## BACHELOR OF ENGINEERING (ELECTRICAL & ELECTRONICS)  
### V SEMESTER

<table>
<thead>
<tr>
<th>Ref No.</th>
<th>Subject</th>
<th>SCHEDULE OF TEACHING</th>
<th>SCHEME OF EXAMINATION</th>
<th>Credits</th>
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<td>EE-501</td>
<td>Power Systems- II</td>
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<td>EE-551</td>
<td>Power Systems- II Lab</td>
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<td>EE-503</td>
<td>Microprocessors and Interfacing</td>
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<td>Microprocessors and Interfacing Lab</td>
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<td>EE-507</td>
<td>Communication Engg.</td>
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<td>Communication Engg. Lab</td>
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<tr>
<td>EE-508</td>
<td>Electromagnetic Filed Theory</td>
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<td>EE-509</td>
<td>Power Electronics</td>
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<td>Power Electronics Lab</td>
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<td>EE-556</td>
<td>Vocational Training after Fourth Semester</td>
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**Note:**  
*marks refer to mid semester evaluation and end semester evaluation.
Course Title | Power Systems-II | Credits | 04
---|---|---|---
Course Code | EE-501 | L T P | 3 1 0
Contact Hours | 45 | Max Marks-50 | Internal Assessment-50 | Elective | N

Pre-requisites | Instrument transformers, Three phase transformers

**Course Objectives**

1. To understand the need of protection of power system.
2. To understand the protection of transformer, generator, bus zone and transmission lines.
3. To understand the construction, working and application of various types of circuit breakers.
4. To understand the causes and protection of overvoltages.
5. To understand the concept of grounding and various types of neutral grounding.

**Course Outcome**

1. Students will be competent to design protection system for transformer, generator, bus zone and transmission lines.
2. Students will be able to design grounding of power system.
3. Students will be able to select proper rating of circuit breakers for protection system design.
4. Students will be able to design grounding of power system.

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**Note for Examiner**- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 5 conceptual questions of 2 marks 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. **Power System Protection**
   (12 hours)

2. **Circuit Breakers**
   Transient recovery voltage, resistance switching, first pole to clear factor, Transient recovery voltage, arc and arc extinction, volt ampere characteristics of arc, methods of arc extinction, construction, working and applications of air-break circuit breakers, oil circuit breakers, vacuum circuit breakers, air blast circuit breakers, SF6 circuit breakers, circuit breaker ratings.
   (13 hours)

**PART B**

3. **Power System Overvoltages**
Causes of Overvoltages: Internal and external, Protection against over voltages by shielding or ground wires and lightning arrestors, Location of lightning arrestor, Selection of lightning arrestor, Basic insulation level, insulation coordination.  

4. Grounding  
Grounding fundamentals, Ground resistance, step voltage, touch voltage and transferred voltage, tolerable step and touch voltages, ground resistance of a hemisphere and driven rod, Ground resistance, Step and Mesh voltages of a grounding grids  
Neutral grounding: ungrounded systems, resonant grounding, solid or effective grounding, reactance grounding, earthing transformer, neutral grounding practice.  

TEXT BOOKS  

OTHER RECOMMENDED BOOKS  
Note: At least eight experiments / projects / technical reports relating to the following:

1. Measurement of soil resistivity and soil model evaluation
3. Grounding system design for a substation.
4. To study the characteristics of over current relay.
5. To study the characteristics of percentage differential relay.
6. To study the characteristics of distance relay.
7. To study current time characteristics of fuses.
8. Technical visit to a substation/generating station, Load Dispatch Centre and preparation of a technical report for the same
9. Conventional and renewable energy sources
10. Distribution system design
11. Digital relaying
12. Reactive compensation of lines
<table>
<thead>
<tr>
<th>Course Title</th>
<th>Microprocessors and Interfacing</th>
<th>Credits</th>
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<td>Course Code</td>
<td>EE-503</td>
<td>04</td>
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<tr>
<td>Contact Hours</td>
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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>To introduce the fundamentals of microprocessors to students so that they understand the computer architecture.</td>
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<tr>
<td>Course Outcome</td>
<td>To understand the microprocessor structure, operation and assembly language programming of 805.</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**  
   (6 hours)

3. **Programming Techniques**  
   (6 hours)

4. **Counters And Time Delays**  
   Counters and Time Delays, Hexadecimal Counter, Modulo Ten Counter, Generating Pulse Waveforms  
   (4 hours)

5. **Stack And Subroutines**  
   Stack Subroutine, Restart, Conditional Call and Return Instructions.  
   (4 hours)
PART-B

6. INTERRUPTS
    The 8085 Interrupt, 8085 Vectored interrupts. RIM, SIM  (3 hours)

7. Interfacing I/O Devices
    Basic Interfacing Concepts, Interfacing Output Displays, Interfacing Input Devices, Memory Mapped I/O  (4 hours)

8. Interfacing Data Converters
    Digital- to- Analog (D/A) Converters, Analog- to- Digital (A/D) Converters  (4 hours)

9. General Purpose Programmable Peripheral Devices
    The 8255 A Programmable Peripheral Interface- I/O Modes and BSR Mode  (3 hours)

10. Serial Communication
    Basic communication concepts in serial I/O RS232C  (3 hours)

11. 8086 Microprocessor
    8086 CPU Architecture, segmented memory, addressing modes  (4 hours)

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
<table>
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<th>Course Title</th>
<th>Communication Engineering</th>
<th>Credits</th>
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<tr>
<td>Course Code</td>
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<td>L T P</td>
<td>3 1 0</td>
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<tr>
<td>Contact Hours</td>
<td>45</td>
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<td>Internal Assessment-50</td>
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<tr>
<td>Pre-requisites</td>
<td>Knowledge of Analog Electronics and digital electronics</td>
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</table>
| Course Objectives | 1. To develop students with solid foundation in mathematical, engineering fundamentals to solve communication engineering problems.  
2. To provide students rigorous training to design and develop electronics systems, such as AM, FM transmitter used in real life.  
3. To provide a platform to the students to get them acquainted with issues related to engineering technologies in communication engineering and their impact on global economy. | |
| Course Outcome(s) | 1. Students will understand various modulation techniques and would be able to generate IC based AM, FM signal.  
2. Students will understand various demodulation techniques and will recover original information signal.  
3. Students would also be capable to identify various modulation and demodulation techniques and able to solve communication engineering problems theoretically and practically.  
4. Students will understand impact of various modulation techniques on resources such as bandwidth utilization and its effect on global economy.  
5. Students will be capable to calculate bandwidth for AM, FM transmitter using modern instruments like digital storage oscilloscope. | |

**Note for Examiner**- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 5 conceptual questions of 2 marks 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. Amplitude Modulation & Demodulation And Systems  
   (14 hours)

2. Frequency Modulation  
   Principles and generation of FM and PM signals, Reactance Modulator method, Armstrong Method, noise consideration in FM and PM system.  
   (7 hours)

**PART-B**

3. Frequency Demodulation And Systems  
   Detection of FM and PM signals, Foster Discriminator, ratio and PLL detectors, FM Transmitter (Block Diagram), FM receiver (Block Diagram), Pre-emphasis and de-emphasis circuit  
   (15 hours)
4. Pulse Modulation & Demodulation
   Principles, generation and detection of PAM, PWM, PPM & PCM signals, noise in pulse modulation system, band width consideration, companding, delta modulation, adaptive delta modulation systems. TDM & FDM. (9 hours)

BOOKS RECOMMENDED:
1. Study of amplitude modulation (AM).
2. Determine the modulation index of amplitude modulated (AM) wave.
4. Study of frequency modulated (FM) wave.
5. Study the demodulation of frequency modulated (FM) wave.
6. Determine the modulation index of frequency modulated (FM) wave.
7. Study of pulse amplitude modulation (PAM).
   (a) Study of pulse code modulation (PCM) transmitter.
   (b) Study of Pulse code modulation (PCM) receiver.
### Course Title
Electromagnetic Fields Theory

### Credits
04

### Course Code
EE-508

### L T P
3 1 0

### Contact Hours
45

### Max Marks
50

### Internal Assessment
50

### Elective
N

### Pre-requisites
Basic knowledge of Coordinate systems, Electric and Magnetic fields

### Course Objectives
1. To learn basic coordinate system, significance of divergence, gradient, curl and its applications to EM fields.
2. To understand the boundary conditions for different materials/surfaces.
3. To get the basics of microwave, transmission lines and antenna parameters.

### Course Outcome(s)
1. Students will apply knowledge of mathematics to solve numerical based on Coulombs law, Gauss law, Biot Savarts law, Amperes Circuital law etc.
2. Students will understand impact of the EM course in many engineering core subjects like optical fiber communication, microwave engineering, antenna engineering etc and its impact on the technology used by the society.

### Note for Examiner-
Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 5 conceptual questions of 2 marks 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. **Static Electric Fields**
   (12 hours)

2. **Static Magnetic Fields**
   The Biot-Savart Law in vector form – Magnetic Field intensity due to a finite and infinite wire carrying a current I – Magnetic field intensity on the axis of a circular and rectangular loop carrying a current I – Ampere’s circuital law and simple applications. Magnetic flux density – The Lorentz force equation for a moving charge and applications – Force on a wire carrying a current I placed in
a magnetic field – Torque on a loop carrying a current I – Magnetic moment – Magnetic Vector Potential.

(12 hours)

PART-B

3. Electric And Magnetic Fields In Materials

(11 hours)

4. Time Varying Electric And Magnetic Fields

(10 hours)

TEXT BOOKS


OTHER BOOKS RECOMMENDED

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<tr>
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<td>Contact Hours</td>
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<td>Internal Assessment-50</td>
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<td>Pre-requisites</td>
<td>Basic fundamentals of Analog and Semiconductor Electronics.</td>
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| Course Objectives | 1. To provide the electrical circuit concepts behind the different working modes of power converters so as to enable deep understanding of their operation.  
2. To equip with required skills to derive the criteria for the design of power converters starting from basic fundamentals.  
3. To analyze and comprehend the various operating modes of different configurations of power converters.  
4. To design different power converters namely AC to DC, and DC to DC converters |
| Course Outcome(s) | 1. To be able to select appropriate power devices for power control applications.  
2. To be able to design and analyze power electronics circuit for Machine control. |

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**PART-A**

1. **Thyristor and Semiconductor Power Switching Devices**

   Devices of Thyristor family and their V-I characteristics: Thyristor, DIAC, TRIAC, GTO, MOSFET, IGBT. Principle of operation of SCR, two transistor model of SCR. Turn on methods of a Thyristor, Switching characteristics of Thyristor during turn-on and turn-off, Gate characteristics, Thyristor triggering .

   Series and parallel operation of SCR’s, Thyristor specifications (latching current and holding current, dv/dt and di/dt etc.), Thyristor Protection circuits, UJT: characteristics and as a relaxation oscillator.

   (15 hours)

2. **SCR Commutation Circuits**


   (08 hours)

**PART-B**

3. **Phase controlled Rectifiers**

   Controlled rectifiers : single-phase half converter and full converters, analysis with R & RL loads, freewheeling diode effect, 3-phase half-wave – full converters & semi converters – analysis with R & RL loads, continuous conduction & discontinuous conduction, Inversion mode -effect of source inductance on 1-phase & 3-phase full converters – overlap angle - single-phase dual converters –
circulating & non circulating current operation. (12 hours)

4. **DC-DC converters**

Step-down chopper, step-up chopper, analysis with R & RL load –PWM, frequency modulation control – current limit control – Fourier analysis of output voltage - two-quadrant & four-quadrant chopper – voltage commutated chopper – current commutated chopper, buck, boost, buck-boost and cuk regulators, condition for continuous inductor current and capacitor voltage - design of LC filter – comparison of regulators. (10 hours)

**TEXT BOOKS RECOMMENDED**


**OTHER BOOKS RECOMMENDED**

Course Title | Power Electronics (Lab) | Credits | 02
--- | --- | --- | ---
Course Code | EE- 559 | Max Marks-50 | P | 03

Note: At least eight experiments are to be performed selecting at least three from experiment 7.

1. To plot the V-I characteristics of the SCR.
2. To draw V-I characteristics of Triac.
3. Study of R and RC triggering circuits for SCR.
4. To study and perform the triggering of SCR circuit through UJT firing.
5. Study of SCR commutation circuits and check the performance of one commutation circuit.
6. Study of Jones chopper or any chopper circuit to check the performance.
7. Design and simulation of following of circuit in MATLAB / other software.
   a) Rectifier circuit with RL Load
   b) Three phase thyristor converter
   c) Class-C commutation Circuit
   d) Buck or buck boost converter