BACHELOR OF ENGINEERING (ELECTRICAL & ELECTRONICS)  
IV SEMESTER

<table>
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<tr>
<th>Ref No.</th>
<th>Subject</th>
<th>SCHEDULE OF TEACHING</th>
<th>SCHEME OF EXAMINATION</th>
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<tr>
<td>AS401</td>
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<td>Power Systems-I</td>
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<td>Power Systems-I Lab</td>
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<td>EE405</td>
<td>Microprocessor and Interfacing</td>
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<td>EE456</td>
<td>Microprocessor and Interfacing Lab</td>
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<td>Total</td>
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Note:
*marks refer to mid semester evaluation and end semester evaluation.
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<th>Numerical Analysis</th>
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<td>Pre-requisites</td>
<td>Mathematics-I and Mathematics-II</td>
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<thead>
<tr>
<th>Course Objectives</th>
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<tbody>
<tr>
<td>1. To understand the errors involved in computations and to estimate the errors</td>
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<tr>
<td>2. To learn method to solve system of equations</td>
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<tr>
<td>3. To learn the numerical methods to interpolate, extrapolate differentiate and integrate functions</td>
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<tr>
<td>4. To learn numerical methods to solve differential equation</td>
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<tr>
<td>5. To learn to optimize functions using various techniques including least square method and functional approximations.</td>
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<tr>
<th>Course Outcome(s)</th>
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<tbody>
<tr>
<td>1. Ability to estimate errors in numerical result</td>
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<tr>
<td>2. Ability to solve system of equations</td>
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<tr>
<td>3. Ability to use numerical methods to interpolate, extrapolate differentiate and integrate functions</td>
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<tr>
<td>4. Ability to use numerical method to solve differential equations</td>
</tr>
<tr>
<td>5. Ability to learn to optimize various functions to minimize the errors in calculations</td>
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**Note for Examiner**- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.

**PART- A**

1. **Error Analysis**
   Relative error, Absolute error, Round-off error, Truncation error, significant digits and numerical instability.  
   (Scope as in Section 1.3, Chapter 1 of Reference 1).  
   (4 hours)

2. **Transcendental and Polynomial Equations**
   Bisection method, Iteration Method based on first degree equation: Secant method, Regula-Falsi method and Newton – Raphson methods, Rate of convergence of Secant method, Regula-Falsi method and Newton-Raphson Method. Bairestow’s method to find quadratic factor of polynomial  
   (Scope as in corresponding topics in Section 2.3, 2.5, 2.9 of Chapter 2 of Reference 1)  
   (8 hours)

3. **Interpolation**
   Polynomial interpolation: Finite differences, Lagrange and Newton interpolation (Forward, Backward and Divided difference methods), inverse interpolation, Hermite interpolation  
   (Scope as in corresponding topics in Section 4.1-4.3, 4.5 of Chapter 4 of Reference 1)  
   (10 hours)
PART B

4. **Solution of Linear Systems**
   Gauss elimination method, Gauss-Seidel method, Cholesky’s Decomposition. Matrix inversion: Gauss-Jordan method. Eigenvalue problem: Bounds on Eigenvalues (Gerschgorin and Brauer theorems), Householder’s method for symmetric matrices, Power method (Scope as in corresponding topics in Section 3.2, 3.4, 3.6, 3.9, 3.11 of Chapter 3 of Reference 1).

   (10 hours)

5. **Numerical Integration**
   Trapezoidal Rule, Simpson’s 1/3 and 1/8 rule, Romberg integration, Newton – Coates formulae (Scope as in corresponding topics in Section 5.7, 5.8 of Chapter 5 of Reference 1).

   (5 hours)

6. **Numerical solutions of ordinary differential equations**
   Taylor’s series, Euler and Runge – Kutta methods. Finite difference methods for boundary value problems (Scope as in corresponding topics in Section 6.4 of Chapter 6 of Reference 1).

   (5 hours)

7. **Functional approximation:** Chebyshev polynomials, Economization of power series, Least square approximation (Scope as in corresponding topics in Section 4.9 of Chapter 4 of Reference 1).

   (3 hours)

**RECOMMENDED BOOKS**


4. James B. Scarborough. *Numerical Mathematical Analysis*

Course Title: Electric Machinery-II
Credits: 04
Course Code: EE-401
L T P: 3 1 0
Contact Hours: 45
Max Marks-50 Internal Assessment-50 Elective N
Pre-requisites: Basic Electrical Engineering

Course Objectives:
1. To understand the working and constructional features of transformer and Electric machines.
2. To understand the process to test, control and analyze the performances various electric machines.
3. To understand the applications of transformer and electric machines in the field.

Course Outcome (s):
1. To be able to explain the principle of operation of various electric machines
2. To be able to identify and select machines for specific applications.
3. To be able to apply control procedures for machines during operation.
4. To analyze the characteristics of electrical machinery.

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PART-A

1. Synchronous Machines

   (18 hours)

PART-B

2. Parallel operation of alternators

   Synchronizing to infinite Bus-Bars, synchronoscope, parallel operation of alternators, Operating characteristics, generating Machine, motoring machine, power angle characteristic, operation at constant load with variable excitation, generating Machine, motoring machines, minimum excitation, observation, compounding curve, synchronous condenser, consideration of armature resistance, power flow (transfer) equations

   (12 hours)
**Special motors:**
Brushless dc motors, schematic and operation, circuit model characteristics of brushless dc motor, PM Brushless dc machine, universal motor and stepper motor, linear induction motor, Hysteresis motor, reluctance motors

**Text Books:**

**Other Recommended Books:**
1. Electrical Machinery and Transformers by Bhag S. Guru and Huseyin R. Hiziroglu,
List of Experiments

1. To perform no load test on a 3 phase alternator (cylindrical rotor).
2. To perform short circuit test on a 3 phase alternator (cylindrical rotor). Measure the resistance of stator winding of alternator. Find out regulation of alternator at full load at (i) unity power factor (ii) 0.85 Power factor lagging (iii) 0.85 Power factor leading using synchronous impedance method.
3. To synchronize an alternator with the 3 phase supply.
4. To perform the parallel operation of two alternators.
5. To perform the slip test to determine the Xd and Xq.
6. To run a stepper motor in different modes with the help of microprocessor.
7. To analyze the power factor improvement of an industry and design the capacitor bank.
8. To obtain positive, negative and zero sequence impedances of a three phase synchronous generator
9. To obtain positive, negative and zero sequence impedances of a three phase transformer
<table>
<thead>
<tr>
<th>Course Title</th>
<th>Control Engineering</th>
<th>Credits</th>
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<tr>
<td><strong>Pre-requisites</strong></td>
<td>Basic Electrical Engineering</td>
<td>1. To understand the introductory concepts of control systems and their illustrative examples.</td>
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<tr>
<td><strong>Course Objectives</strong></td>
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<td>2. To understand the basic concepts of modelling of control systems.</td>
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<td>3. To understand the basic concepts of state space analysis of control systems.</td>
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<td>4. To study the time domain analysis and frequency domain analysis of control systems.</td>
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<td><strong>Course Outcome(s)</strong></td>
<td></td>
<td>1. Students can outline the components of control systems</td>
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<td>2. Students will be competent to do mathematical modelling of physical system</td>
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<td>3. Students will be able to check stability of control system using time domain and frequency domain analysis.</td>
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<td>4. Students will be able to demonstrate the working of different types of control components</td>
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**PART-A**

1. **Introductory Concepts**
   Open loop and closed loop control systems, Servomechanisms, feedback and effects of feedback, linear and non-linear systems, time variant & invariant, continuous and sampled data control systems, illustrative examples.

   (4 hours)

2. **Modelling**
   Mathematical models of linear electrical, mechanical, translational, rotational, gear, thermal, pneumatic and hydraulic systems, electrical and mechanical analogies. Laplace transforms Transfer function, Block diagram representation, signal flow graphs and associated algebra, characteristics equation.

   (6 hours)

3. **State Space Analysis**
   Concepts of state variable, state vector and state space, State space representation, solution of state equation for LTI and LTV systems, state transition matrix.

   (6 hours)

4. **Time Domain Analysis**
   Typical test-input signals, Transient response of the first and second order systems. Time domain specifications, Dominant closed loop poles of higher order systems. Steady state error and error co-efficient.

   (8 hours)

5. **Stability**
   Concepts of absolute and relative stability, pole –zero location, Routh-Hurwitz stability criterion.

   (6 hours)

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PART-B

6. **Root Locus Technique**
The extreme points of the root loci for positive gain. Asymptotes to the loci, Breakaway points, intersection with imaginary axis, location of roots with given gain & sketch of the root locus plot.. Rules for construction of root locus, root contours, root sensitivity, generalized root locus.

7. **Frequency Domain Analysis**

8. **Control Components**
Error detectors- potentiometers and synchros, a.c. and d.c. servo motors, brushless d.c. motors, A.C. and D.C. techogenerators, stepper motors.

**RECOMMENDED BOOKS:**
Course Title | Control Engineering (Lab) | Credits | 02
Course Code | EE-452 | Max Marks-50 | P | 03

Note: At least eight experiments are to be performed.
1. To study the input-output characteristics of a potentiometer and to use a potentiometer as an error detector.
2. To study transmitter - receiver characteristics of a synchros set and to use the set as control component.
3. To study the operation of d.c. position control system.
4. To study the operation of d.c. speed control system.
5. To design different compensating networks for the given cut off frequency response.
6. To study PID controller and to obtain the effect of proportional, Integral and derivative control action.
7. To study the MATLAB Programming for controls systems related to steady state and transfer function conversions.
8. To obtain the step and ramp input response for the various transfer functions using MATLAB.
9. To obtain the root locus response for different systems using MATLAB.
10. To obtain response of basic control system problems in SIMULINK and tune them in MATLAB.
11. To run and use SIMULINK based models in MATLAB. To analyze and simulate the models of following real time applications in MATLAB:
12. Missile System.
13. Sun-seeker System
<table>
<thead>
<tr>
<th>Course Title</th>
<th>Power System-I</th>
<th>Credits</th>
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<td>Contact Hours</td>
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<td>Pre-requisites</td>
<td>Basics of Electrical Engineering</td>
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</table>
| Course Objectives    | 1. To understand the basic structure of power system.  
2. To understand the role of insulators and towers.  
3. To understand the various parameters of transmission lines.  
4. To understand the importance of transmission lines and their operation. |       |
| Course Outcome(s)    | 1. Students will be able to apply the knowledge of per unit system in power system.  
2. Students can understand the various types of conductors and supporting structures for overhead power transfer.  
3. Students can determine the parameters transmission lines under different types of configuration.  
4. Students can identify the performance of transmission lines. |       |

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**PART-A**

1. **Introduction**
   Introduction to Power System, Basic structure of AC power system, Distribution voltage level, Layout of power supply network, System interconnection, System voltage and transmission efficiency, Working voltage, Choice of next high voltage, Representation of power system components, One line diagram and impedance diagram, Complex power.
   (6-hours)

2. **Conductors and Underground Cables**
   Types of conductors: Hard drawn copper conductors, AAC, AAAC, ACSR and bundled conductors, Resistance, Skin effect.  
   Types of Underground cables, capacitance of single core cables, grading of cables, capacitance of three core belted cables, power factor and heating of cables  
   (7 hours)

3. **Insulators and Supporting Structures**
Types of insulators, voltage distribution across suspension insulators, string efficiency, methods of improving string efficiency.
Line supports, wood poles, Concrete poles, Steel poles, Supporting towers, Vibration of conductors, Effect of vibration on transmission lines, Prevention of vibration.

(6 hours)

Part-B

4. **Transmission-Line Parameters**
Conductance and Inductance: Solid Cylindrical Conductor, Inductance: Single-Phase Two-Wire Line and Three-Phase Three-Wire Line with Equal Phase Spacing, Composite Conductors, Unequal Phase Spacing, Bundled Conductors, Series Impedances: Three-Phase Line with Neutral Conductors and Earth Return, Electric Field and Voltage: Solid Cylindrical Conductor
Capacitance: Single-Phase Two-Wire Line and Three-Phase Three-Wire Line with Equal Phase Spacing, Stranded Conductors, Unequal Phase Spacing, Bundled Conductors
Shunt Admittances: Lines with Neutral Conductors and Earth Return, Electric Field Strength at Conductor Surfaces and at Ground Level, Parallel Circuit Three-Phase Lines
(15-hours)

5. **Transmission Lines: Steady-State Operation**
(6 hours)

6. **Transients of Transmission lines**
Transmission-line transients, Transient Analysis: Travelling Waves, reflections and refraction of waves.
(5 hours)

**TEXT BOOKS**

3. Other Recommended Books
Design/analysis projects relating to the following.
1. Determination of ABCD parameters of short and medium transmission lines.
2. Line loadability.
3. Steady state operation of transmission lines.
4. To study different types of underground cables.
5. To study different types of insulators.
6. To study various supporting structures.
7. Ferranti effect
8. Power factor improvement
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<th>Microprocessors and Interfacing</th>
<th>Credits</th>
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<td>Pre-requisites</td>
<td>Basic electronic and Programming fundamentals</td>
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<tr>
<td>Course Objectives</td>
<td>1. To understand the basic concepts of a microprocessor.</td>
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<td>2. To understand the architecture of microprocessor 8085.</td>
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<td>3. To know assembly language programming of 8085.</td>
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<td>4. To understand the key concepts of interfacing.</td>
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<td>5. To understand the architecture of 8086</td>
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<td>Course Outcome</td>
<td>1. Students will understand fundamental microprocessor concepts of 8085 and of 8086</td>
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<td>2. Students will understand architecture of 8085</td>
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<td>3. Students will learn the 8085 assembly language programming</td>
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<td>4. Students will be able to learn real world interfacing of microprocessor which includes both hardware and software concepts, hence will be able to design Basic systems based on microprocessors</td>
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<td>5. Student will understand the basic architecture difference between 8085 and 8086</td>
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PART-A

1. Microprocessor Architecture and Microcomputer System
   Microprocessor Architecture & Operations, Memory, Input and Output Devices, The 8085 MPU, Example of an 8085-Based Microcomputer, Memory Interfacing. (4 hours)

2. Programming the 8085
   Introduction to 8085 Assembly Language Programming, The 8085 Programming Model, Instruction Classification, Instruction Format. Data Transfer (Copy) Operations, Arithmetic Operations, Logic Operations, Branch Operations, Writing Assembly Language Programs. (6 hours)

3. Programming Techniques
4. **Counters And Time Delays**
   Counters and Time Delays, Hexadecimal Counter, Modulo Ten Counter, Generating Pulse Waveforms

5. **Stack And Subroutines**
   Stack Subroutine, Restart, Conditional Call and Return Instructions.

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**PART-B**

6. **INTERRUPTS**
   The 8085 Interrupt, 8085 Vectored interrupts. RIM, SIM

7. **Interfacing I/O Devices**
   Basic Interfacing Concepts, Interfacing Output Displays, Interfacing Input Devices, Memory Mapped I/O

8. **Interfacing Data Converters**
   Digital- to- Analog (D/A) Converters, Analog- to- Digital (A/D) Converters

9. **General Purpose Programmable Peripheral Devices**
   The 8255 A Programmable Peripheral Interface- I/O Modes and BSR Mode

10. **Serial Communication**
    Basic communication concepts in serial I/O RS232C

11. **8086 Microprocessor**
    8086 CPU Architecture, segmented memory, addressing modes

**TEXT BOOKS**
1. Ramesh S.Gaonkar, “Microprocessor Architecture, Programming and Applications with the 8085”, Penram International Publishing

**OTHER REFERENCE BOOKS**
2. Charles M.Gilmore, “Microprocessor Principles and Applications”, TMH.
3. Douglas V. Hall, “Microprocessors and Interfacing programming and Hardware” TMH.
Note: Attempt any ten programs.

1. Study of 8085 Microprocessor kit
2. Write Assembly Language Program to add n given numbers with and without carry.
3. Write Assembly Language Program to count positive & negative numbers in given n numbers.
4. Write Assembly Language Program to de-assemble 8-bit number in two nibbles.
5. Write Assembly Language Program to reassemble two nibbles in 8-bit number.
6. Write Assembly Language Program to sort given n numbers in ascending order
7. Write Assembly Language Program to relocate the given numbers in same & reverse order.
8. Write Assembly Language Program to add two 16 bit numbers
9. Write Assembly Language Program for addition but answer in decimal

Interfacing of Microprocessor 8085:

10. To obtain a square wave on CRO
11. To interface A to D converter
12. To interface D to A converter
13. To interface stepper motor with μP to control its step size and direction of rotation
14. To develop a traffic light controller program and interface using Input/Output Module