



# BASIC ELECTRONIC CIRCUITS

Lecture - 1

# Outline

- Examples of Electronic Systems:
  - Music System, Radio, Television, etc.
- Syllabus
- Evaluation Criteria
- Basic quantities

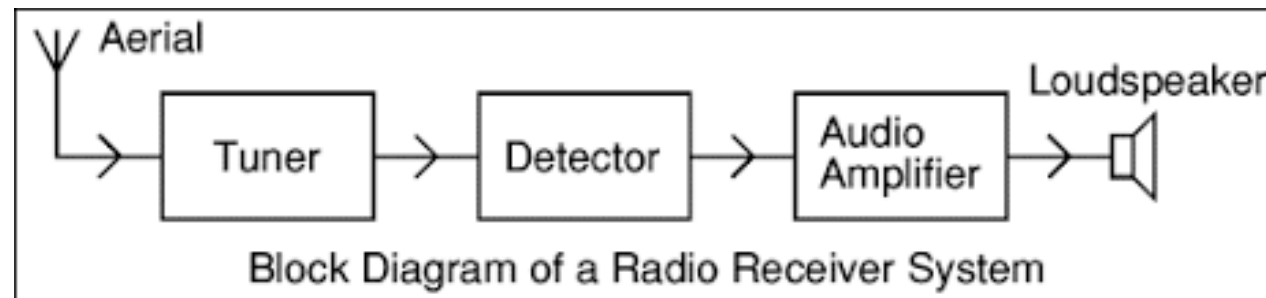
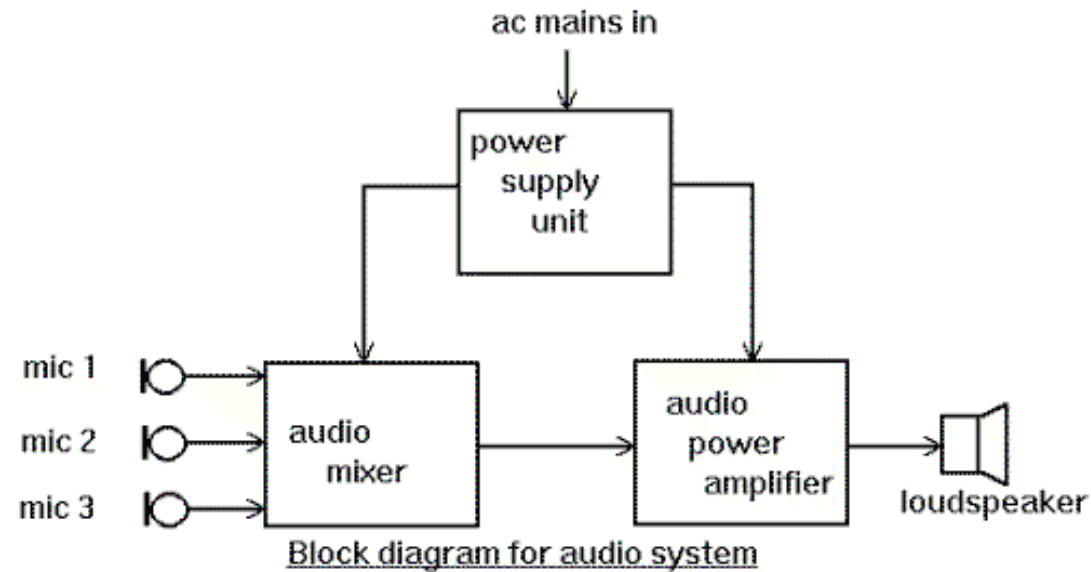
What is an electronic circuit?

is a path that directs and controls electric currents to perform some specified function

What is an electronic system?

composed of electronic circuits, which include amplifiers, signal sources power supplies and digital logic circuits.

# Examples of Electronic Systems



# Syllabus

- Unit 1:
  - Review of basic concepts: Physical and mathematical representations of Ohm's law, Kirchhoff's laws, Series and parallel connections, Voltage and current division, Network theorems.
- Unit 2:
  - Characterization of a four-terminal network based on its terminal voltages and currents, Two-port parameters - Impedance and Admittance, Transmission parameters (ABCD), Relation between  $Z$ ,  $Y$  and ABCD parameters.

- Unit 3:

- D-C power supply: Diode characteristics, half-wave and full wave rectifiers, shunt capacitor filter, voltage regulator, regulated D-C power supply.
- Transistors Basics: BJT (CE) IV Char.

- Unit 4:

- Amplifier: Amplifier parameters, controlled source models, classification, operational amplifier (OP-AMP) as a linear active device, the VCVS model of an op-amp, different amplifier configurations using op-amp, frequency response of op-amp and op-amp based amplifiers.

- Unit 5:

- Filter: Concepts of low-pass, high-pass and band-pass filters, ideal (brick-wall) filter response, frequency response of simple RC filters, active RC filters using Op-amp, Oscillator: Effects of negative and positive feedback of an amplifier, condition of harmonic oscillation, RC and LC oscillator circuits.

- Unit 6:

- Analog-Digital conversion: Digital to Analog Converter (DAC) using binary resistor scheme, R-2R ladder DAC, DAC using switched current resources, Analog to Digital converter (ADC) using capacitor charge/discharge: single-slope and dual-slope ADCs, ADC using counter and DAC, ADC using successive approximation.

# Additional Concepts: Lab. purpose

- Comparator: Op-amp as a comparator, digital inverters (TTL/CMOS) as comparators, comparator with hysteresis, Schmitt trigger using Op-amp, 555 timer as a two dimensional comparator.
- Waveform generators: Concept of bistable, monostable and astable circuits, timer and relaxation oscillator based on comparator and RC timing circuit, square wave generator using 555 timer, crystal clock generator.



# Laboratory experiments list: Proposed

1. Familiarization with Laboratory Instruments and Characterization of Passive Circuit Elements ( $R$ ,  $L$ ,  $C$ ).
2. Verification of Theorems: MPT, Thevinin's, Norton's, and superposition.
3. Two-port networks:  $Z$ ,  $Y$ , and  $ABCD$  etc.
4. Diode Characteristics and DC Power Supply.
5. Transistor characteristics ( $CE$ ).
6. Design of Operational Amplifier Configurations.
7. Design of waveform generators using Operational Amplifier.
8. Filters using Op-Amps.
9. Astable and Monostable Multivibrator and Applications of Astable Multivibrator.

# Text books

- Circuits and Networks analysis and synthesis by **Sudhakar and Shyammohan**
- Engineering circuit analysis by **William Hayt, Jr et. al.**
- Microelectronic circuits theory and applications by **Sedra and Smith**
- Electronic Circuits analysis and design by **D A Neamen**
- Linear Integrated circuits by **Roy Chaudhary**

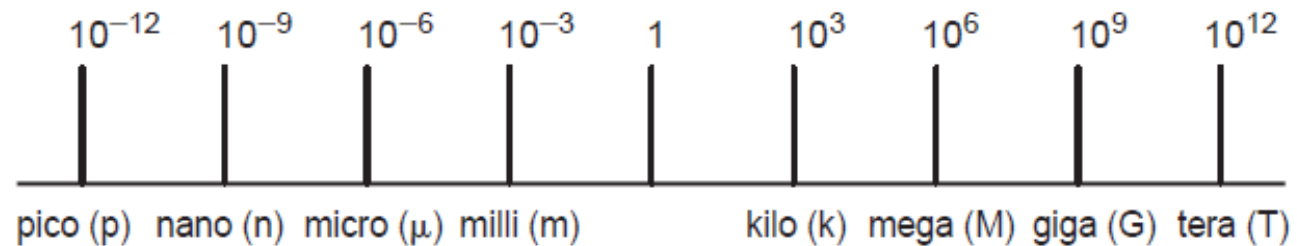
# Evaluation Criteria: Theory and Lab

- Class Tests: 15 %
  - Class Test 1 (Before Mid-1)
  - Class Test 2 (Between Mid-1 and Mid-2)
  - Class Test 3 (Between Mid-2 and END SEM)
- MID Semester Exams: 35%
  - MID -1 : 15%
  - MID -2 : 20%
- END SEM: 50 %
  - Theory Exam: 25%
  - Laboratory Exam: 20%
  - Lab. record: 5%

# SI units

Table 1: Fundamental quantities

Quantity	Unit	Abbreviation
Current	Ampere	A
Length	meter	m
Mass	kilogram	kg
Temperature	Kelvin	K
Time	second	s



# SI Units

Table 2: Derived quantities

Quantity	Unit	Abbreviation	Equivalent	Symbol
Frequency	Hertz	Hz	$s^{-1}$	$f$
charge	coulomb	C	$A s$	$Q$
force	Newton	N	$Kg m s^{-2}$	$F$
Energy	Joule	J	$N m$	$W$
Flux (magnetic)	Weber	Wb	$V s$	$\Phi$
potential	Volt	V	$kg m^2 s^{-3} A^{-1}$	$V$
Power	Watt	W	$J s^{-1}$	$P$
Resistance	Ohm	$\Omega$	$V A^{-1}$	$R$
Inductance	Henry	H	$V s A^{-1}$	$L$
Capacitance	Farad	F	$A s V^{-1}$	$C$