

Radio Fundamentals - Lecture



I. Constitution of matter

A. General

1. Elements
2. Compound
3. Mixture

B. Composition of atom

1. Nucleus
2. Electron
3. Protons

C. Conductors and Insulators

D. Electric current

E. Resistance

2. Electrical Units

A. Volt

B. Current

C. Resistance

3. D. C. Circuits

A. Ohm's Law

B. Kirchhoff's Law

C. Series circuits

D. Parallel circuits

E. Series-Parallel circuits

F. Power

G. Voltage Dividers

4. Magnetism

- A. Properties of magnetic substances
- B. Molecular theory of magnetism
- C. Magnetic Field
- D. Electromagnetism
- E. Reluctance
- F. Magnetomotive Force
- G. Core saturation
- H. Hysteresis

5. Sources of Electricity

- A. Mechanical
 - 1) Conductor in Magnetic Field
 - 2) Simple AC generator
 - 3) D.C. generator
- B. Chemical
 - 1) Primary cells
 - 2) Secondary cells
- C. Misc.
 - 1) Piezoelectric
 - 2) Photoelectric
 - 3) Thermoelectric

6. Alternating Current

- A. Generation
- B. Vectors
- C. Sine curve

- D. Phase angles
- E. Use of Vectors
 - a. Addition
 - b. Subtraction
- 7. Inductance
 - A. Self-inductance
 - B. Mutual inductance
 - C. Inductors in parallel
 - D. Inductors in series
 - E. Inductive Reactance
 - F. Transformers
- 8. Capacitance
 - A. General
 - 1) Charges
 - 2) Electric Field, Dielectric
 - 3) Unit
 - B. Capacitors in Parallel
 - C. Capacitors in Series
 - D. Capacitive Reactance
- 9. Alternating Current Circuits
 - A. Impedance
 - 1) Phase Relations
 - 2) Impedance Triangles
 - 3) Power Factor
 - B. AC Voltage Dividers

C. Resonant Circuits

- 1) Series Resonance
- 2) Parallel Resonance
- 3) Resonance Curve
- 4) Q Factor

D. Impedance Matching

- 1) Energy Transfer
- 2) Impedance Ratio
- 3) Coupling

10. Non-sinusoidal Wave

- A. General
- B. Composition
- C. Square Wave
- D. Sawtooth
- E. Peaked
- F. Other Wave shapes

11. Circuit Requirements of Non-sinusoidal Wave

- A. Frequency Response
- B. Passing a Square Wave
- C. Distortion Circuits

12. R. C. Transients

- A. Resistance
- B. Capacitance
- C. R. C. Charging
- D. R. C. Discharging

- E. R.C. time constant
- F. Universal R-C, R-L, time constant chart
- 13. R-L Transients
 - A. Inductance
 - B. R-L Charging
 - C. R-L Discharging
 - D. R-L time constant
- 14. AC Transient Circuits
 - A. General
 - B. Relative time (frequency and T.C.)
 - C. Coupling Circuits
 - D. R-C Instigator and Differentiator
 - E. Sine-Wave input
 - F. Square-wave input
 - G. Sawtooth-wave input
 - H. Miscellaneous inputs
- 15. Electron Emission
 - A. Thermionic Emission
 - B. Types of Emitters
 - C. Heating Emitters
 - D. Electron Motion
 - E. Electron Transit Time
- 16. Diodes
 - A. Construction
 - B. Operation

C. Space charge

D. Use

17. Triodes

A. Construction and operation

1) Grid effect

2) Bias

B. Amplification

C. Tube characteristics

1) μ (μ_s)

2) Plate Resistance (r_p)

3) Transconductance (g_m)

D. Typical tube problem application of tube characteristics to triode amplifier circuit.

E. Grid-plate Polarity Inversion

F. Bias methods

G. Distortion

H. Interelectrode capacitance

18. Multi-Element Tubes

A. General

B. Tetrodes

C. Pentodes

D. Beam-Power Tubes

E. Multi-Grid Tubes

F. Multi-Unit Tubes

- 19. Tubes at VHF
 - A. General
 - B. Ordinary Tubes
 - C. Special Tubes
- 20. Gas Filled Tubes
 - A. General
 - B. Electrical Conduction in Gas Tubes
 - C. Gas Filled Diodes
 - D. Thyratrons
- 21. Cathode-Ray Tubes
 - A. General
 - B. Electron Beam
 - C. Fluorescent Screens
- 22. Rectifier Circuits
 - A. General
 - B. Half Wave
 - C. Full Wave
 - D. Bridge
 - E. Metaflic-Oxide Rectifiers
 - F. Voltage Doubler
 - G. Voltage Multiplier
- 23. Filter Circuits
 - A. General
 - B. Capacitance Filter
 - C. Inductance Filter

- D. Inductance-Capacitance Filter
- E. Resistance-Capacitance Filter
- 24. Voltage Dividers
 - A. General
 - B. Circuits
 - 1) Current, Voltage, Resistance Relations
 - 2) Location of Ground
- 25. Voltage Regulators
 - A. General
 - B. Slow Tube
 - C. Vacuum Tube Regulator
 - D. Voltage Stabilizer
- 26. Current Regulators
- 27. Amplifiers-Classification
 - A. General
 - B. According to use
 - C. According to Bias
 - 1) Class A
 - 2) " B
 - 3) " AB
 - 4) " C
 - D. According to Frequency Response
- 28. Distortion in Amplifiers
 - A. General
 - B. Frequency Distortion

- C. Phase Distortion
- D. Amplitude Distortion
- 29. Coupling methods
 - A. General
 - 1) Resistance-Capacitance Coupling
 - 2) Impedance Coupling
 - 3) Transformer Coupling
 - 4) Direct Coupling
 - B. Equivalent Circuit of VT amplifier
 - C. R-C Coupling
 - 1) Triode
 - 2) Pentode
 - 3) Frequency Response (Equivalent Circuit)
 - a. Low
 - b. Mid
 - c. High
 - D. Impedance Coupling
 - E. Transformer Coupling
 - 1. Frequency Response
 - a. Low
 - b. Mid
 - c. High
 - F. Direct Coupling
- 30. D.C. Amplifier
 - A. Operation
 - B. Uses

- 31. Feedback Amplifiers
 - A. General
 - B. Principle
 - C. Positive Feedback
 - D. Negative Feedback
 - E. Advantages of Negative Feedback
 - F. Negative Feedback Methods
- 32. Tuned Amplifiers
- 33. Video Amplifiers
 - A. R-C Circuits
 - 1) Compensation
 - a. Low Frequency
 - b. High Frequency
- 34. Cathode Follower
 - A. General
 - B. Circuit Operation
 - C. Voltage gain
 - D. Input Impedance
 - E. Output Impedance
 - F. Distortion caused by limiting
 - G. Advantages
- 35. Phase Inverters
 - A. General
 - B. Transformer
 - C. VT phase Inverters

- D. Single-tube Paraphase Amplifier
- E. Two-tube Paraphase Amplifier
- 36. Basic Oscillators
 - A. General
 - B. Feedback
 - C. Ultracedion
 - D. TPTG
 - E. Push-Pull Oscillator
 - F. Transitron Oscillator
- 37. RC Oscillators
 - A. General
 - B. Wein bridge
 - C. Phase Shift
- 38. Limiting Circuits
 - A. General
 - B. Series Diode
 - C. Parallel-Diode
 - D. Double-Diode
 - E. Grid Limiting
 - F. Saturation Limiting
 - G. Cut-off Limiting
 - H. Overdriven Amplifier
 - I. Limiter Applications
- 39. Clamping Circuits
 - A. General

- B. Diode Clamp
- C. Grid Clamp
- D. Biased Clamp
- 40. Peaking
 - A. General
 - B. RC Differentiator
- 41. Multivibrators
 - A. General
 - B. Trigger Circuits
 - C. One-shot
 - D. Cathode Coupled
 - E. Plate Coupled
 - F. Electron Coupled
- 42. Phase Shifting
 - A. General
 - B. Phase-splitting Circuits
 - C. R-C Phase Split
 - D. R-L " "
- 43. Transistors
 - A. General
 - B. Crystal Structure
 - 1) Donors
 - 2) Acceptors
 - C. Construction and Electrode Designation
 - D. Current, Resistance, Voltage, Power Gain
 - E. Grounded Base

- F. Grounded Emitter
- G. " Collector
- H. Amplifiers
- I. Oscillators
- J. High Frequency Operation
- K. Special Circuits
 - 1) Class B Amplifier
 - 2) R.F. Oscillators
 - 3) DC transformers
- 44. Vacuum Tube Applications
 - A. Voltage Amplifier
 - B. R.F. Amplifier
 - 1. Low Level
 - 2. Power
 - C. Frequency Conversion
 - D. " Multiplication
- 45. Transmission Lines
 - A. Impedance
 - B. Equivalent Circuits
 - C. Wave Motion
 - D. Reflection
 - E. Non-Resonant Lines
 - F. Resonant Lines
 - G. Matching Sections
- 46. Antennas
 - A. Radiation.

- 1) E and H Fields
- B. Reception
- C. Basic Principles
 - 1) General
 - 2) Electrical Length
 - 3) Antenna Impedance
 - 4) Radiation Resistance
 - 5) Wave polarization
 - 6) Field Strength
- D. Basic Antennas
 - 1) Half Wave dipole
 - 2) Vertical Grounded Antenna
- E. Radiation Pattern for Half Wave Antennas
 - 1) General
 - 2) Vertical dipole
 - 3) Horizontal Dipole
- F. Folded Dipoles
- G. Feedlines
 - 1) Resonant
 - 2) Non Resonant
- H. Directional Antennas
- I. Ground Reflections
 - 1) Antenna Images
 - 2) Height of Antenna Above Ground
- J. Modes of Propagation

- 1) Ground Wave
- 2) Tropospheric
- 3) Sky-Wave
- 4) MUF
- 5) LUF
- 6) FOT
- 7) Fading

Fundamentals
Suggested Laboratory Projects

1. None
2. Measure Voltage, Current, Resistance
3. Calculate and then Combine Resistors in series, parallel,
to obtain specified values. Measure branch currents etc.
4. Electromagnet Compass
Saturated Reactor
5. Simple generator (magnet and galvanometer) Voltage
measurement of storage cells
6. AF Oscillator and Scope
7. Inductance and mutual measurement simple transformer
8. Capacity measurement
9. AF Oscillator, series and parallel circuits coupling
measurements
10. Signal Generator and Scope
11. Differentiator and Integrator
12. RC and RL time constants with scope
13. " " " " " " "
14. AC Transients
15. VT construction displays
16. Diode Space Charge
17. Triode Amplifier
18. Multi-element tube
Power amplifier

19. VHF Tubes
20. Voltage Regulator Tubes
Thyratrons
21. Scope
22. Rectifier Circuits
23. Filter arrangements
24. Voltage Divider
25. Voltage Regulator Systems
26. Current Regulator
27. Amplifier Bias, Drive etc...
28. Distortion Measurement
29. Amplifier Coupling (measurements of response)
30. DC Amplifiers
31. Feedback
32. Tuned Stages
33. Broad-band Amplifier
34. Cathode Follower
35. Phase Inverters
36. Oscillator circuits
37. RC Oscillators
38. Limiters, Clippers, etc.
39. " " "
40. Peaking
41. Multivibrators
42. Phase Shifters

- 43. Transistor measurements
 - " Circuits
- 44. Mixers and Multipliers (VT)
- 45. Transmission line measurement
- 46. Antenna demonstrations.