

**Introduction to Electrical Circuits**  
(Only for ECE during I B.Tech., I Semester)

**Course Code: EC1T6**

**Credits: 3**

**Lecture: 3 periods/week**

**Internal assessment: 30 marks**

**Tutorial/Interaction Session:1period/weekSemester end examination: 70 marks**

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**Prerequisites:**

1. Elementary concepts of Physics such as electricity and magnetism
2. Basic concepts of Engineering Mathematics such as algebra, linear equations, trigonometry and differential equations.

**Course Objectives:**

1. To learn the key concepts and laws of electricity and magnetism in a logical sequence.
2. To learn the properties of passive components and electric sources
3. To learn the applications of electric circuit reduction techniques
4. To learn the techniques of determination of parameters and behaviour of an electric circuit for DC and AC excitations.

**Course Outcomes:**

1. Ability to practice the technical representation of common electrical and magnetic systems.
2. Ability to use the passive components in electric and electronic circuit design
3. Ability to apply techniques to reduce any complex electric circuit to an appropriate form.
4. Ability to use techniques to evaluate the parameters of an electric circuit excited by DC and AC sources.

**UNIT-I**

**Introduction to Electrical Circuits:** Concepts of charge, electric current, Force, work. Electrical power, electrical potential and e.m.f. Passive and active elements, resistance and resistivity, temperature coefficient of resistance, Ohm's Law. Sources- Ideal, practical, independent, dependent and Source transformation, Electric circuits: Nodes, Branches and Loops, Series resistors and voltage division, parallel resistors and current division, Kirchoff's Laws, Wye-Delta transformation.

**Capacitors and capacitance:** Electrostatic Fields, Capacitors, Electric flux density, Permittivity, Parallel plate capacitor, Capacitors connected in parallel and series, Energy stored in a capacitor.

## UNIT-II

**Magnet circuits:** Magnetic fields, Magnetic flux and flux density, field strength, Permeability, Electromagnetism, mmf, Reluctance, Inductance -self and mutual inductances, coefficient of coupling, dot convention, energy stored in an inductor, inductances in series and parallel, Composite series magnet circuits, Comparison between electrical and Magnetic quantities.

## UNIT-III

**AC Fundamentals:** Generation of alternating voltage sine wave, Types of waveforms: Square wave, saw-tooth wave, Triangular wave, Frequency, phase angle, wavelength, Peak, average, RMS values, Form factor and peak factor of ac periodic waveforms.

**Phasors and Complex quantities:** Introduction, phase representation of alternating voltage, addition, subtraction of phasors, polar and rectangular form, j-operator: Multiplication and division of complex quantities.

## UNIT-IV

**Single phase series a.c circuits:** Purely resistive a.c circuit, purely inductive a.c circuit, purely capacitive circuit, R-L series a.c circuit, R-C series a.c circuit, R-L-C series a.c circuit, concept of reactance, impedance and admittance.

**Single phase parallel a.c circuits:** R-L parallel a.c circuits, R-C parallel a.c circuit, L-C parallel a.c. circuit L-R-C parallel a.c. circuit.

## UNIT –V

**Resonance:** series resonance, tuning for resonance, Q-factor, selectivity and bandwidth of a series resonant circuit. Parallel resonance: Q factor for parallel L-C circuits, Resonance frequency for parallel L-C circuits. Related problems

### Text Books:

1. Electrical Circuit Theory and Technology- John Bird, Elsevier, Revised Ed., 2001
2. Electric Circuits – David A Bell, Oxford University Press, 7<sup>th</sup> Ed., 2009.
3. Electric Circuits- A. Sudhakar & Shyammohan S. Palli, Tata Mc-Graw- Hill, 2005
4. Principles of Electrical Engineering, V.K Mehta, S.Chand Publications, 11<sup>th</sup> Ed., 2010.

### References:

1. Fundamentals of Electric Circuits, Charles K. Alexander, Mathew N.O.Sadiku, Tata Mc-Graw- Hill, 4<sup>th</sup> Ed., 2012.
2. Circuit Theory, A.Chakrabarti, Dhanpat Rai., New Delhi, 2008.

### e-learning resources:

<http://nptel.ac.in/courses.php>, <http://jntuk-coeerd.in/>