

ELECTRICAL SYSTEMS AROUND US

IC 160



Catalog

- **Credits : (3-0-0-3)**
- **Objective:** Develop an understanding of common electrical systems & appliances
- **Unit 1: Common Appliances (3hrs):** Exploring the common appliances, their ratings, power consumption and working.
- **Unit 2: Heating and Lighting(9 L+ 4T) :** Understanding how illumination and temperature control are integrated in our buildings, Types of sources and elements, source transformation, Kirchoff's laws, Mesh and Nodal analysis, Thevenin's theorem, Norton's theorem, superposition theorem, maximum power transfer theorem. Single phase: AC fundamentals, sinusoidal and non-sinusoidal waveforms- average and effective values, form and peak factors, concept of phasors, analysis of series and parallel RLC circuits, power triangle and power factor, resonance in series and parallel circuits, transient analysis of RL and RC circuits. Three phase: Three phase emf generation, delta and star connections, balanced supply and balanced load, measurement of power in three phase circuits.
- **Unit 3: Supply of Electricity (10+ hrs)**
- Concepts of magnetic circuits, analogy with electrical circuits, B-H curve, hysteresis and eddy current losses, magnetic circuit calculations. Constructional features, operating principle, emf equation, phasor diagram, equivalent circuit, voltage regulation, efficiency, open and short circuit tests, Renewable energy.
- **Unit 4: Fans and Pump (12 hrs)**
- DC machines: constructional features, working principle, emf and torque equation, armature
- reaction, types of excitation and generator characteristics. Introduction to three phase Induction motor and three phase Synchronous generator.
- **Unit 5: Upcoming topics (2 hrs)**
- Relevant topics related to the current trend can be selected by the instructor.
- Text Book
- I.J.Nagrath, 'Basic Electrical Engineering', Tata McGraw Hill, India
- Reference Books
- Vincent Del Toro, 'Electrical Engineering Fundamental, Prentice Hall
- Charles K. Alexander and Matthew N. O. Sadiku, "Fundamentals of Electric Circuits", Tata McGraw Hill, India

Syllabus



- **Unit 1: Common Appliances**
- **Unit 2: Heating and Lighting**
- **Unit 3: Supply of Electricity**
- **Unit 4: Fans and Pump**
- **Unit 5: Current Trend of Technology**

Unit Descriptions

□ **Unit 1: Common Appliances**

- *Exploring the common appliances around us and classify whether ac device or dc device.*

□ **Unit 2: Heating and Lighting**

- *Kirchhoff's laws, KCL, KVL etc.*
- *Network Theorems : Thevenin's, Norton's, superposition, maximum power transfer theorem.*
- *Single phase: AC fundamentals, analysis of series and parallel RLC circuits.*
- *Three phase: Three phase emf generation, delta and star connections, measurement of power in three phase circuits.*

Unit Descriptions (Contd).

□ Unit 3: Supply of Electricity

- *Concepts of magnetic circuits, B-H curve, hysteresis and eddy current losses etc.*
- *Constructional features, operating principle, emf equation, equivalent circuit, voltage regulation, efficiency, open and short circuit tests, Renewable energy.*

□ Unit 4: Fans and Pump

- *DC machines: constructional features, working principle, emf , torque equation and generator characteristics.*
- *Introduction to three phase Induction motor and three phase Synchronous generator.*

Unit Descriptions (Contd).

□ **Unit 5: Current Trend of Technology**

- *Relevant topics related to the current trend can be selected by the instructor.*

□ **Reference Books**

- A. R. Hambley, 'Electrical Engineering: Principles and Applications', Prentice Hall
- I. J.Nagrath, 'Basic Electrical Engineering', Tata McGraw Hill, India
- V. Del Toro, 'Electrical Engineering Fundamental, Prentice Hall
- Charles K. Alexander and Matthew N. O. Sadiku, "Fundamentals of Electric Circuits", TataMcGraw Hill, India

About Instructor

- Dr. Tricha Anjali
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 - Office: Multipurpose Hall, Room 0-3
 - Office Hours: By appointment

About TAs

- Rajeev Kumar
- Gurinderbir Singh
- Anshul Kumar Mishra

About Lab

□ Dr. Satinder Kumar Sharma

- Lab 1: Introduction to Spice software, familiarization with different analysis methods (ac, dc and transient), familiarization with datasheets of components
- Lab 2: Familiarization with various measuring instruments such as ammeter, voltmeter, wattmeter, tachometer, multimeter, oscilloscope
- Lab 3: Circuit Analysis using Spice
- Lab 4: Transient analysis of RLC circuit
- Lab 5: Analysis of magnetically coupled circuit
- Lab 6: Frequency response of RLC circuit
- Lab 7: Design of passive filters
- Lab 8: Measurement of power in three phase circuit using two wattmeter method
- Lab 9: Open circuit and short circuit test of transformer
- Lab 10: Characteristics of dc shunt generator

Reference Books

1. Basic Electrical Engineering by Kothari and Nagrath
2. Electrical Engineering Fundamentals by Vincent Del Toro
3. Electrical Engineering: Principles and Applications by Allan Hambley
4. Engineering Circuit Analysis by Hayt et. al.
5. <http://www.allaboutcircuits.com>
6. www.wikipedia.org
7. www.google.com

Marks Distribution

- Total: 100 points
 - Exam 1: 30
 - Exam 2: 30
 - Final: 30
 - Attendance: 5 (at least 75%)
 - Assignments: 5

Grading

Grade	Value	Interpretation	% students	Large classes
O	10	Outstanding	5	$\geq \mu + 1.65 \sigma$
A	9	Very Good	15	$\geq \mu + 0.75 \sigma$ and $< \mu + 1.65 \sigma$
B	8	Good	30	$\geq \mu - 0.15 \sigma$ and $< \mu + 0.75 \sigma$
C	7	Average	30	$\geq \mu - 1.05 \sigma$ and $< \mu - 0.15 \sigma$
D	6	Below Average	15	$\geq \mu - 1.95 \sigma$ and $< \mu - 1.05 \sigma$
E	4	Pass	5	$< \mu - 1.95 \sigma$
F	0	Fail		

For more details, refer to

<http://insite.iitmandi.ac.in/index.php/institute/grading-system>

Policies

- ❑ No late homework submission
- ❑ You may be excused from an exam only with a university approved condition, with proof. For example, if you cannot take an exam because of a sickness, we will need a doctor's note.
- ❑ The Institute policies against academic dishonesty will be strictly enforced.
- ❑ Disabilities: Contact instructor