables, basic machine relation in *dq* variables, steady state analysis using *dq variables*, electrical transients in induction machine, Operation of three phase induction motor on unbalanced supply voltage (single phasing), Power invariance.

**UNIT III** **Fractional Horse Power Motor:** Qualitative examination, starting and running performance of single phase induction motor, revolving field theory of single-phase induction motor, starting methods of single phase induction motor, Equivalent Circuit for Single phase Induction motors , Maximum starting torque conditions in Single phase I.M.

**UNIT IV** **Two phase & AC Commutator Motors:** Two-phase control motors AC tachometers and servomotor. Unbalanced operation of symmetrical two-phase machine, the symmetrical component concept. EMFs induced in commutator windings, Torque, action of commutator as frequency converter, Qualitative analysis of single-phase series motors, phasor diagrams, Operation under AC and DC supply: Universal motor, methods for improving commutation.

**UNIT V** **Special Motors:** Construction, principle of operation and application of Variable Reluctance motor, Stepper motor, Linear Induction motor, Permanent Magnet Brushless DC motor. Permanent Magnet Synchronous motor

**Text Books:**

1. "Generalized Theory of Electrical Machines " Dr. P.S. Bimbhra, Khanna Publishers, 5th Edition

2."Performance and Design of AC Commutator Machines "by Taylor.

**Reference Books:** .

1. " Electrical Machines" Fitzerald and Kingseley, 2nd Edition, McGraw Hill.

2 ." Power System Stability", Vol-3 by E.W. Kimbark, John Wiley& Sons,

3. Special Electrical Machines" S. Jaganathan Pearson Publication 1st Edition

# Chhattisgarh Swami Vivekanand Technical University, Bhilai

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|---|---|---|---|
| Branch: | **Electrical Engineering** | Semester: | **VI** |
| Subject: | **Power Electronics** | Code: | **324653(24)** |
| Total Theory Periods: | **48** | Total Tutorial Periods: | **12** |
| No. of class Tests to be conducted: | **2 (Minimum)** | No. of assignments to be submitted: | **2 (Minimum)** |
| ESE Duration: | **Three Hours** | Maximum Marks in ESE: **80** | Minimum Marks in ESE: **28** |

**Course Objectives:**

1. To introduce students the basic theory of power semiconductor devices and passive components, their practical application in power electronics.
2. To familiarize the operation principle of AC-DC, DC-DC, DC-AC conversion circuits and their applications.
3. To provide the basis for further study of power electronics circuits and systems.

**Course Outcomes:**

1. An ability to understand basic operation of various power semiconductor devices and passive components.
2. An ability to understand the basic principle of switching circuits.
3. An ability to analyze and design an AC/DC rectifier circuit.
4. An ability to analyze and design DC/DC converter circuits.
5. An ability to analyze DC/AC inverter circuit.

**UNIT I** **Power Semiconductor Devices:** Silicon controlled rectifier (SCR), structure, principle of operation, two-transistor analogy, switching characteristics, trigger requirement , series and parallel operation of SCRs, ratings and protection, Triac structure and principle of operation only, Modern semiconductor devices, power BJT, MOSFET, IGBT structure, static characteristics.

**UNIT II** **Phase Controlled Rectifiers:** Principle of phase control, performance parameters, single-phase half wave controlled mid -point full controlled converters and half controlled converters for R,RL and RLE load, comparison of controlled converters with and without freewheeling diode, Effect of source inductance in single-phase. Single phase dual converter in circulating and non circulating mode, Three-phase half wave and fully controlled bridge converter, three-phase semi-converter.

**UNIT III** **DC To DC Converters:** Forced Commutation Techniques for thyristor: Self commutation, Impulse commutation, Resonant pulse commutation and Complementary commutation, Principle of chopper operation, controlled strategies, step up chopper, step down chopper, chopper, configurations, Performance parameter of step down chopper with R-L-E load for continuous and discontinuous conduction .Working principle of Voltage commutated ,Current commuted and Load commuted thyristor chopper.

**UNIT IV** **DC to AC Converter:** Inverter: Classification of inverters, voltage source inverter, current source inverter, Series and modified series resonant thyristor inverter. Performance parameters of single phase half bridge and full bridge inverter for R-L loads, 3-phase inverter-180 degree and 120 degree conduction mode using ideal switches for balanced R load only. Pulse width modulated switching scheme for voltage control, SPWM and modified SPWM of 1-phase inverters, PWM with Uni-polar and Bipolar Voltage Switching. (Elementary analysis only)

**UNIT V** **Cyclo-converters & AC Controllers:** Basic principle of operation, step-up and step down single-phase to single-phase cyclo-converter, Principle of On-off and phase control, AC controller circuit configurations, Performance parameters of Single phase bidirectional controllers for R and RL only.

**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. “A text book of power electronics”, S.N Singh, DhanpatRai& Co.(P)Ltd. 1st Edition
3. “An Introduction to thyristor and its applications” M. Ramamoorty, East-West Press, 2nd Edition

# Chhattisgarh Swami Vivekanand Technical University, Bhilai

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|---|---|---|---|
| Branch: | **Electrical Engineering** | Semester: | **VI** |
| Subject: | **Instrumentation Techniques** | Code: | **324654(24)** |
| Total Theory Periods: | **40** | Total Tutorial Periods: | **12** |
| No. of class Tests to be conducted: | **2 (Minimum)** | No. of assignments to be submitted: | **2 (Minimum)** |
| ESE Duration: | **Three Hours** | Maximum Marks in ESE: **80** | Minimum Marks in ESE: **28** |

**Course Objectives:**

1. To understand the concept of Current Transformer and Potential Transformer.
2. To provide students with the fundamental knowledge about the error presents in instruments.
3. To provide students with the fundamental knowledge of different types of Transducer and their application.
4. To provide students with the fundamental knowledge about the PLC and their programming.

**Course Outcomes:**

1. Student can understand the use of CT and PT as a protective and measuring device.
2. Student would be able to select proper Transducer for measurement of various Electrical quantities.
3. Student would be able to find error and calibrate the instruments.
4. Student can write programs for different processes using PLC.

**UNIT I**

**Errors in Measuring Instruments:** Errors in measurement, general and statistical analysis of errors, Instrument transformers, errors of CTs and PTs, methods of reduction of errors of instrument transformers, Testing of CTs (Absolute and Silabee's methods), Testing of PTs: Absolute and method using wattmeter.

**UNIT II**

**Passive and Active Electrical Transducers:** Resistive, capacitive, inductive, piezoelectric, photovoltaic, Hall effect transducers, selection of transducers, transducers characteristics, semiconductor photo-diode, photo transistor, frequency generating transducers, pressure inductive transducers, LVDT, differential output transducer, thermistor, strain gauge, measurement of angular and linear velocity using electrical transducers, reluctance pulse pick-ups, AC tachogenerators.

**UNIT III**

**Data Acquisition System and Recorders:** Introduction of DAS, Objective of DAS, Signal conditioning of inputs, single and multi-channel DAS, Computer based DAS, Sample and hold, Multiplexing, D/A, A/D conversion general description of Data loggers, Digital transducers, optical encoders, resistive digitial encoders, shaft encoders.

Recorders: Introduction, Strip chart recorders, General description of XY recorders, galvanometer type recorders, potentiometric recorders.

**UNIT IV**

**PLC:** Introduction, PLC and Operations, Basic ladder diagram, General PLC Programming Procedure, Devices to which PLC Input and Output Modules are connected.

**UNIT V**

**Basic PLC Programming and Functions:** Programming On-Off inputs to produce On-Off outputs, Relation of Digital Gate Logic to Contact / Coil Logic, Creating Ladder diagrams from process control descriptions.

Basic PLC Functions, Register Basics, PLC Time Functions, PLC Counter Functions.

**Text Books:**


1. Electrical and Electronics Measurements and Instrumentation: . Purkait, B Biswas, S. Das and C. Koley, McGraw hill
2. Electronic Measurements and Instrumentation: K. Lal Kishore, Pearson.
3. Programmable Logic Controllers, John W.Webb, Ronald A. Reis, Prentice Hall .


**Reference Books:**


1. Electronic Instrumentation by H. S. Kalsi, McGraw Hill
2. Instrumentation Measurement and Analysis: Nakra and Chaudhry, McGraw Hill.
3. Electronic Instruments and Instrumentation Technology" by M.M.S. Anand, PHI Publications.

# Chhattisgarh Swami Vivekanand Technical University, Bhilai

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|---|---|---|---|
| Branch: | **Electrical Engineering** | Semester: | **VI** |
| Subject: | **Principles of Digital Signal Processing** | Code: | **324655(24)** |
| Total Theory Periods: | **40** | Total Tutorial Periods: | **12** |
| No. of class Tests to be conducted: | **2 (Minimum)** | No. of assignments to be submitted: | **2 (Minimum)** |
| ESE Duration: | **Three Hours** | Maximum Marks in ESE: **80** | Minimum Marks in ESE: **28** |

**Course Objectives**

The signal for processing is mathematically modelled as a function or a sequence of numbers that represent the state or behaviour of a physical system. Signal processing is one of the fundamental theories and techniques to construct modern information systems. The course content:

1. Aims to teach the fundamentals of discrete-time signals and systems.
2. Includes the concept and the classification of discrete-time signal
3. Teaches the representations of signals in time, frequency, z- and discrete frequency domains
4. Provides the representations and analyses of systems
5. Develops the techniques to design digital filters.

**Course Outcomes -** Upon successful completion of the course the students should be able to:

1. Analyze a given signal or system using tools such as Fourier transform and z-transform
2. Analyze the various characteristics to know the property of a signal or a system
3. Process signals to make them more useful.
4. Design a signal processor (digital filter) for a given problem.

**UNIT I** **Introduction to digital signal processing:** Introduction, Basic elements of DSP; Classification of signals: continuous and discrete, energy and power; mathematical representation of signals; Classification of systems: Continuous and discrete, linear, causal, stable, dynamic, time variance; Representation of systems; Analog to digital conversion, sampling techniques, Sampling theorem, quantization, quantization error, Nyquist rate, aliasing effect.

**UNIT II** **Discrete linear time system analysis:** Introduction, impulse response, convolution sum, interconnection of linear time invariant system; Causal LTI systems, stability of LTI systems, Correlation, Z-transform, inverse z-transforms; systems described by difference equations, Solution by z-transform; Impulse Response and Frequency Response.

**UNIT III** **Fourier analysis:** Discrete Fourier series, Discrete Fourier transform (DFT), Properties of Discrete Fourier Transform, Linear Convolution of sequence using DFT, Frequency domain representation of discrete time system, Phase and amplitude spectra, Relation between Discrete- Time Fourier Transform (DTFT) and DFT, Circular convolution, Computation of DFT using Fast Fourier transform (FFT): Radix- 2 decimation in time and decimation in frequency FFT algorithms, Inverse FFT, Overlap-add and save methods

**UNIT IV** **Infinite Impulse response (IIR) filters:** Introduction, Structures of IIR systems, IIR filter design by Impulse Invariance, Bilinear transformation, Approximation of derivatives; Design of Butterworth and Chebyshev filters, Frequency transformation, Realization using direct, cascade and parallel forms.

**UNIT V** **Finite Impulse response (FIR) filters:** Introduction, Structures of FIR systems, Characteristics of FIR digital filters, Linear phase FIR filter design using windows, frequency sampling method; designing using Pade Approximation method and Least Squares design methods.

**Text Books:**


1. Digital Signal Processing Principles, Algorithms and Applications: John G Proakis and D. G. Manolakis, Pearson, Fourth Edition, 2007
2. Digital Signal Processing, A Computer Based approach: S.K. Mitra, Tata McGraw Hill, New Delhi, 2001
3. Signal and systems, Oppenheim, PHI


**Reference Books:**


1. Discrete Time Signal Processing: Alan V.Oppenheim, Ronald W. Schafer & Hohn. R.Back, Pearson Education, 2nd edition, 2005.
2. Introduction to Digital signal processing: Johnny R. Johnson, PHI learning Private Ltd, New Delhi
3. Digital Signal Processing: S.Salivahanan, A. Vallavraj, C. Gnanapriya,TMH

# Chhattisgarh Swami Vivekanand Technical University, Bhilai

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|---|---|---|---|
| Branch: | **Electrical Engineering** | Semester: | **VI** |
| Subject: | **Power System Analysis Laboratory** | Code: | **324661(24)** |
| Total Lab Periods: | **36** | Batch Size: | **30** |
| Maximum marks in ESE: | **40** | Minimum marks in ESE: | **20** |

**List of experiments: (minimum 10 experiments are to be performed)**

1. Determination of the phase sequence of a three phase supply by static method.
2. Determination of vector group ($Dy_1$) of a three phase transformer.
3. Determination of vector group ($Dy_{11}$) of a three phase transformer.
4. Determination of zero sequence impedance and currents for different connections of a three phase transformer.
5. Determination of the zero sequence reactance of a synchronous generator.
6. Determination of Negative Sequence Reactance of synchronous generator.
7. Study of the effect of load angle $\delta$ on the stability of synchronous machines.
8. Determination of the fault current in case of three phase fault on a power system.
9. Determination of the fault current in case of line to ground fault on a power system.
10. Determination of the fault current in case of line to line fault on a power system.
11. Determination of the fault current in case of double line to ground fault on a power system.
12. Determination of the change in fault current with the change in the fault location of the power system.
13. Computer Simulation of balanced and unbalanced faults on a power system and observation of the change in system currents and voltages from that of a healthy system.
14. Simulation of Short, Medium & Long transmission line.
15. Computer simulation of a simple system, formation of the bus admittance/ impedance matrix and power flow on the system using software(PSCAD, ETAP, My Power, etc).

**Apparatus Required:**

1 Three phase transformer
2. Three phase synchronous machine.
3. Power Oscilloscope
4. Transmission line model.
5. Software, (PSCAD, ETAP, My Power, etc.)

# Chhattisgarh Swami Vivekanand Technical University, Bhilai

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|---|---|---|---|
| Branch: | **Electrical Engineering** | Semester: | **VI** |
| Subject: | **Electrical Machine – III Laboratory** | Code: | **324662(24)** |
| Total Lab Periods: | **36** | Batch Size: | **30** |
| Maximum marks in ESE: | **40** | Minimum marks in ESE: | **20** |

**List of experiments: (To be performed minimum 10 experiments)**

1. Determination of negative sequence reactance of alternator by static test.
2. Determination of negative sequence reactance of alternator by line-to-line short circuit test.
3. Determination of zero sequence reactance by synchronous machine.
4. Determination of the $X_d$ & $X_q$ of synchronous machine.
5. Measurement of circuit Constant of 1-phase induction motor.
6. Speed reversal of 1-phase induction motor.
7. Single phasing characteristics of 3-phase induction motor.
8. To study effect of capacitor on starting, running, and performance of induction motor.
9. Output characteristics of Synchro Transmitter.
10. To use Synchro transmitter pair as remote control device.
11. Characteristics of stepper motor.
12. To measure direct axis reactance $X_d$ of synchronous Generator by OCC and SCC test.
13. Study of Linear Induction Motor.
14. To study synchronization of two alternators with each other and effect of change in excitation and speed (frequency) on load sharing.
15. To study speed control of Induction motor by Cascade connection.

**Apparatus Required:**

1. 3-Phase Alternator
2. 1-Phase Induction motor, 3-Phase Induction Motor( Slip-ring & cage)
3. Stepper Motor
4. Synchro Transmitter
5. Linear Induction Motor.
6. AC Commutator Motor.
7. Ammeter, Voltmeter
8. 1-Phase & 3-Phase Variacs.
9. Rheostats, resistive Load.

# Chhattisgarh Swami Vivekanand Technical University, Bhilai

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|---|---|---|---|
| Branch: | **Electrical Engineering** | Semester: | **VI** |
| Subject: | **Power Electronics Laboratory** | Code: | **324663(24)** |
| Total Lab Periods: | **36** | Batch Size: | **30** |
| Maximum marks in ESE: | **40** | Minimum marks in ESE: | **20** |

**List of experiments: (minimum 10 experiments are to be performed)**

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 class A/B/C forced commutation chopper circuits.
10. To study Single Phase series inverter with R and RL loads.
11. To study Single Phase parallel 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 step down cycloconverter for R and RL loads.
15. 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

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|---|---|---|---|
| Branch: | **Electrical Engineering** | Semester: | **VI** |
| Subject: | **Instrumentation Techniques Laboratory** | Code: | **324664(24)** |
| Total Lab Periods: | **36** | Batch Size: | **30** |
| Maximum marks in ESE: | **40** | Minimum marks in ESE: | **20** |

**List of experiments: (minimum 10 experiments are to be performed)**

1. Measurement of % ratio error and phase angle error of CT.
2. Measurement of current, voltage and power using CT & PT.
3. Measurement of displacement using LVDT.
4. Measurement of force using strain gauge.
5. To Study Piezo-electric transducer.
6. Measurement of temperature using phototransistor demonstration set up.
7. Measurement of displacement using capacitive pickup.
8. To demonstrate the operation of D/A converter.
9. To demonstrate the operation of A/D converter.
10. Measurement of intensity of light.
11. Masurement of angular displacement using capacitor transducer.
12. Industrial automation demonstration through PLC.
13. Measurement of current / voltage using Hall.
14. Measurement of liquid level using capacitive pick-up.
15. Speed control of DC motor using PLC.

**Apparatus Required**:

1. CRO,
2. Multimeter, Pin type patch cords,
3. Study Kits or Set-Up for respective experiments.
4. PLC

# Chhattisgarh Swami Vivekanand Technical University, Bhilai

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|---|---|---|---|
| Name of Program: | **Bachelor of Engineering** | | |
| Branch: | **Common to All Branches** | Semester: | **VI** |
| Subject: | **Managerial Skills** | Code: | **300665 (76)** |
| No. of Lectures: | **2/Week** | Tutorial Period: | **NIL** |
| Total Marks in ESE: | **NIL** | Marks in TA: | **40** |

Minimum number of Class Tests to be conducted: **Two**

**Objective:**
The course is introduced to develop managerial skills tremendously and enrich the abilities to enable one to meet the challenges associated with different job levels. Managerial skills are essential for overall professional development of an individual apart from gaining technical knowledge in the subject.

**Course Objectives**
Upon completion of this course, the student shall be able

- To define and explain the concept of managerial, written and oral communication skill;
- To understand the leadership skill;
- To develop self-appraisal and understand distinction between leader and manager;
- To develop positive attitude and thinking; and
- To understand managerial functions and develop creativity.

**UNIT I** **Managerial Communication Skills:** Importance of Business Writing: writing business letters, memorandum, minutes, and reports- informal and formal, legal aspects of business communication, oral communication- presentation, conversation skills, negotiations, and listening skills, how to structure speech and presentation, body language.

**UNIT II** **Managerial skills - Leadership**: Characteristics of leader, how to develop leadership; ethics and values of leadership, leaders who make difference, conduct of meetings, small group communications and Brain storming, Decision making, How to make right decision, Conflicts and cooperation, Dissatisfaction: Making them productive.

**UNIT III** **Proactive Manager:** How to become the real you: The journey of self-discovery, the path of self-discovery, Assertiveness: A skill to develop, Hero or developer, Difference between manager and leader, Managerial skill check list, team development, How to teach and train, time management, Stress management, Self-assessment.

**UNIT IV** **Attitudinal Change:** Concept of attitude through example, benefits of right attitude, how to develop habit of positive thinking, what is fear? How to win it? How to win over failure? How to overcome criticism? How to become real you? How to Motivate? How to build up self confidence?

**UNIT V** **Creativity**: Creativity as a managerial skill, Trying to get a grip on creativity. Overview of Management Concepts: Function of Management: Planning, organizing, staffing, controlling.

**Course Outcome**

- The students will be able to develop formal and informal, negotiation, written and oral communication skill;
- The students will be able to develop manage groups, resolve conflicts and leadership skill and decision making qualities;
- The students will be able to develop self-appraisal, teaching, training and managing stress and time;
- The students will be able develop positive thinking, motivating team members and winning race; and
- The students will be able to develop creativity and fundamental management functions.

**Text Books:**

1. Basic Managerial Skills for all by E.H. Mc Grawth, Prentice Hall India Pvt Ltd,2006
2. Basic Employability Skills by P. B. Deshmukh, BSP Books Pvt. Ltd., Hyderabad, 2014

**Reference Books:**

1. How to develop a pleasing personality by Atul John Rego, Better yourself bools, Mumbai,2006
2. The powerful Personality by Dr. Ujjawal Patni & Dr. Pratap Deshmukh, Fusion Books, 2006
3. How to Success by Brian Adams, Better Yourself books, Mumbai, 1969

# Chhattisgarh Swami Vivekanand Technical University, Bhilai

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|---|---|---|---|
| Branch: | **Electrical Engineering** | Semester: | **VI** |
| Subject: | **Fibre Optics (Professional Elective – I )** | Code: | **324671(24)** |
| Total Theory Periods: | **40** | Total Tutorial Periods: | **12** |
| No. of class Tests to be conducted: | **2 (Minimum)** | No. of assignments to be submitted: | **2 (Minimum)** |
| ESE Duration: | **Three Hours** | Maximum Marks in ESE: **80** | Minimum Marks in ESE: **28** |

**Course Objectives**

Knowledge of Fibre optics now a days is a must for the technologically advanced countries.
The course content:

1. Aims to teach the fundamentals of Optical fibre.
2. Includes the concept and classification of different types of fibre.
3. Teaches the behavioural aspects of Optical fibre in the field of Optical fibre communication.

**Course Outcomes**

Upon successful completion of the course the students should be able to:

1. Analyze a given optical fibre with different characteristics.
2. Analyze the various characteristics to know the property of a signal or a system
3. Know the components materials used for preparation of optical fibre.
4. Design a economical Optical fibre for communication system.

**UNIT I** Introduction to optical communication, principle of light transmission, optical fiber modes and configuration, mode theory for circular wave guides, single mode fibers, multimode fibers, numerical aperture, mode field diameter, fiber material, fiber fabrication techniques.

**UNIT II** Optical sources, LEDs, LASER diodes, Modal reflection noise, Power launching and coupling, Population inversion, Fiber splicing, Optical connectors, Photo detectors, PIN, Avalanche detectors, Response time, Avalanche multiplication noise.

**UNIT III** Signal degradation in optical fibers, attenuation losses, Signal distortion in optical wave guides, material dispersion, Wave guide dispersion, Chromatic dispersion, Intermodal distortion, Pulse broadening in graded index fiber, mode coupling, Advanced fiber designs: Dispersion shifted, Dispersion flattened, Compensating fibers, Design optimization in single mode fibers.

**UNIT IV** Coherent optical fiber communication, Modulation techniques for homodyne and heterodyne systems, Optical fiber link design, Rise time budget and link power budget, Long haul systems, Bit error rate, Line coding, NRZ,RZ, Block codes, Eye pattern.

**UNIT V** Advanced system techniques, Wavelength division multiplexing, Optical amplification, Semiconductor amplifier, EDFA comparison between semiconductor and optical amplifier, Gain bandwidth, Photonic switching, Optical networks, Optical fiber bus, Ring topology, Star architecture, FDDI and SONET standards.

**Text Books:**


1. Optical Fiber Communication", Gerd Keiser, Mc Graw Hill International Ed.
2. Optical Fiber Communication" A.K. Ghatak & K. Tyagarajan.
3. Optical Fibre Communication: Principals and Techniques", John M. Senior, PHI New Delhi


**Reference Books:**


1. Fibre Optics: Principles and Applications", N.S. Kapany, Academic Press, New York.
2. Fibre Optics System Network Applications", Terry Edwards, John Wiley & Sons.
3. Fibre Optics Test & Measurements", Dennis Drickson, Prentice Hall PTR, NJ USA.
5. Fibre Optic Communication Technology", D. Jafar, K. Mynbaev & Lowell L. Schenier, Pearson Education, Asia.it's Applications, S.C. Gupta, PHI India.

# Chhattisgarh Swami Vivekanand Technical University, Bhilai

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|---|---|---|---|
| Branch: | **Electrical Engineering** | Semester: | **VI** |
| Subject: | **Computer Aided Design of Electrical Machine (Professional Elective – I )** | Code: | **324672(24)** |
| Total Theory Periods: | **40** | Total Tutorial Periods: | **12** |
| No. of class Tests to be conducted: | **2 (Minimum)** | No. of assignments to be submitted: | **2 (Minimum)** |
| ESE Duration: | **Three Hours** | Maximum Marks in ESE: **80** | Minimum Marks in ESE: **28** |

**Course Objectives:**

1. To study the basics of computer aided design of various electrical machines.
2. To study the optimal design of dc machines.
3. To study the optimal design of power transformers.
4. To study the optimal design of three-phase alternator.
5. To study the optimal design of three-phase induction motor.

**Course Outcomes:**

At the end of course students should be able to:

1. Understand the basics of computer aided design of various electrical machines.
2. Understand the optimal design of dc machines, power transformers, three-phase alternator, and three-phase induction motor.

**UNIT I** **Introduction:** Design problem-mathematical programming methods, computer aided design-mathematical formulation of the problem, Programming techniques (LP & NLP only), Methods of solution, Unconstrained optimization problems, constrained optimization problems.

**UNIT II** Design of armature, Windings and field systems, Selection of variables of optimal design, Formulation of design equations, Objective function, Constraint functions, Algorithms for optimal design.

**UNIT III** Design of magnetic circuit, Design of windings, Selection of variables for optimal design, Formulation of design equations, objective function, Constraint functions, Algorithms for optimal design.

**UNIT IV** Design of stator, windings, Design of field systems for salient pole and non-salient pole machines, Selection of variables for optimal design, Formulation of design equations, Objective function, Constraint functions, Algorithms for optimal design.

**UNIT V** Design of stator, Windings Design of squirrel cage rotor, Design of slip ring rotor, Selection of variables for optimal design, Formulation of design equations, Objective functions Constraint functions, Algorithms for optimal design.

**Reference Books:**


1. Principles of Electrical Machine Design with Computer Programmes by – S.K. Sen, Oxford and IBH publishing Co.
2. Computer – Aided Design of Electrical Equipment – by Dr. M Ramamoorthy – Affiliated East – West Press Pvt. Ltd. New Delhi.
3. Electrical machine Design – by A.K. Sawhney, Dhanpat Rai & Sons.
4. Performance and Design of A.C. Machines – M.G Say, Affiliated East West Press Pvt. Ltd., New Delhi.
5. Performance and Design of D.C. Machines – Clayton and Hancock.

# Chhattisgarh Swami Vivekanand Technical University, Bhilai

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|---|---|---|---|
| Branch: | **Electrical Engineering** | Semester: | **VI** |
| Subject: | **Process Control (Professional Elective – I )** | Code: | **324673(24)** |
| Total Theory Periods: | **40** | Total Tutorial Periods: | **12** |
| No. of class Tests to be conducted: | **2 (Minimum)** | No. of assignments to be submitted: | **2 (Minimum)** |
| ESE Duration: | **Three Hours** | Maximum Marks in ESE: **80** | Minimum Marks in ESE: **28** |

**Course Objective:**
The objective of this course is to explain the importance of process control in terms of variability, efficiency, and safety in process industries. It explains the components of control loops and controller algorithms and the control systems used in process industries

**Course Outcomes:**
After completing this course, students will be able to determine needed control loop components in specific process control applications. They will be able to understand the operation of the entire control loop, and understanding how the control loop is affected by the process. They would be able to setup, calibrate, configure, and tune various real-world instrumentation and control loops.

**UNIT I** **Introduction:** Special characteristics of process systems large time constraints, interaction, multistage, pure lag, control loops for simple systems and their Dynamics & stability.

**UNIT II** **Control Techniques – I:** Generation of control action in electronic and pneumatic controllers, control valves, valves positioners, relief and safety valves, relays, volume boosters, pneumatic transmitters for process variable, Tuning of controllers – Zeigler Nichols and other techniques.

**UNIT III** **Control Techniques – II:** Different control techniques and interaction of process parameters e.g. feed forward, cascade, ratio, over- ride controls, batch continuous process controls, Feed forward Control scheme.

**UNIT IV** **Operation and Process Optimization:** Various process schemes / unit operations and their control schemes e.g. distillation columns, absorbers, heat exchangers, furnaces, reactors, mineral processing industries, etc. Use of control schemes for process optimization.

**UNIT V** **Case Studies:** Advanced control strategies with case studies, Use of DDC and PLC, Introduction to supervisory control, Conversion of existing control schemes in operating plants, data loggers.

**Text Books:**


1. Dale Patrick, Stephen Fardo, “Industrial Process Control system”.
2. Smith C.A. & A.B. Corripio,” Principal & Practiced Automatic Process Control”, J. Wiley.


**Reference Books:**


1. Shinskey F.G.” Process control System”, III Ed. McGraw Hill
2. Rao M & S.Qiv,”Process Control Engg.”Gordan & Breach

# Chhattisgarh Swami Vivekanand Technical University, Bhilai

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|---|---|---|---|
| Branch: | **Electrical Engineering** | Semester: | **VI** |
| Subject: | **Computer System Architecture (Professional Elective – I )** | Code: | **324674(24)** |
| Total Theory Periods: | **40** | Total Tutorial Periods: | **12** |
| No. of class Tests to be conducted: | **2 (Minimum)** | No. of assignments to be submitted: | **2 (Minimum)** |
| ESE Duration: | **Three Hours** | Maximum Marks in ESE: **80** | Minimum Marks in ESE: **28** |

**Course Objectives**

This subject aims to give an idea of evolution of computers, their various types and generations. It introduces the hardware and software in a computer system. It also gives knowledge of data transfer schemes, memory and its management. It also gives an idea arithmetic processor design and parallel processing.

**Course Outcomes**

By the end of this course we will learn to:

- Basic computer architecture and functioning.
- Data transfer schemes
- Instructions, programs and subroutine execution.
- Types of memory and their management.

**UNIT I** **Introduction to Architecture:** Basic Computer block diagram, input and devices, generations of computers their main features, Computer software, Application and system software their classification and significance. Instruction , program and sub-routines.

**UNIT II** **Requester transfer and Micro-Operations:** Requester transfer and Micro- Operations: Register transfer language, Inter – Register transfer, Arithmetic, Logic and shift micro operations, Control functions. Computer Organization and Design: Instruction, codes computer instructions, Timing and, control Execution of instructions, Input-Output and interrupts, Design of computer.

**UNIT III** **Central Processor Organization:** Central Processor organization: Processor bus organization, ALU, Stack Organization, Instruction formats, Addressing modes, Data transfer and manipulation, Program control, Parallel processor. Micro program control organization: Control memory, Address sequencing, Microprogram example, Microprogram sequencer, & Microinstruction formats.

**UNIT IV** **Arithmetic Processor Design:** Arithmetic Processor Design: Comparison and subtraction, Algorithm for addition, Subtraction, Multiplication, division, Processor Configuration, Design of Control. Arithmetic algorithms: Arithmetic with signed 2's complement numbers, Multiplication and Division, Floating point arithmetic operations, Decimal Arithmetic Unit and operations

**UNIT V** **I/O Organization:** I/O Organization: I/O interfaces, asynchronous data transfer, DMA, Priority interrupt, I/O processor, Multiprocessor system organization. Memory organization: Various memories – Auxiliary, Associative, Cache, Microcomputer, Virtual ones, and Memory Hierarchy, Memory Management hardware.

**Text Books:**

1. Computer System Architecture by M. M. Mano
2. Computer Architecture and Organization, J.P. Hayes International Student Edition, McGraw – Hill.

**Reference books:**

1. Structured computer organization 3rd Edn by A. S. Tannabaum.
2. Computer Organization by V.C.Hamacher et al McGraw.
3. Introduction of Digital computer Design by V. Rajaraman & T.Radhakrishnman.

# Chhattisgarh Swami Vivekanand Technical University, Bhilai

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|---|---|---|---|
| Branch: | **Electrical Engineering** | Semester: | **VI** |
| Subject: | **Power System Planning & Reliability (Professional Elective – I )** | Code: | **324675(24)** |
| Total Theory Periods: | **40** | Total Tutorial Periods: | **12** |
| No. of class Tests to be conducted: | **2 (Minimum)** | No. of assignments to be submitted: | **2 (Minimum)** |
| ESE Duration: | **Three Hours** | Maximum Marks in ESE: **80** | Minimum Marks in ESE: **28** |

**Course Objectives:**
This course covers power system planning, operation and management issues as well as reliability in a deregulated environment. The course will give a comprehensive overview of power system reliability.

**Course Outcomes:**
By the end of the course the students will be able to know about evaluation of generation, transmission and distribution system reliability and their impacts on system planning. They would also know about the factors affecting power system expansion planning, operation and management as well as reliability in an electricity market including system adequacy, security, ancillary services market, decision making and other management issues.

**UNIT I** **Review of Reliability concepts:** Review of probability theory element of probability theory Probability distribution, Random variable, Density & distribution functions, Mathematical expectation, Binominal distribution, Poisson distribution, Normal distribution, Exponential distribution, and Weibull distribution.

**UNIT II** **Reliability of Engineering System:** Reliability of engineering systems Component reliability, Hazard models, Reliability of systems with non-repairable components, series, parallel, series-Parallel, Parallel-Series configurations, Non-series-parallel configurations, Minimal tie-set, minimal cut-set and decomposition methods, Repairable systems, MARKOV process, Long term reliability Power System reliability.

**UNIT III** **Modelling:** Reliability of engineering systems Reliability model of a generating unit, State space methods, Combining states, Sequential addition method, Load modeling, Cumulative load model, Merging of generation and load models, Loss of load probability, percentage energy loss, Probability and frequency of failure, operating reserve calculations.

**UNIT IV** **Power System Reliability:** Power Network Reliability Weather effect on transmission lines, Common mode failures, Switching after faults, three, state components, Normally open paths, Distribution system reliability. Composite System Reliability Bulk Power supply systems, Effect of varying load, Inter connected systems, Correlated and uncorrelated load models, cost and worth of reliability.

**UNIT V** **Reliability Improvement and Testing:** Reliability Improvement & Testing proper Design simplicity, Component improvement Testing Plans, time censored & sequential reliability tests, accelerated life test, environment test, Reliability estimations.

**Textbooks:**


1. J.Endreny, Reliability Modeling in Electric Power Systems, John Wiley & Sons.
2. Roy Billinton & Ronald, Nallan, Reliability Evaluation of Power systems, Plenum Press, New York


**Reference Book:**


1. A.S Pabla , “Electrical Power system planning”, Mac Millan,Delhi,1998
2. X.Wang & J.R. Mc Donald , “Modern Power system planning”, McGraw. Hill, 1993.

# Chhattisgarh Swami Vivekanand Technical University, Bhilai

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|---|---|---|---|
| Branch: | **Electrical Engineering** | Semester: | **VI** |
| Subject: | **Cyber Security (Professional Elective – I )** | Code: | **324676(24)** |
| Total Theory Periods: | **40** | Total Tutorial Periods: | **12** |
| No. of class Tests to be conducted: | **2 (Minimum)** | No. of assignments to be submitted: | **2 (Minimum)** |
| ESE Duration: | **Three Hours** | Maximum Marks in ESE: **80** | Minimum Marks in ESE: **28** |

**Course Objectives:**

1. To explore basics idea about the networking and its applications.
2. To explore basics idea about the different types of security attacks and their vulnerabilities.
3. To develop an idea for secure data communication on networks.
4. To give an idea about security management, laws and standards.

**Course Outcomes:**

1. They will learn about concepts of networks and its basic components.
2. They will be in condition to identify different types of attacks and their vulnerability.
3. They will be able to explain different types of networks are in use and how to communicate securely using them.
4. They will learn about the security management and their applications.

**UNIT I** **Overview of Networking Concepts:** Basics of Communication Systems, Transmission Media, topology and Types of Networks, TCP/IP Protocol stacks, Wireless Networks, The Internet. **Information Security Concepts:** Information security overview: background and current scenario, Types of attacks, Goals for security, E-commerce security, Computer Forensics, Steganography.

**UNIT II** **Security Threats and Vulnerabilities:** Overview of Security threats, weak/ strong passwords and password cracking, Insecure network connections, Malicious code, Programming bugs, Cyber crime and cyber terrorism, Information warfare and surveillance. *Cryptography/Encryption*: Introduction to Cryptography/Encryption, Digital Signatures, Public Key infrastructure, Applications of Cryptography, tools and techniques of Cryptography.

**UNIT III** **Security Management Practices:** Overview of security management, Information classification process, Security policy, Risk management, Security procedures and guidelines, Business continuity and disaster recovery, Ethics and best practices. Security Laws and Standards: Security assurance, security laws, IPR, International standards, Security audit, SSE-CMM/COBIT etc.

**UNIT IV** **Information and Network Security: Access Control and Intrusion Detection:** Overview of identification and authorization, Overview of IDS, Intrusion, Detection Systems and Intrusion prevention systems. **Server Management and Firewalls:** User management, Overview of Firewalls, Types of firewalls, DMZ and firewall features.

**UNIT V** **System and application Security: Architectures and Models:** Designing secure operating systems, Controls to enforce security services, Information security models. **System Security:** Desktop security, email security:PGP and SMIME, Web security: Web authentication, SSL and SET, Database security. **OS Security:** OS security vulnerabilities, updates and patches, OS integrity checks, Antivirus software, Configuring the OS for security, OS Security Vulnerabilities, Updates and patches. Wireless Networks and Security: Components of wireless networks, Security issues in wireless.

**Text Books:**


1. Cyber Laws: Intellectual property and E commerce, Security-Kumar K, dominant publisher.
2. Information Security policy and implementation Issues NIIT, PHI.
3. TCP/IP Protocol Suite fourth Edition – Behrouz A. Forouzan.
4. Cryptography and Network Security Second Edition – William Stalling.


**Reference Books:**


1. Cyber CRIME notorious aspects of the humans and net criminals activity in Cyber world. Barna Y Dayal D P Dominant Publisher.
2. Spam Attack, Cyber Stalking and abuse, Dayal D P Dominant Publisher.
3. Information Security, NIIT: PHI.