BASIC ELECTRONIC CIRCUITS

Lecture - 1

Outline

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

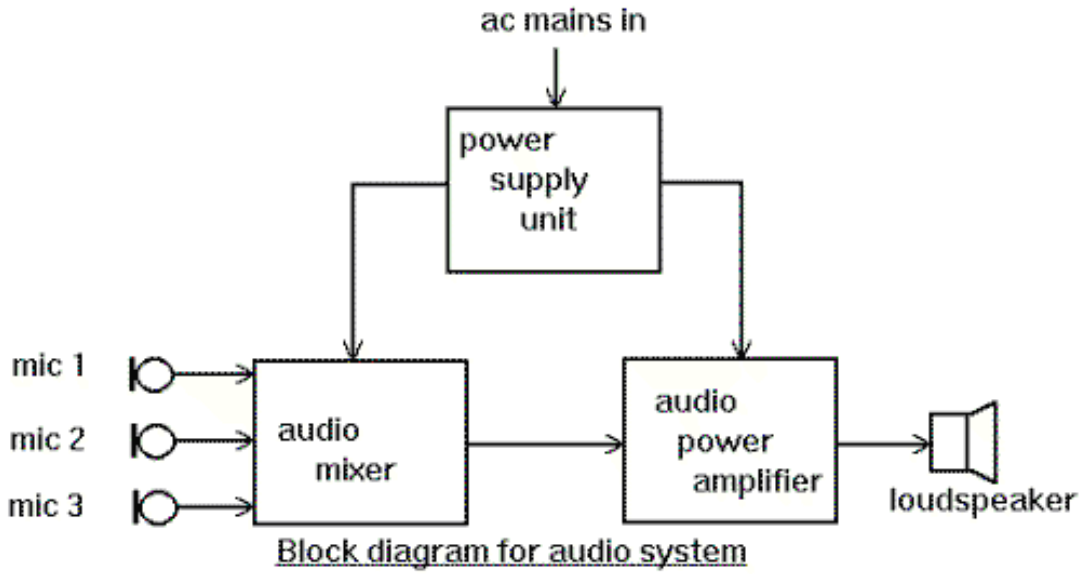
What is an electronic circuit?

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

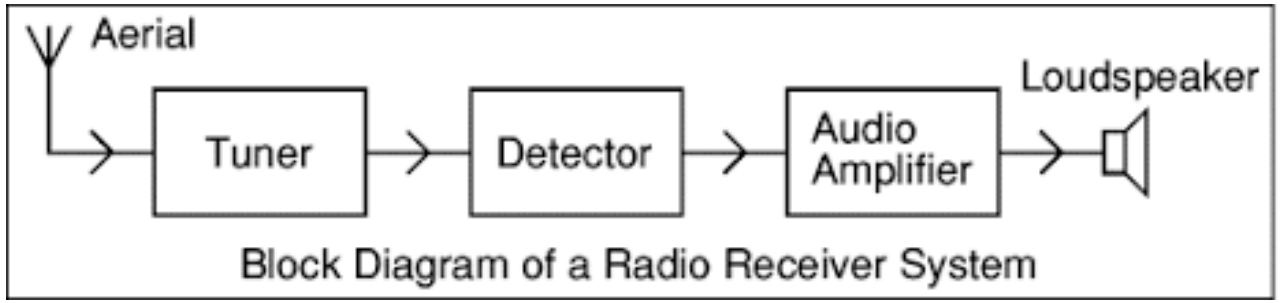
What is an electronic system?

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

Examples of Electronic Systems



Block diagram for audio system



Block Diagram of a Radio Receiver System

Syllabus

Unit 1:

- SI units, Time, frequency, wavelength, Charge, Current, Voltage, Power, Voltage and current sources, Review of basic concepts, physical and mathematical representations of Ohm's law, Kirchoff's laws, passive elements: resistor, inductor and capacitor, Series and parallel resistive networks, Voltage and current division.

Unit 2:

- D-C power supply: Diode characteristics, half-wave and full wave rectifiers, shunt capacitor filter, voltage regulator, regulated D-C power supply.

- Unit 3:
- Transistor: BJT, modes of operation, CE configuration input/output characteristics. Amplifier: Amplifier parameters, operational amplifier (OP-AMP), the VCVS model of an op-amp, Op-amp configurations: inverting and non-inverting, Difference amplifier, instrumentation amplifier, Op-Amp as: adder, subtractor, integrator etc.

- Unit 4:

- 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.

- Unit 5:
- Op-amp based Comparator: inverting and non-inverting comparators, Applications: zero crossing detector, window detector, Schmitt trigger, square wave generator (Astable multivibrator), Monostable multivibrator, sine wave generator. 555 timers: functional diagram, monostable operation.

- Unit 6:

- Analog-Digital conversion: Digital to Analog Converter (DAC) using binary resistor scheme, R-2R ladder DAC, Analog to Digital converter (ADC): Parallel comparator, ADC using counter and DAC, ADC using successive approximation.

Laboratory experiments list: Proposed

1. Familiarization of laboratory Equipment.

2. (a) verification of voltage and Current Division principles of resistive circuits.

(b) Diode Characteristics i) PN Junction Diode and ii) Zener Diode.

3. DC power supply: (a) Rectifier circuits (i) Half Wave Rectifiers (ii) Full Wave Rectifiers; (b) DC Power Supply.

4. Characteristics of BJT transistor in common emitter Configuration.

5. Design of Operational Amplifier Configurations: a) Inverting Amplifier b) Non- Inverting Amplifier c) Summing Amplifier d) Differential Amplifier e) Instrumentation Amplifier.

6. Filters using Op-Amps (a) Low-pass, (b) High-pass, (c) Band-pass and (d) band Stop.

7. Design of waveform generators using Operational Amplifier: a) Sine b) Square and c) Triangular.

8. 555 timers: (a) Astable, (b) Mono-stable and (c) Schmitt Trigger.

9. Analog to Digital and Digital to Analog converters.

Text books

- Circuits and Networks analysis and synthesis by **Sudhakar and Shyammohan**
- Engineering circuit analysis by **Wiliam 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**

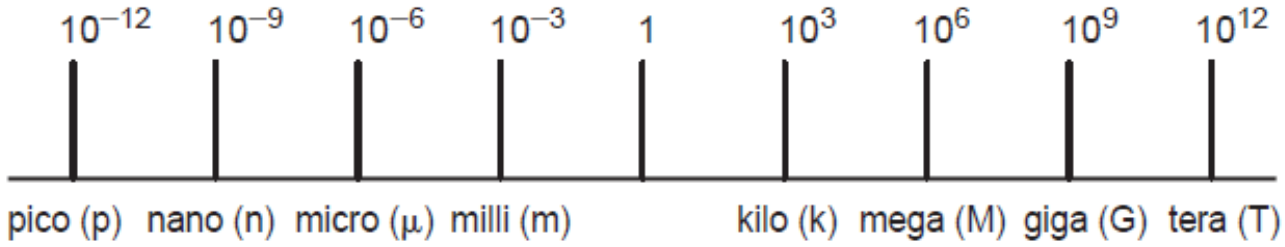
Evaluation Criteria: Theory and Lab

- MID Semester Exams: 40%
  - MID -1 : 20%
  - MID -2 : 20%
- END SEM: 50 %
  - Theory Exam: 30%
  - Laboratory Exam: 20%
- Assignments: 10%

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	Φ
potential	Volt	V	kg m^2 s^{-3} A^{-1}	V
Power	Watt	W	J s^{-1}	P
Resistance	Ohm	Ω	V A^{-1}	R
Inductance	Henry	H	V s A^{-1}	L
Capacitance	Farad	F	A s V^{-1}	C