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

SCHEME OF TEACHING AND EXAMINATION

B.E. VII SEMESTER ELECTRICAL ENGINEERING

o.	Board of Studies	Subject Code	Subject	Periods per week			Scheme of Exam			Total Marks	Credit L+(T+P)/2
				L	T	P	ESE	CT	TA		
1	Electrical Engg.	324731(24)	Switchgear & Protection	4	1	-	80	20	20	120	5
2	Electrical Engg.	324732(24)	Modern Control System	4	1	-	80	20	20	120	5
3	Electrical Engg.	324733(24)	Electrical Drives	4	1	-	80	20	20	120	5
4	Electrical Engg.	324734(24)	Energy Auditing and Management	4	1	-	80	20	20	120	5
5	**Refer Table -2**		**Professional Elective-II**	4	1		80	20	20	120	5
6	Electrical Engg.	324761(24)	Switchgear & Protection Lab	-	-	3	40	-	20	60	2
7	Electrical Engg.	324762(24)	Electrical Drives Lab	-		3	40	-	20	60	2
8	Electrical Engg.	324763(24)	Programming and Simulation in MATLAB	-	-	3	40	-	20	60	2
9	Electrical Engg.	324764(24)	Project Phase-I	-	-	4	100	-	40	140	2
10	Management	324765(76)	Innovative & Entrepreneurial Skills	-	-	1	-	-	40	40	1
11	Electrical Engg.	324766(24)	**Practical Training Evaluation	-	-	1	-	-	40	40	1
Total				**20**	**5**	**15**	**620**	**100**	**280**	**1000**	**35**

L - Lecture, T - Tutorial,
P - Practical, ESE- End Semester Exam , CT- Class Test
TA - Teacher's Assessment
****To be completed after VI Sem. and before the commencement of VII Sem.**

Table -2 Professional Electives-II

S.No	Board of Studies	Subject Code	Subject
1	Electrical Engg.	324741(24)	Power Apparatus System
2	Electrical Engg.	324742(24)	Systems Software
3	Electrical Engg.	324743(24)	Modeling & Simulation
4	Electrical Engg.	324744(24)	Advanced Microprocessor
5	Electrical Engg.	324745(24)	Embedded system software in C
6	Electrical Engg.	324746(24)	Microcontroller & embedded Systems
7	Electrical Engg.	324747(24)	Digital Image Processing

Note (1) One fourth of total strength of students subject to minimum of twenty students is required to offer an elective in the college in a particular academic session.

Note(2) Choice of elective course once made for an examination cannot be changed in future examinations.

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

Semester: BE VII **Branch: Electrical Engg.**
Subject: Switchgear & Protection **Code: 324731(24)**
Total Theory Periods - 48 **Total Tutorial Periods: 12**
Total marks in End Semester Exam: 80

Course Objectives:

1. To understand the principle of protective schemes and various faults in the Power System Scenario.
2. To study the various types of the circuit breakers, the arc quenching phenomena and the protection against over voltages.
3. To explain the students protection systems used for electric machines, transformers, bus bars, overhead and underground feeders.

Course Outcomes:

At the end of the course, students will be able to

1. Design the relevant protection systems for the main elements of a power system.
2. Analyze overcurrent, differential, and ratio protection devices and their application in a coordinated protection scheme.
3. Understand the stability problems and clearing of faults to mitigate these problems.

UNIT I: Protective Relays

Trip circuit & circuit Breaker, Current transformer & protection, instantaneous over current relay, I.D.M.T. Relay, Differential relay, Directional relay, Generalized torque expression, impedance relay, reactance relay, mho relay.

UNIT II: Generation, Transformer & Bus bar Protection

Generator protection – Differential protection of stator, inter turn fault protection, protection against unbalance loading, protection of rotor against ground fault, protection against field failure, protection against failure of prime mover, field suppression in alternators.

Transformer protection – difficulties in differential protection, mode of C.T. connection for differential protection of three phase transformer, protection against magnetizing inrush current, core balance earth leakage protection.

Bus bar protection- Differential protection, frame leakage protection.

UNIT III: Feeder and Transmission line protection

Feeder protection- protection of ring main feeder, protection of parallel feeders.

Transmission line protection-Over current protection of lines, Three step distance protection, effect of power swings on distance relay, Directional comparison carrier current protection, phase comparison carrier current protection, carrier aided distance protection.

UNIT IV: Static Relays

Amplitude & phase comparators, duality between amplitude & phase comparators, circulating current amplitude comparators, coincidence type phase comparator, block spike phase comparator, integrating phase comparator, Hall effect sine phase comparator, Design of directional relay, reactance relay, mho relay, impedance relay, quadrilateral characteristics relay using cosine phase comparator and amplitude comparator.

UNIT V: Circuit Breakers

Initiation of Arc, High resistance arc interruption, current zero arc interruption, Recovery voltage, Factor affecting recovery voltage, Restriking voltage, Rate of Rise of Restriking Voltage, Breaking of capacitive current, current chopping, Resistance switching, Circuit Breaker rating, Circuit Breaker testing, Minimum oil circuit breaker, Air Blast circuit Breaker, SF-6 Circuit Breaker.

Text Books

1. Fundamentals of Power System Protection, Paithankar Y. G., Bhide S. R., Prentice Hall of India Limited, New Delhi , 2nd Edition, 2010.
2. Power System Protection and Switchgear, Badri Ram, Vishwakarma D N., Tata McGraw Hill Publishing House Limited, New Delhi, 2005.

Reference books

1. Electrical Power Systems, Wadhwa, C.L., New Age International Publishers Limited, 2006, New Delhi,6th Edition, 2010
2. Switchgear Protection and Power Systems (Theory, Practice & Solved Problems, Sunil, S.Rao, Khanna Publishers Limited, New Delhi, 12th Edition, 2008.
3. A Text Book on Power Systems Engineering, Soni, M.L., Gupta, P.V., Bhatnagar, U.S. and Chakrabarti, A., Dhanpat Rai & Sons Company Limited, New Delhi, 2008.

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

Semester: BE VII **Branch: Electrical Engg.**
Subject: Modern Control System **Code : 324732(24)**
Total Theory Periods - 48 **Total Tutorial Periods: 12**
Total marks in End Semester Exam: 80

Course Objectives:

This course will introduce the students to develop new skills and analytical tools required to analyze and design methods for the control of both multivariable linear and nonlinear systems. It would give them opportunity to look at some of the research topics in modern control theory and dynamical systems and see how the theory of nonlinear and discrete dynamics and chaos can be used to engineer new control devices.

Course Outcomes By the end of this course the students will learn to:

1. Decide in advance if a given dynamical system is controllable and observable.
2. Design state feedback controllers to change the evolution of a dynamical system of interest.
3. Optimize the control system design to minimize the control energy spent or achieve control in minimum time.
4. Complex dynamics of nonlinear systems

UNIT-I Non- Linear Control Systems

Introduction to non-linear system: Comparison of linear and non-linear systems, properties of non-linear systems, some common non-linearities (saturation, dead-zone, on-off, non-linearity, backlash, Hysteresis) and their describing functions, Singular points, Stability analysis of non-linear systems using describing function, Limit cycle.

UNIT-II State Space Analysis

Concept of state, state variable, State no uniqueness, state models for linear continuous time functions, Eigen vectors, invariance properties, diagonalization and Jordan canonical form Cayley Hamilton theorem, Computation of state transition matrix by different methods. state equations in CCF, OCF and Diagonal Canonical form.

UNIT-III Liapunov Stability Analysis of Linear and Non-Linear Systems

Introduction – basic concepts, Concept of stability – stability in the sense of Liapunov-absolute stability indirect method of Liapunov and direct method of Liapunov with four stability theorems, Liapunov Stability Analysis of Linear Systems, Liapunov function, Construction of Liapunov function for linear systems and non-linear systems – Krasovskii's method, variable gradient method.

UNIT- IV Control System Design by State Space

Pole placement design, Ackermann's Formula for Pole Placement, design of full and reduced order state observers, Ackermann's Formula for design of state observers, design of Servo system.

UNIT- V Optimal and Discrete System Control

Discrete System Control: Introduction, Impulse sampling and Data Hold, Reconstructing Original signals from Sampled signals, The Pulse Transfer Function, Mapping between the s Plane and the z Plane, Dominant characteristic equation Roots, Stability Analysis using Bilinear transformation Method and Jury's stability test.

Optimal Control Systems: Introduction, Parameter Optimization and Optimal Control problems, Performance Index, (Elementary study)

Text Books:

1. Control systems: Smarjit Ghosh, Pearson, Second edition
2. Control Systems Principles and Design: M. Gopal, McGraw Hill.
3. Modern Control Engineering: K. Ogata, PHI, Second edition, 1991

Reference Books:

1. Modern Control Engineering: Roy Choudhary, PHI.
2. Applied Nonlinear Control: Jaan Jacques E. Slotine and Weiping Li, Prentice Hall NJ, 1991.
3. Control Systems Technology: Curtis Johnson and Heidar Malki, Pearson.
4. Modern Control Systems: R. C. Dorf and R. H. Bishop, Pearson
5. Digital control systems: Benjamin C. Kuo. Oxford university Press, Second Edition.

Semester: BE VII **Branch: Electrical Engg.**
Subject: Electrical Drives **Code : 324733(24)**
Total Theory Periods - 48 **Total Tutorial Periods: 12**
Total marks in End Semester Exam: 80

Course Objectives:

1. Describe the structure of Electric Drive systems and their role in various applications
2. Understand basic requirements placed by mechanical systems on electric drives.
3. Describe the operation of dc motor drives to satisfy four-quadrant operation to meet mechanical load requirements.
4. Design torque, speed and position controller of motor drives.
5. Describe the operation of induction machines in steady state that allows them to be controlled in induction-motor drives.
6. Learn speed control of induction motor drives in an energy efficient manner using power electronics.
7. Describe operation of tractions.

Course Outcomes:

At the end of the course the students will be able to describe:

1. Electric drive systems for different mode of operations.
2. Operation of tractions.
3. Speed control of DC and AC machines using Power Electronics.
4. Design of ratings on the basis of heating and cooling.

UNIT I: Electric Drives

Basic concept of electric drives its advantages and types, choice of electric drives, Fundamental equations, speed torque conversions and multi quadrant operation, drive parameters, component of load torque, nature and classification of load torques, calculation of time and energy loss in transient operation, steady state stability and load equalization.

UNIT II: Control and Rating of Electric Drives

Modes of operation of electric drives, Closed loop control of drives, closed loop control of multi motor drives, Selection of motor power rating-Heating and Cooling of motors, Selection of motor power rating under different loading conditions, Continuous, Short and Intermittent periodic duty.

UNIT III:DC Drives

Review of dc motors and their performance, Braking: Regenerative braking, Dynamic braking, Plugging. Transient Analysis of separately excited dc motor with armature and field control, Transient Analysis of starting and dynamic braking of dc separately excited dc motor. Speed control, Controlled Rectifier fed dc drives: single phase and three phase half controlled and fully controlled, Multi quadrant operation of dc drives, Chopper Controlled dc drives.

UNIT IV: Induction and Synchronous Motor Drives

Review of conventional method of starting, and Speed control, Braking: Regenerative braking, Dynamic braking, Plugging. Speed control by stator voltage control, supply frequency control, Voltage source inverter (VSI) and current source inverter (CSI) fed three-phase induction motor drives, Static rotor resistance control induction motor drive, Slip power recovery drives.

Synchronous motor drives: Speed control of synchronous motor using voltage and current source inverters, Self-controlled synchronous motor drives

UNIT V: Traction Drives

Electric Traction system, Nature of traction load, calculation of Traction drive rating and energy consumption, Important feature of traction drives, Motors employed in traction, Conventional method for AC and DC traction drives control, Semiconductor converter controlled drives employing DC motors, AC motors for 25 KV AC traction.

Text Books:

1. Fundamentals of electrical drives, G K Dubey, 2nd edition, NarosaPb
2. Electric Drives. Vedam Subramanyam, TMH Pbs.

Reference Books:

1. Electric Motor Drives, R. Krishnan, PHI Pb
2. Modern Power Electronics and A C Drives, B K Bose, Pearson Education
3. Electrical Machines, Drives and Power Systems, Theodore Wildi, Pearson Sixth Edition

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

Semester: BE VII **Branch: Electrical Engg.**
Subject: Energy Auditing and Management **Code : 324734(24)**
Total Theory Periods - 48 **Total Tutorial Periods: 12**
Total marks in End Semester Exam: 80

Course Objectives:

Familiarizing with management especially with management in energy sector engineering. Fundamentals of product strategy management. Studying methods of energy accounting and energy auditing in energy sector, industry and final consumption. Finding opportunities to increase the rational use of energy.

Course Outcomes:

Understanding basics of demand side management and mechanisms (technical, legal or financial) that influence energy consumption. Recognizing opportunities for increasing rational use of energy. Learning the basics of energy auditing with application on different sectors.

UNIT I: Overview

History of Energy Management: Energy forecasting, Limitations of energy resources. Renewable energy recourses. Load management. Energy management. Demand side management (DSM) Energy conservation in realistic distribution system. Short term load forecasting for de-centralized load management.

UNIT II:Energy Situation and Global Energy Sources

World energy consumption. Energy in developing countries. Firewood crises. Indian energy sources. Non-conventional renewable energy sources. Potential of renewable energy sources. Solar energy types. Wind energy. Wave, tidal and OTEC. Super-conductors in power system. Wind power generation for large scale generation of electricity. Wind driven induction generators.

UNIT III: Energy Auditing as Applicable to an Industry

Classification of energy audit System optimization. Power factor improvement. Preventive maintenance. Process modification. Non-conventional energy sources. Electricity tariffs. Types of off-peak tariffs.

UNIT IV: Elements of Energy Auditing and Metering Methodologies (Case Studies):

Capacity utilization. Technology up-gradation. Fine tuning, Energy conservation. Concept and methods of energy conservation.

UNIT V: Demand Side Management

Introduction to DSM. Concept of DSM. Benefits from DSM. DSM techniques. Time of day pricing, Multi-utility exchange model. Time of day pricing models for planning, load management. Load priority technique. Peak clipping. Peak shifting. Valley filling. Strategic conservation. Energy efficient equipment, Socioeconomic awareness programs.

Text Books:

1. Energy Demand: Analysis, Management and Conservatioin, Ashok.V.Desai(ED), Wiley Eastern Ltd., New Delhi.
2. Energy technology, S. Rao, Parulekar, Khanna Pbs.

Reference Books:

1. Demand Side Management , Jyothi Prakash, Tata McGraw-Hill Publishers.
2. Renewable Energy Sources and Conservation Technology,N.K.Bansal, Kleeman Millin, Tata McGraw-Hill Publishers.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Semester: B.E. VII **Branch: Electrical Engg.**
Subject: Switchgear Protection Lab **Code: 324761(24)**
Total Practical Periods: 36
Total Marks in End Semester Exam: 40

List of experiments: (Minimum 10 experiments to be performed)

1. To study Over Current Relay static type & draw characteristics.
2. To study Under Voltage relay Electromechanical type & draw characteristics.
3. To study Over Voltage relay Electromechanical type & draw characteristics.
4. To study IDMT Over Current relay Electromechanical Type & draw current verses time characteristics.
5. To study IDMT earth fault relay Electromechanical type draw current verses time characteristics.
6. To study operating characteristics of percentage-biased differential relays tp plot the characteristics of percentage biased Differential relay for 20%,30% and 40%,
7. To study the construction and operation of Buchholz Relay.
8. To study the characteristics of Instantaneous relays.
9. To study Static type Negative Sequence relay.
10. To study the time-grading protection of feeder [simulation Model].
11. To study the current-grading protection of feeder [simulation Model].
12. To study the time-current grading protection of feeder [simulation Model].
13. To plot the characteristics of Directional Over Current relay
14. To study different types of circuit breakers.
15. To study different protection schemes for alternators.

Apparatus Required:

1. Relays
2. Transformer
3. Variable voltage source
4. Digital meter
5. Over Current and Negative Sequence Relay (static type)
6. Directional Over Current Relay
7. IDMT Over Current Relay (Electromechanical type)
8. Over Voltage/Under Voltage/ Instantaneous Relay (Electromechanical type)
9. Buchholz Relay
10. Differential relay
11. Circuit Breaker
12. MATLAB with Power System toolbox

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Semester: B.E. VII **Branch: Electrical Engg.**
Subject: Electric Drives Lab **Code: 324762(24)**
Total Practical Periods: 36
Total Marks in End Semester Exam: 40

List of experiments: (Minimum 10 experiments to be performed)

1. To study the heating time constant for a Continuous Duty Motor
2. To Study the heating time constant of a Short time Duty Motor
3. To Study the cooling time constant of a Short time Duty Motor
4. To Study the heating time constant of a Short Time Duty Motor
5. To Study the cooling time constant for an Intermittent Duty Motor
6. Performance and speed control of D.C drive using 3-phase full converter
7. Performance and operation of a four quadrant chopper on D.C drive
8. Study and performance of electrical Dynamic braking and Plugging of D.C shunt motor
9. Study of V/F control operation of 3-ϕ Induction motor
10. Simulation of PWM VSI/CSI fed 3-ϕ Induction motor control using MATLAB/PSPICE/PSIM software
11. Study of solid state stator voltage control of 3-ϕ Induction motor (using AC voltage regulator)
12. Performance and speed control of 3-ϕ Induction motor using 3-ϕ voltage source inverter
13. To study frequency control Synchronous motor drive
14. Study of AC motors for 25KV Ac traction
15. Study of Resistance wielding and Arc welding

Apparatus Required

1. AC motor speed control trainer
2. DC motor speed control trainer
3. Heating cooling time constant unit
4. V/f control of Induction motor

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

Semester: BE VII **Branch: Electrical Engg.**
Subject: Programming and Simulation in MATLAB **Code :324763(24)**
Total Theory Periods – 36
Total marks in End Semester Exam: 40

List of experiments: (Minimum 10 experiments to be performed covering every topic)
Each topic is followed by suggested programs/ simulations

MATLAB Basics: Variables and arrays, initialising, multidimensional arrays, subarrays, array and matrix operations, built-in basic MATLAB functions, display of output data, introduction to simple and multiple plots with colour, style, legends, etc.

1. Create a matrix

   and determine the size, display every element of z, create subarrays z(: ,2:5) and z(:,2:3:5).
2. Input two 4 x 4 arrays A and Band do the following:
   A. Find the maximum and minimum values in each column of A and B.
   B. Find the maximum and minimum values in each row of A and B.
   C. Find the maximum and minimum values of A and B.
   D. Find the result of the expressions A+B, A*B, A.*B, A./B, A.\B.
   E. Find transpose and inverse of A and B.
   F. Find rank of A and B
   G. Reshape the matrices to another array of different size.
3. Create linear plots with different colors and lines for the following data giving title and axes markings.

x	0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
y	10	10	16	24	30	38	52	68	82	96	123

4. Make a three dimensional plot for the function.

MATLAB branching and looping: Relational and logical operators, logical functions, branching with if constructs and switch construct, while loop, for loop, break and continue statements.

1. Assume *a, b, c* and *d* be are as defined below

   Evaluate the following expressions
   i. a > b & c > d
   ii. a == b
   iii. ~(a > b)
   iv. isinf(a/c)
   v. d | b > a
   vi. isempty (c)
   vii. a > b & ischar(d)
2. Write a program to solve for the roots of a quadratic equation, regardless of the type. Input each coefficient of the using input function and display each result using disp and fprintf functions.
3. Using grades ranging from 'A' to 'F', classify the marks from 0 to 100. Write a program to display the same using nested if constructs and switch construct.
4. A Fibonacci sequence *f(n)* is defined as follows: the first term *f(0)* and second term *f(1)* in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the

sequence, i.e., $f(n)= f(n-1)+ f(n-2)$. Write a program using while loop to generate the first n terms of the sequence where n is the input by the user.

5. Write a program to find the factorial of a number using for loop. The program should result 1 for zero input and report an error message if the input is negative or not an integer.
6. The day of the year is the number of days (including the current day) that have elapsed since the beginning of a given year. It is a number in the range 1 to 365 for ordinary years and 1 to 366 for leap years. Write a program that accepts a day, month and year, and calculates the day of the year corresponding to that date

MATLAB built-in special functions: Polynomial related functions like root finding, creating polynomial using roots and discrete data, differentiation using syms and diff functions, finding Laplace and inverse Laplace transforms using laplace and ilaplace functions, solving linear and nonlinear equations.

1. Find the roots of the polynomial $p(x)=x^3 - 4x^2 + 5x - 2$ using the function root. Also find the polynomial using the function poly for the same roots. Plot $p(x)$ for x ranging from 1 to 20.
2. Solve the following system of equations using MATLAB and get the values of x_1, x_2 and x_3.

$$2x_1 + x_2 + 5x_3 = -1$$
$$x_1 - 2x_2 + x_3 = 1$$
$$x_2 + 2x_3 = 0$$

3. Write a program to find the numerical solution of the following set of non-linear equations:

4. Use MATLAB functions syms and diff to compute the expressions for and and evaluate their numerical values at $x = 0$, $x = 5$ and $x = 10$.
5. Find the inverse Laplace transform of following functions using MATLAB function ilaplace.

   i. ii. iii.
6. Evaluate the partial fractions expansion of following functions using MATLAB function residue:

   i. ii.

   iii. iv.

User defined functions: Breaking large program into functions, creating functions with dummy arguments,

1. Write a function to convert the rectangular coordinate to polar coordinate and vice versa. Use these functions in the main program to list the result for various values of angles and magnitudes.
2. Write a function to calculate the factorial. Use the function to compute binomial coefficient.
3. Write a function 'sort_ascending' to sort a list of numbers in ascending order and compare the performance with the MATLAB function sort by creating an arbitrary matrix of size 4 x 20. Determine the execution time in each case by using tic and toc functions.
4. The gravitational force F between two bodies of masses m_1 and m_2 specified in kg, isgiven by where G is the gravitational constant and r is the distance in meter between the two masses. Write a function to calculate F. Test your function by determining the force on an 800 kg satellite in orbit 38,000 km above the earth. G=6.672 × 10^{-11} N m^2 / kg and mass of earth is 5.98×10^{24} kg.

MATLAB applications:

1. Let a voltage source V = 120 V with an internal resistance $R_s$of 5 Ω be connected with a load resistance R_L. Using MATLAB create an array of R_L from 1 Ω to 100 Ω with a step size of 1. Plot the power supplied to the load as function of R_L. From the plot find the value of R_L that will result in the maximum possible power being supplied by the source to the load. How much power will be supplied in this case?

2. In a series *RLC* circuit R=1.4 Ω, L= 2 H and C = 0.32 F. The initial inductor current is zewro and the initial capacitor voltage is 0.5 V. A step voltage of 1 V is applied at time t = 0, Determine $i(t)$ and $v_c(t)$ over the range 0< t <15 sec. Also obtain one plot of current $i(t)$ and capacitor voltage $v_c(t)$ versus time.
3. A simple low pass filter circuit consists of a resistor R and capacitor C in series, and the ratio of the output voltage V_o to the input voltage V_i is given by

   where, V_i is the sinusoidal input voltage of frequency f. Assuming R =16 kΩ and C =1 μF, plot the amplitude and frequency response of this filter.
4. Consider the simple mass-spring-damper system with mass M = 1 kg, frictional coefficient B = 5 N/m/sec and the spring constant K = 25 N/m. With the system initially at rest, a force F = 25 N is applied a time t = 0. Obtain the transfer function of the system and convert the same into state space model. Obtain the unit step response of the system and find the settling time and peak overshoot.
5. Sketch the root locus for the open loop transfer function Find the dominant roots of the characteristic equation with damping ζ=0.5 and also find the value of gain K at the dominant root.
6. Sketch the bode plot for the open loop transfer function . Also determine the gain margin, phase margin, gain cross over frequency and phase cross over frequency. Plot the nyquist plot for the same.
7. A 345 kV, three phase transmission line is 130 km long. The resistance per phase is 0.036 Ω per km and the inductance per phase is 0.8 mH per km. The shunt capacitance is 0.0112 μF per km. the receiving end load is 270 MVA with 0.8 power factor lagging at 325 kV. For the medium line model, write a general program to find the voltage and power at the sending end and the voltage regulation.

Simulink:

1. Consider the simple mass-spring-damper system with mass M = 1 kg, frictional coefficient B = 5 N/m/sec and the spring constant K = 25 N/m. With the system initially at rest, a force F = 25 N is applied a time t = 0. Obtain the state model and construct a simulation diagram for the system. Simulate the step response of this system and store the graphical results in a file.
2. Simulate the series *RL* circuit and find the response of current to (a) a DC signal (b) to an AC signal. Also show the plots for voltage and current in a single plot for case (b) and comment on the phase difference between the two for various values of R and L.
3. A system described by the following equation:

   and initial conditions are: Use Simulink to get the plot of x for the range t = 0 to 5 sec.
4. Use Simulink to create a single phase rectifier circuit to convert an AC signal to DC.
5. Use Operation Amplifier (OPAMP) to construct the following circuit models using Simulink:
   (a) An inverting amplifier (b) An Integrator
   (c) A differentiator
6. To study the bipolar and unipolar switching scheme of a single phase full bridge inverter using MATLAB simulation.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Semester: 7th **Branch: Electrical Engg.**
Subject: Project Phase I **Code: 324764(24)**
Total practical periods: 48 **Total Marks in end Semester Exam: 100**

The project is by far the most important piece of work in the degree course. It provides an opportunity to the students to demonstrate independence and originality, to plan and organize a complete project covering the entire final year, and to put into practice some of the techniques that have been taught throughout the course.

The students of final year are advised to choose a project that involves a combination of theory and practical, or a piece of theoretical work or developing a complex application which may already exist, or by enhancing some existing application or method to improve its functionality, performance, etc. The project may be hardware based or software/simulation based. Projects which are predominantly study or survey reports should not be acceptable, unless they are backed up with experimentation, implementation, or theoretical analysis. Innovative projects are encouraged and more appreciable.

Project work shall be carried out under the supervision of a faculty member possessing at least a PG degree or a minimum of 3 years experience with whom, the students shall be in continuous touch during the period of project work.

The students are required to do the project in two phases which covers both the 7^{th} and 8^{th} semesters. It is preferred that a project be implemented by team of three to four students, but if necessary it may be implemented by five students that depends on the suitability, scope and the volume of work. The process of allotment of supervisor/guide to a particular project group is a work of the department.

The idea and topic for the project may be a proposal from the project supervisor/guide or the student group, or a combination of the two. The project supervisors/guides are advised to give projects and suggest project titles focusing more on the current field of research and ensure the level of innovation. No project supervisor can guide more than three project groups in the academic schedule.

Attendance register will be maintained and students are expected to work in the respective labs. They should have regular meetings with their guides and inform the timely progress of their work.
In Phase I the students are expected to carry out the literature survey on the proposed work, derive the required relations, finalize the architectural design, the algorithms / techniques used and the expected outcomes for the proposed system.

In Phase I there shall be two assessments by a review committee constituted by the department, during each of the project semesters. The students shall make presentation on the progress made before the committee. The first review should be held within 4 weeks after the finalization of the thrust area and the final review would be held at the end of 12 weeks but within the schedule. The internal assessment marks would be awarded based on the interaction with the guide, attendance record, presentations and the project report duly signed by the supervisor and the head of the department.

The final evaluation of Project Work for Phase I & Phase II shall be done independently in the respective semesters and marks shall be allotted as per the scheme. It will be based on the project report submitted in each of the Phase – I & Phase - II semesters and a Viva-Voce Examination by a team consisting of the an Internal examiner and an External Examiner appointed by the university.

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

Semester: BE VII **Branch: Electrical Engg.**
Subject: Power Apparatus System **Code : 324741(24)**
Total Theory Periods - 48 **Total Tutorial Periods: 12**
Total marks in End Semester Exam: 80

Course Objectives:

1. To gain knowledge about Transmission system components (Tower, accessories, sag etc).
2. To study insulation coordination and surge protection.
3. To understand various grounding systems.
4. To know basic concept of reliability of system in view of transmission and Distribution.

Course Outcomes

After going through this course, student will be able to:

1. Describe Transmission system components. (Tower, accessories, conductor, sag etc).
2. Explain insulation coordination and surge protection.
3. Write about various grounding systems.
4. Correlate basic concept of reliability with Reliability of transmission and Distribution System.

UNIT – I Transmission System Components:

Types Of Insulator , Conductors, Towers , Span, Conductor Configuration Spacing, Clearance , Sag & Tension Calculation, Voltage Distribution Over The Insulator String , String Efficiency , Selection of Conductor Size, Number of Circuit , Ground Wire, Surge Impedance Loading.

UNIT-II Distribution System :

Types, Primary & Secondary Distribution System, Voltage Drop In AC & DC System, Selection of Distribution Voltage , Size of Conductor, Kelvin's Low, General Design Consideration Load Estimation Substation Equipment Protection System, Design of A Typical Distributions System (Rural / Town/ Industrial)

UNIT-III Power System Grounding:

Different Methods, Isolated Neural , Solid Grounding, Effective Grounding, Resistance & Impedance Grounding, Zig Zag Transformer Grounding, Effect of Grounding on System Over Voltages. Merits & Demerits Of Various Grounding Systems.

UNIT-IV Surge Protection & Insulation coordination :

External & Internal Overvoltage Mechanism of Lightening Discharge , Wave Shapes Of Stroke Current, Line Design On Direct Stroke Over Voltage Protection , Earth Wire, Rod Gap , TRF , Expulsion Tube , Surge Diverter Selection Of BIL , International Recommendation , Selection of Arrestor Rating, Coordination of Protector Devices With Apparatus Insulation.

UNIT-V Reliability of Transmission and distribution System:

Definitions : Outage , Bath Tub Curve , Causes of Failures, Two State Model, Failure & Repair Rate, Probability Density Function, Reliability of Series / Parallel System , Reliability Planning , Preparation of Reliability Models. Numerical problems related to Reliability of Transmission and distribution system.

Text Books :

1. Power System Analysis & Design, BR Gupta S.Chand Publications
2. Substation Design & Equipment, Gupta & Sation – Dhanpat Rai.Publications
3. An Introduction to Reliability and Maintainability Engineering, Ebeling; Tata McGraw Hill

Reference Books:

1. Transmission & Distribution, Westinghouse
2. Electrical Power System Design, M. V. Deshpande (TMH)

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

Semester: BE VII **Branch: Electrical Engg.**
Subject: System Software **Code : 324742(24)**
Total Theory Periods - 48 **Total Tutorial Periods: 12**
Total marks in End Semester Exam: 80

Course Objectives

This subject aims to give an idea of system softwares in a computer system. It gives knowledge of its structure, main elements like macros, loader and linker. It also introduces the macros and various software tools of system software.

Course Outcomes

By the end of this course students will know:

1. Basic machine structure and functioning.
2. Assembler and its Design process
3. Software tools within system software

UNIT-I Machine structure:

Memory, registers, Data & instruction Formats C Languages Vs Assembly Languages, Addressing Modes, Data Transfer operations, Arithmetic Instructions, Compare & Branch Instructions, Logical & shift Operations, Subroutines in Assembly Languages.

Unit-II Assemblers:

Introduction to Translators: Interpreters vs. Compliers, Definition of an assembler, Symbol Tables, Table Processing-Search & sort Techniques, Design of an Assembler, Assembler Directives & Assembler Schemes, Single pass & multi pass Translators, Intermediate Code Forms, and List Generation & Error Indication

Unit-III Macros & Conditional Assembly:

Macro Definition, Feature of Macro facility, Macroinstruction arguments, conditional Macro Expansion, Label in macros, Macro calls within macros, Use of macros, Implementation of Macros in assemblers.

Unit-IV Loaders Features & Linker Editors:

Automatic Library Search, Loader Design Options, Load Address & Address Origin, Loading Libraries, Program Forms & self Relocation. Linkage Editors, Dynamic Linking, Bootstrap Loaders.

Unit- V

Software Tools: Text Editors: Word Processors, MS DOS EDLIN editor, Binary File Editors MS DOS DEBUG Editor, Debug command line Arguments, Loading & manipulating of addresses & data.

Textbooks:

1. System Software: An Introduction To Systems Programming, 3/E, Leland L., Beck and D. Manjula, Pearson
2. System Programming by J.J.Donovan (TMH)
3. Microcomputer System: 8086/8088 & Family-Architecture & Design by Liu & Gibson, PHI

Reference Books:

1. Advanced Dos by Michael Hyman & Ray Duncan (Ms-press).
2. Ms-Dos User's manual (MS-Press).
3. Structured programming in Assembly Languages for IBM-PC by William C.Runnion.

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

Semester: BE VII **Branch: Electrical Engg.**
Subject: Modeling and Simulation **Code :324743(24)**
Total Theory Periods - 48 **Total Tutorial Periods: 12**
Total marks in End Semester Exam: 80

Course Objectives:

1. To acquire the knowledge to understand the numerical models of dynamical systems and virtual reality modeling.
2. To cover both analytical methods and simulation of queueing systems in MATLAB and will cover the programming languages of discrete stochastic system (GPSS, SIMSCRIPT).
3. To develop the ability to process of translating real-world problems into simulation models, and the model building techniques involved.

Course Outcomes:

The students will be able to :

1 Understand the basic concepts of simulation and its utility in solving real-world problems.
2. Apply statistical knowledge and modeling techniques required to construct and validate simulation models for real-world systems.
3. Analyze and interpret simulation outputs.
4. Communicate effectively in a well-structured manner and build up an open-minded attitude.

UNIT-I System Models & Role of simulation:

Basic concept & nomenclature, Types of system-Determination, Stochastic, Continuous & Discrete Systems, System Simulation-Uses of simulation & its limitation, Steps in simulation studies-Statistical Tool: Generation & Testing of pseudorandom numbers, Random variate generation for Uniform, Exponential Normal & passion distributions, Sampling & Estimation, Maximum Likelihood estimation, Confidence interval estimation.

UNIT –II Discrete Event Simulation:

Representation of time, Approach to discrete event simulation Queuing Models-Single & multi-server queues, Steady state behavior of queues, Network of queues, Inventory System simulation, Programming languages for discrete system simulation-GPSS, SIMSCRIPT (Brief overview)

UNIT-III Modeling & performance Evaluation of computer Systems:

Behavioral, Data flow & structural modeling, Overview of hardware, Modeling & Simulation, Simulation for behavioral model, Evaluation of multiprocessor systems, workload characterization & Benchmarks.

UNIT-IV Continuous System Simulation:

Continuous System Models-Open & closed loop systems, Model described by differential equations, Systems dynamics, Growth & decay models, Systems dynamics diagram, Simulation of aircraft models,Biologial & sociological systems simulation, Simulation Languages Overview-CSMP.

UNIT-V Virtual Reality Modeling:

Overview of Virtual Reality Modeling Language VRML 20,creating dynamic worlds, integrating JavaScript's either VRML Verification & Validation of Simulation Models: Goals of Model Verification & validation, Input data Analysis, Output Analysis, Sensitivuity analysis, Hypothsis testing, Performance measures & their estimation

TextBooks:

1. Discrete System Simulation, J.E.Banks, Prentice Hall
2. System Simulation, G.Gordon, PHI
3. System Simulation and Modeling, Sankar Sengupta, Pearson

Reference Books:

1. A VHDL Primer, J.Bhastav, Prentice Hall
2. Computer Systems Performance Evaluation, D.Ferrari, Prentice Hall

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

Semester: BE VII **Branch: Electrical Engg.**
Subject: Advanced Microprocessor **Code :324744(24)**
Total Theory Periods - 48 **Total Tutorial Periods: 12**
Total marks in End Semester Exam: 80

Course Objectives:

1. To develop understanding of the architectures of advanced microprocessors
2. To get knowledge of microprocessor based systems
3. To acquire the skills in the programming and applications of these processors
4. To understand various interfacing concepts
5. To understand various interfacing circuits necessary for various application

Course Outcomes:

By the end of this course students will learn to:

1. Describe the features and use of advanced microprocessors
2. Compare and contrast the features of different members of a microprocessor family
3. Design memory, I/O, and interrupt interfaces to the microprocessor.
4. Develop software to control an application.

UNIT I: Architecture and Instruction set for 8086:

Architecture and pin configuration of 8086, instruction format, addressing modes, data transfer instruction, arithmetic instructions, Branching & Looping Instructions, NOP and Halt, Flag Manipulation Instructions, Logical, shift and Rotate Instruction, Byte and String Manipulation: string Instructions; REP Prefix, Table Translation, Number Format conversions. Assembler Directives and Operators; Assembly Process; Translation of assembler Instructions, Programming of Microprocessor 8086.

UNIT – 2: System Bus Structure:

Basic 8086/8088 system bus architecture, Minimum mode Configuration, Maximum mode Configuration; memory interfacing with 8086/8088 in minimum and maximum mode; system Bus standards. Interrupts of Microprocessor 8086.

UNIT – 3: Advanced Microprocessor architecture:

CPU 80386 Architecture and functional pin diagram, Function of Bus Interface unit, Execution unit, control unit, Instruction decoder Unit, Segmentation unit & page unit, General purpose Registers, Flag Register, Test & Debug Register, and Pipelining. Addressing mode and Instruction set of microprocessor 80386.

UNIT – 4: Task and Modes of Operation:

Real mode, Virtual Mode, Protected Mode, Page based Virtual Memory, Single level tasks: Segment Register, segment descriptors, Local descriptor table, Global Descriptor Register, Interrupt Descriptor Register, Multilevel tasks: Gate Descriptor, Task state segment, Task switch; Task gate descriptors, Related Instructions, Page descriptors, addressing technique. Address Calculation, Segment and Page Protection, Scaling; Bit Addressing, Programmer invisible register, Cache Memory, Virtual memory, Types of cache.

UNIT – 5: Multiprocessor Configuration & Interfacing

Numeric data Processor 8087; I/O Processor 8089, Communication between CPU and IOP, Related Instruction; Interfacing and programming of programmable peripheral interface 8255 and programmable interrupt controller 8259 with microprocessor 8086.

Text Books:

1. Microcomputer Systems: 8086/8088 Family – Architecture, Programming, and Design; Y.Liu and G.A. Gibson; PHI.
2. Advanced Microprocessors and Peripherals, K. M. Bhurchandi and A. K. Ray, McGraw Hill, India.
3. The X86 Microprocessors: Architecture And Programming (8086 To Pentium), Lyla B. Das, Pearson

Reference Books:

1. 80386 Microprocessor Handbook: C.H.Pappas and W.H. Murray: Osborne McGraw Hill
2. The Intel Microprocessors, Barry B. Brey, Pearson

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

Semester: BE VII **Branch: Electrical Engg.**
Subject: Embedded System Software in C **Code :324745(24)**
Total Theory Periods - 48 **Total Tutorial Periods: 12**
Total marks in End Semester Exam: 80

Course Objectives

1. Learn the basic components and structure of a C program, learn to define variables, and use operators and operands to create C expressions and statements
2. Develop the students to write their own programs using standard language infrastructure regardless of the hardware or software platform.
3. Introduce the student with embedded software concepts used in embedded system
4. Develop an understanding of the technologies behind the embedded computing systems

Course Outcomes

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

1. Be the familiar with basic concepts of computer programming
2. Write their programs efficiently using the C programming language.
3. Introduce the student with embedded software concepts used in embedded system
4. Get educated and trained with practical job oriented knowledge.
5. Develop practical skills to cater to the industry requirements

UNIT-IIntroduction to C language

The C language and its advantages, Structure of a C program –preprocessor directives, declaration and definition, Writing C programs, Building an executable version of C program, Debugging and executing C program.

C Language Fundamentals

Identifiers and keywords, Data types, Arithmetic, unary, logical, bit-wise, assignment and conditional operators, Declarations, Expressions, Statements and symbolic constants, Input/Output management, Decision making and Branching, Decision making and looping

UNIT – II Functions, Arrays, Pointers and Structures

Defining and accessing functions, Passing arguments to functions, The C standard library functions, Defining and processing arrays, Passing arrays to a function, 2-dimensional arrays, String Manipulation, Pointer Arithmetic, Types of functions(parameterized and non-parameterized), Control structures.

UNIT – III Programming Techniques of Embedded C

Introduction to embedded system, Choice of - processor, programming language and operating system, Development of embedded software

Introducing the AVR Family (Elementary treatment)

Introduction, The external interface of the Standard ATMEGA16(only), Reset requirements, Clock frequency and performance, Memory issues, I/O pins, Timers, Interrupts, Serial interface, Parallel interface, internal PWM, ADC.

UNIT – IV Reading and writing I/O Pins

Introduction, Basic techniques for reading from port pins, Reading and writing bytes, Reading and writing bits (simple version), Reading and writing bits (generic version), The need for pull-up resistors, Dealing with key de-bounce, Reading switch inputs and Counting, Creating 'hardware delays' using Timer 0 and Timer 1, 'timeout' mechanisms, Creating and testing loop timeouts and hardware timeouts, interrupts and its examples.

UNIT – V Hardware Interfacing

LED interfacing, LCD interfacing, motor interfacing (DC motor, PWM servo, stepper), 4X4 matrix interfacing, sensor interfacing (analog and digital).

Text Books:

1. Schaums outline of Theory and Problems of programming with C : B. S. Gottfried, Tata McGraw-Hill
2. Embedded C - Michael J. Pont, 2nd Ed., Pearson Education, 2008
3. Embedded C programming and Atmel AVR, 2nd edition, Richard Barntt, Sarah Cox and Larry O' Cull , Delmar Cengage Learning.

Reference Books:

1. Let us C: Yashwant Kanetker, BPB Publications
2. C – programming: E.Balagurusamy Tata McGraw Hill
3. The 'C' programming language: B.W.Kernighan and D.M.Ritchie, PHI
4. Embedded Software Development with C: Qian, Haring and Cao, Springer

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

Semester: BE VII **Branch: Electrical Engg.**
Subject: Micro Controller & Embedded System **Code :324746(24)**
Total Theory Periods - 48 **Total Tutorial Periods: 12**
Total marks in End Semester Exam: 80

Course objectives:

1. To understand basic concepts of microcontroller 8051
2. To understand architecture and features of typical Microcontroller
3. To understand need of microcontrollers in embedded system
4. To understand the programming of microcontrollers and embedded systems with a focus on real-time application.
5. To learn interfacing of real world input and output devices
6. To study various hardware and software tools for developing applications

Course Outcomes:

Upon completion of the course the student will be able to:

1. Program, build and test a microcontroller system.
2. Interface a microcontroller system to user controls and other electronic systems.
3. Describe the internal architecture of microcontroller systems, including counters, timers, ports, and memory.
4. Understand principles of embedded systems design

Unit –I: Introduction

Introduction to 8051 family, introductions to general-purpose microprocessor, Micro controller for embedded system. A brief history of 8051, 8052, 8751, AT8951, pin configuration of 8051, 89C52RD2.

Unit-II: Instruction set of 8051

Instruction set, 8051 assembly language programming, Internal Structure of 8051, power resetting, Built up RAM & ROM, I/O programming and addressing modes.

Unit-III: Counter and Timer programming

Counter and Timer details, Counter and Timer programming using 8051, interrupt programming, Types of Interrupt.

Unit-IV: Serial Communication Programming

Asynchronous serial communication, Data programming, RS232 standard, RS422 standard, 1488 &1489 standard, GPIB, MAX232 Driver, serial communication programming.

Unit-V: Interfacing

ADC & DAC interfacing, stepper motor interfacing, Keyboard interfacing Memory interfacing, embedded design concept, embedded design card, 8096 Architecture**.**

Textbooks:

1. 8051 programming, interfacing and Application K J Ayala, Penram; TMH
2. The 8051 Microcontroller and Embedded Systems Using Assembly and C (English) 2nd Edition, Muhanmmed Ail Mazidi, Janice Gillispie Mazidi, Rolin D./ McKinlay, Pearson
3. Micro controller & Embedded System Manual.

Reference Books:

1. 8051 Microcontroller: Internals, Instructions, Programming & Interfacing
2. Programming and customizing the 8051 micro controller, Predko: TMH
3. Embedded System Design: An introduction to processes, Tool And Techniques, Arnold. S.Berger

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

Semester: BE VII **Branch: Electrical Engg.**
Subject: Digital Image Processing **Code :324747(24)**
Total Theory Periods - 48 **Total Tutorial Periods: 12**
Total marks in End Semester Exam: 80

Course Objectives:

This course is designed to teach students the fundamentals of digital image. The primary objective of this course is to introduce students to basic principles of digital images, image data structures, and image processing algorithms.

Course Outcomes: A student who successfully completes this course should be able to:

1. Understand the digital image processing fundamentals, hardware and software, digitization, enhancement and restoration
2. Apply image processing techniques in time and frequency domains.
3. Work in the field of technical communication.

UNIT I: Fundamentals of Image Processing

Origins of Digital Image Processing, Examples of fields that use Digital Image Processing, Fundamental steps, Components, Elements of Visual Perception, Light and the Electromagnetic Spectrum, Sensing and Acquisition, Sampling and Quantization Relationship between Pixels.

UNIT II:Image Enhancement in the Spatial Domain

Gray Level Transformation, Histogram Processing, Enhancement using Arithmetic or Logic Operation, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Image Enhancement in the Frequency Domain, Introduction to the Fourier Transform, Smoothing frequency – Domain Filters, Sharpening Frequency Domain Filters.

UNIT III: Image Restoration

Models of Image Degradation, Noise Models, Restoration in the presence of Noise, Periodic Noise Reduction, Linear, Position-Invariant Degradations, Inverse Filtering.

UNIT IV: Colour Image Processing

Fundamentals, Colour models, Pseudocolour Image Processing, Basics of Full-Colour Image Processing, Colour Transformations, Smoothening and Sharpening, Colour segmentation, Noise in Colour Images.

UNIT V: Image Compression

Fundamentals, Image Compression Models, Elements of Information Theory, Error Free compression, Lossy Compression, Image Compression Standards.

Text Book:

1. Digital Image Processing by Rafael E. Gonzalez & Richard E. Woods, LPE, Pearson, India.
2. Fundamentals of Digital Image Processing by Anil. K. Jain, LPE, Pearson Edu. India.

Reference Books:

1. Digital image Processing by William .K. Pratt, John Wiley & Sons Publisher