COURSE CONTENT

Course

Course code: EIE312
Course title: Principles of Communications 3 Units
Course status: Compulsory

Course Duration

Three hours per week for 15 weeks (45hours)

Lecturer's Data

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Consultation Hours: Mondays, Tuesdays and Fridays (12:00noon-2:00pm)

Course Content – Illustration below:

An elementary account of the types of transmission (Analogue signal transmission and digital signal transmission). Block diagram of a communication system. Brief Historical development on communications: Telegraph, Telephony, Radio, Satellite, Data, Optical and mobile communications, Facsimile. The frequency Spectrum. Signals and vectors, orthogonal functions. Fourier series, Fourier integral, signal spectrum, convolution, power and energy, correlation. Modulation, reasons for modulation, types of modulation. Amplitude modulation systems: Comparison of amplitude modulation systems. Methods of generating and detecting AM, DBS and SSB signals. Vestigial sideband Frequency mixing and multiplexing, frequency division multiplexing. Applications of AM systems. Frequency modulation systems: Instantaneous frequency, frequency deviation, modulation index, Bessel coefficients, significant sideband criteria. Bandwidth of a sinusoidally modulated FM signal, power of an FM signal, direct and indirect FM generation. Various methods of FM demodulation, discriminator, phase-lock loop, limiter, pre-emphasis and de-emphasis, Stereophonic FM broadcasting. Noise waveforms and characteristics. Thermal noise, shot noise, noise figure and noise temperature. Cascade network, experimental determination of noise figure. Effects of noise on AM and FM systems. Block diagram of a superheterodyne AM radio receiver, AM broadcast mixer, local oscillator design, intermodulation interference, adjacent channel interference, ganging, tracking error, intermediate frequency, automatic gain control (AGC), delay AGC, diode detector, volume control. FM broadcast band and specification, Image frequency, block diagram of a FM radio receiver, limiter and ratio detectors, automatic frequency control, squelch circuit, FM mono and FM stereo receivers. AM broadcast band and specification. TV broadcast band and specification. Signal format, transmitter and receiver block diagrams of black and white TV and colour TV.B.

Course Description:

This is a foundational course on communications systems which introduces the basic

building blocks of communication systems and circuits and proceeds to equip the students with the necessary skills to analyse signals in such systems as well as solve simple real life problems. The course covers types of transmission (Analogue signal transmission and digital signal transmission) and different communication systems. A brief historical development on communications with reference to Telegraph, Telephony, Radio, Satellite, Data, Optical and mobile communications, Facsimile is covered. The frequency Spectrum, Signals and vectors, orthogonal functions, Fourier series, Fourier integral, signal spectrum, convolution, power and energy, correlation are taught to enable the students develop analytical skills for analysing telecommunications signals. Modulation, reasons for modulation, the various types of modulation and their applications are taught extensively. Amplitude modulation systems, comparison of amplitude modulation systems, methods of generating and detecting AM, DBS and SSB signal, vestigial sideband Frequency mixing and multiplexing, frequency division multiplexing and Applications of AM systems are covered. Frequency modulation systems are taught with respect to Instantaneous frequency, frequency deviation, modulation index, Bessel coefficients, significant sideband criteria, Bandwidth of a sinusoidally modulated FM signal, power of an FM signal, direct and indirect FM generation, various methods of FM demodulation, discriminator, phase-lock loop, limiter, pre-emphasis and de-emphasis and Stereophonic FM broadcasting. Noise waveforms and their characteristics Important concepts relating to noise such as Thermal noise, shot noise, noise figure and noise temperature, noise Cascade network, experimental determination of noise figure, Effects of noise on AM and FM systems are covered. Block diagram of a superheterodyne AM radio receiver, AM broadcast mixer, local oscillator design, intermodulation interference, adjacent channel interference, ganging, tracking error, intermediate frequency, automatic gain control (AGC), delay AGC, diode detector, volume control. FM broadcast band and specification, Image frequency, block diagram of a FM radio receiver, limiter and ratio detectors, automatic frequency control, squelch circuit, FM mono and FM stereo receivers are also taught. AM broadcast band and specification, TV broadcast band and specification are also introduced. Signal format, transmitter and receiver block diagrams of black and white TV and colour TV.B. are briefly introduced. The scope of discussion is limited to that specified in the course content above. Some areas not covered may however be given as assignment to students to explore.

Course Justification:

This course is a foundational course in understanding the principles of communication systems. A good understanding of this course will prepare the students for future practice as Engineers whether in Academics or in the Industry. It will give the students the basic knowledge and skills needed for understanding the operation of various communication systems with respect to how signals are transmitted and received. They will be able to describe the processes involved in sending different types of communication signals from a sender to a receiver. It will also equip the students with the basic knowledge and ability necessary to analyze and solve real life problems using Fourier series and transforms and other relevant theories by applying the necessary theorems and laws. This course affords our students the privilege to have the fundamental knowledge and theory which will enable them to be part of those who will

design, maintain and create the next generation of communication devices and systems for our world.

Course objectives

At the end of this course, students would be able to:

(i) Develop a deeper and rigorous understanding of the fundamental Principles of Communication and give an historical development on communications.

(ii) Give an elementary account of the types of transmission (Analogue signal transmission and digital signal transmission) and draw the block diagram of a communication system.

(iii) Understand and discuss the entire range of the electromagnetic spectrum with respect to the various frequency bands.

(iv) Understand and discuss the concept of Signals, vectors and orthogonal functions.

(v) Understand and discuss the concept of signal analyses using Fourier series, Fourier integrals, convolution theory, power and energy theory, correlation theory.

(vi) Develop a deeper and rigorous understanding of Modulation, reasons for modulation and types of modulation.

(vii) Understand and discuss the concept of Amplitude modulation (AM) and the various AM systems being used in Radio frequency transmission.

(viii) Understand and discuss the concept of Frequency modulation with respect to Instantaneous frequency, frequency deviation, modulation index, Bessel coefficients, significant sideband criteria, Bandwidth of a sinusoidally modulated FM signal, power of an FM signal, direct and indirect FM generation, Various methods of FM demodulation, discriminator, phase-lock loop, limiter, pre-emphasis and de-emphasis, Stereophonic FM broadcasting etc.

(ix) Understand and discuss the concept of Noise waveforms and their characteristics.

(x) Understand and discuss the principle of operation of the superheterodyne receiver and all the associated terms.

(xi) Understand and discuss the concept of FM broadcast band and specification, automatic frequency control, squelch circuit, FM mono and FM stereo receivers.

(xii) Understand and discuss the concept of AM and TV broadcast band and specification.

Course Requirement – Illustration below:

To derive maximum benefits from the course and for fast grasping of many of the principles of communications, the course requires that the students be familiar with basic circuit theorems and characteristics of basic electronic components like diodes, transistors, resistors and capacitors. The students should also have a good knowledge of basic mathematics and physics. However, the course is structured to accommodate to

some extent, students that do not fall into this category since some of these basics will be introduced. A good knowledge and understanding of the course requires that students carry out some laboratory practical. This is done in another practical course compulsory for all 300Level students in the department.
The method of grading is shown in Table1. .

Table1: Method of Grading-

S/N	**Grading**	**Score** (%)
1.	1st Test	5
2.	2nd Test	10
3.	3rd Test	10
4.	Assignment	5
5.	Final Examination	70
	Total	**100**

Course Delivery Strategies – Illustration below:

1. Lecture delivery with explanations using lecture notes, real life examples, diagrams and graphs.
2. The use of the University's Intranet e-platform for quizzes, assignments, group discussions, etc.
3. Giving off net assignments and classwork.
4. Uploading the lecture materials on the e-learning platform.
5. Giving online assignments.
6. Having practical discussion sections at the end of the lecture.

LECTURE CONTENT

For this section, the topic of each week, objectives, description, study question and other information are presented.

1. **Week 1:** Introduction to Principles of Communication and historical development on communications.

   - **Objectives**

   The students at the end of the lectures for the week should be able to:

   (i) Define and discuss the terms Communications and Telecommunications and differentiate between them.

   (ii) Give a brief history of communications with specific focus on technology, the inventors and the numerous systems that have evolved into today's telecommunications systems.

   - **Description**

   First hour: Introduction of basic concepts and principles of communications. Brief Historical development on communications with respect to Telegraph, Telephony,
   Second hour: Radio, Satellite, Data, Optical and mobile communications, ,
   Third hour: Facsimile, Discussion and questions.

   - **Study Question:**

1. What is Communication?
2. Draw a block diagram of a telecommunication system
3. List the various telecommunications systems that have been used so far to convey information from a sender to a receiver..
4. List the fundamental differences between the telephone and the telegraph.

- **Reading List - Books and materials students can read. Illustration below:**

1. Anokh. Singh and A. K. Chhabra. Principles of Communication.
2. Rodger E. Ziemer and William H. Tranter. Communications Principles: Systems, Modulation and Noise by.
3. Dr. J.S Chitode (2009) Principles of Communication by, Technical Publications,. ISBN8184316615, 9788184316612
4. Taub Principles of Communication Systems, (2008), McGraw-Hill Education (India) Pvt Limited. ISBN 0070648115, 9780070648111

- **Week 2:** Analogue and Digital signal transmission and Frequency Spectrum
- **Objectives**

At the end of the week, the students should be able to:

1. Define and discuss analogue and digital signals.
2. Define and discuss analogue and digital signal transmission.
3. Define the electromagnetic frequency spectrum.
4. List the various frequency bands in the electromagnetic spectrum.

- **Description**

First hour: An elementary account of the types of transmission. What are Analogue and digital signals? Analogue signal transmission and digital signal transmission and their examples.

Second hour: The electromagnetic frequency spectrum, Frequency bands, range of wavelength and their areas of use.

Third hour: Discussion and questions.

- **Study Question:**

1. Define and discuss analogue and digital signals.
2. Define and discuss analogue and digital signal transmission
3. Define electromagnetic spectrum?
4. List the various frequency bands that make up the electromagnetic spectrum.
5. State the uses of the frequency bands you have listed in Question 4 above.

Reading List - Books and materials students can read. Illustration below:

1. Anokh. Singh and A. K. Chhabra. Principles of Communication.
2. Rodger E. Ziemer and William H. Tranter. Communications Principles: Systems, Modulation and Noise by.
3. Dr. J.S Chitode (2009) Principles of Communication by, Technical Publications,. ISBN8184316615, 9788184316612
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- **Week 3:** Signals Analysis, Vectors and Orthogonal functions
- **Objectives**

At the end of the week, the students should be able to:

1. Understand and discuss the concept of signals.
2. Represent a square wave signal by an approximate sinusoidal signal.
3. Understand and discuss the concept of vectors and orthogonal functions and how they relate to signals.

4. Evaluate Mean square errors in signal functions.
5. List different series used to analyse and represent signals.

Description

First hour: Signals and signal representation. Representing a square wave signal by an approximate sinusoidal signal.

Second hour: Vectors and Orthogonal functions, Mean square errors in signal functions.

Third hour: Discussion and questions

Study Question:

1. What is a signal?
2. With the aid of relevant diagrams describe how a square wave can be approximated using a sinusoidal function.
3. Briefly discuss the concept of Orthogonality as it relates to signals.
4. Show that the functions *Sin nwt and Cos mwt* are orthogonal over the interval $t_0;\ t_0 + \frac{2\pi}{w_0}$ $where\ m\ and\ n\ are\ any\ intergers$?
5. Given a function $f(t)$ defined as

$f(t) = \begin{pmatrix} 1\ (0<t<\pi) \\ -1\ (\pi<t<2\pi) \end{pmatrix}$

If $f(t)$ is to be approximated by another function g(t) over the period (0 to 2π), so that $f(t) = C\ g(t)$. Calculate the optimum value "C" to minimise the mean square error in the approximation.

Reading List - Books and materials students can read. Illustration below:

1. Anokh. Singh and A. K. Chhabra. Principles of Communication.
2. Rodger E. Ziemer and William H. Tranter. Communications Principles: Systems, Modulation and Noise by.
3. Dr. J.S Chitode (2009) Principles of Communication by, Technical Publications,. ISBN8184316615, 9788184316612
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- **Week 4:** Signal Analysis
- **Objectives**

At the end of the week, the students should be able to:

1. Understand and discuss the concept of Fourier series, Fourier integral, signal spectrum, convolution, power and energy, correlation as they relate to signals.
2. Use Fourier and other related series to represent real and complex signals.
3. Identify different harmonic components in a signal that has been represented by a given series.
4. Calculate the power and energy of a signal spectrum.

Description

First hour: Fourier series, Fourier integral,

Second hour: signal spectrum, convolution.

Third hour: Power and energy and correlation. Questions and discussion

Study Question:

1. List the properties of the Fourier transform.
2. State and discuss Parseval's Theorem.
3. Represent the output of a full wave rectifier shown in the figure below in terms of exponential Fourier series.

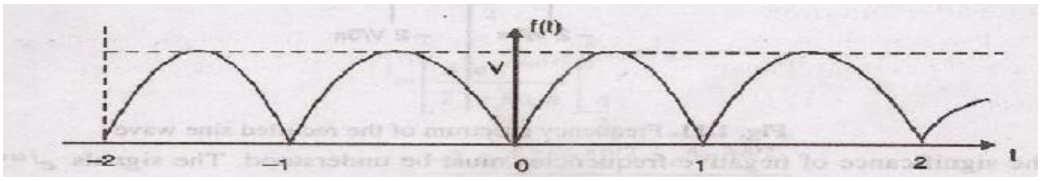

Fig Q3. Waveform of the full wave Rectifier Output.

4. What is a signal spectrum?
5. A train of rectangular pulses making excursions from 0 to 10 Volts has duration of 50ms and are separated by intervals of 500ms. Assuming that the centre of a pulse is located at pulse period t=0,
   (i) Write the exponential Fourier series for the pulse train.
   (ii) Find the spectral amplitude as a function of frequency. Include three spectral components on each side of f=0.
   (iii) How is the spectrum affected if pulse period t is reduced to 250ms.
6. Determine the values of the constants C1, C2, …….C7 in the approximated waveform of the figure below. Also calculate the mean square error.

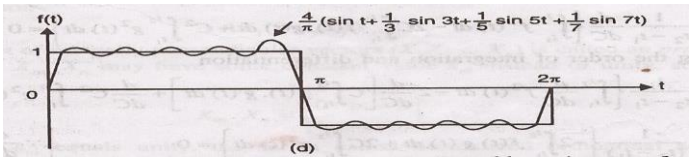

Fig Q6

Reading List - Books and materials students can read. Illustration below:

1. Anokh. Singh and A. K. Chhabra. Principles of Communication.
2. Rodger E. Ziemer and William H. Tranter. Communications Principles: Systems, Modulation and Noise by.
3. Dr. J.S Chitode (2009) Principles of Communication by, Technical Publications,. ISBN8184316615, 9788184316612
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- **Week 5:** Modulation
- **Objectives**

At the end of the week, the students should be able to:

1. Understand and discuss modulation.
2. List and discuss reasons for modulation.
3. List and write short notes on types of modulation.

Description

First hour: Definition and illustration of modulation.
Second hour: Reasons for modulation and types of modulation
Third hour: Discussion and questions.

Study Question:

1. What is modulation?
2. List and discuss the various reasons for modulation.
3. List and write short notes on the various types of modulation you know.

Reading List - Books and materials students can read. Illustration below:

1. Anokh. Singh and A. K. Chhabra. Principles of Communication.
2. Rodger E. Ziemer and William H. Tranter. Communications Principles: Systems, Modulation and Noise by.
3. Dr. J.S Chitode (2009) Principles of Communication by, Technical Publications,. ISBN8184316615, 9788184316612

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- **Week 6:** Amplitude Modulation.
- **Objectives**

At the end of the week, the students should be able to:

1. Understand, define and discuss Amplitude modulation.
2. List and compare amplitude modulation systems.
3. Discuss the methods of generating and detecting AM, DBS SSB and vestigial sideband.

6. **Description**

First hour: Definition of Amplitude modulation. AM modulation process. Comparison of AM modulation systems.
Second hour: Methods of generating and detecting AM, DBS, SSB.
Third hour: Vestigial sideband, Discussion and questions.

Study Question:

1. In sufficient details, discuss the concept of Amplitude Modulation.
2. What are the advantages and disadvantages of suppressing the Carrier in an AM system.
3. A transmitter radiates 7kW without modulation and 10.125kW after modulation. Determine the depth of modulation.
4. List and compare amplitude modulation systems.
5. List and discuss the methods of generating and detecting AM.
6. What are the relative merits of high level modulation and low level modulation in AM transmission?
7. Assume the modulating signal and the carrier of an AM wave are represented by :

$e_m = E_m Sinw_m t$ and $e_c = E_{cm} Sinw_c t$ respectively where w_m and w_c are the signal and carrier angular velocities respectively.

(i) Estimate the equation for the modulation signal.
(ii) State the three important components in the equation.

8. A transmitter radiates 8.8kW without modulation and 10.125kW after modulation, determine the depth of modulation.

Reading List - Books and materials students can read. Illustration below:

1. Anokh. Singh and A. K. Chhabra. Principles of Communication.
2. Rodger E. Ziemer and William H. Tranter. Communications Principles: Systems, Modulation and Noise by.
3. Dr. J.S Chitode (2009) Principles of Communication by, Technical Publications,. ISBN8184316615, 9788184316612
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- **Week 7:** Amplitude Modulation.
- **Objectives**

At the end of the week, the students should be able to:

1. Solve problems relating to AM.
2. Understand and discuss the concept of Frequency mixing and multiplexing, frequency division multiplexing.
3. List and discuss different modulation circuits

4. List and discuss applications of AM systems.

Description

First hour: Review of AM. Concept of frequency mixing and multiplexing.

Second hour: Frequency division in AM systems, Modulation circuits, Power in AM waves.

Third hour: List and discuss applications of AM systems. Discussion and questions.

Study Question:

1. Discuss the concept of frequency mixing and multiplexing and frequency division multiplexing in AM systems.
2. The anode dissipation of a class C power amplifier is 944 Watts when modulation depth is 60%, the efficiency of the power amplifier 50% while that of the modulator is 25%. Find.

(i) Carrier power and modulator tube dissipation when modulation depth is 100%

(ii) Audio frequency output and rating of the modulation value to effect 100% modulation.

(iii) Overall efficiency at 60% modulation depth

3. List and write short notes on the following types of Amplitude modulation circuits:
   (i) Non Linear modulation circuits (3mks)
   (i) Linear modulation Circuits.
4. An AM radio transmitter gives a power output of 5 kW when modulated to a depth of 95%. If after modulation by a speech signal which produces an average modulation depth of 20% the carrier and one side band are suppressed, determine the average power in the remaining output.

Reading List - Books and materials students can read. Illustration below:

1. Anokh. Singh and A. K. Chhabra. Principles of Communication.
2. Rodger E. Ziemer and William H. Tranter. Communications Principles: Systems, Modulation and Noise by.
3. Dr. J.S Chitode (2009) Principles of Communication by, Technical Publications,. ISBN8184316615, 9788184316612
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- **Week 8:** Frequency Modulation
- **Objectives**

At the end of the week, the students should be able to:

1. Understand, define and discuss Frequency Modulation.
2. Discuss the frequency spectrum of an FM wave.
3. Define and explain the following terms as they relate to frequency modulation:

(i) Instantaneous frequency,

(ii) frequency deviation,

(iii) modulation index,

(iv) Bessel coefficients,

(v) significant sideband criteria

Description

First hour: Definition of Frequency modulation. Frequency spectrum of an FM wave.

Second hour: Instantaneous frequency, frequency deviation, modulation index, Bessel coefficients.

Third hour: Significant sideband criteria, Discussion and questions.

Study Question:

1. With the aid of relevant diagrams, discuss the concept of Frequency modulation.
2. Derive the equation of the modulated FM wave (e_{mod}) when
   Modulating signal $(e_m) = E_m Cosw_m t$ and
   Carrier signal $(e_c) = E_c Sin(w_c t + \theta)$
   Note $that\ \theta = initial\ phase\ angle$?
3. An FM wave is represented by the voltage equation
   e_{mod}=10 $sin(10\ X\ 10^6 t + 8 Sin\ 3X10^4 t)$
   Calculate:
   (i) The modulating frequency
   (ii) The Carrier frequency
   (iii) The modulating index
   (iv) The frequency deviation.
4. In sufficient details, discuss the frequency spectrum of an FM wave.
5. The frequency deviation produced on a 100MHz carrier by a 5000Hz signal is 50kHz. Determine the angle of phase advance and retardation by this signal and also frequency deviation that would be produced by a signal of equal magnitude out of frequency 100Hz.

Reading List - Books and materials students can read. Illustration below:

1. Anokh. Singh and A. K. Chhabra. Principles of Communication.
2. Rodger E. Ziemer and William H. Tranter. Communications Principles: Systems, Modulation and Noise by.
3. Dr. J.S Chitode (2009) Principles of Communication by, Technical Publications,. ISBN8184316615, 9788184316612
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- **Week 9:** Frequency Modulation/Demodulation
- **Objectives**

At the end of the week, the students should be able to:

1. Understand, define and discuss Bandwidth of a sinusoidally modulated FM signal.
2. Understand and discuss the power of an FM signal.
3. Understand and discuss direct and indirect FM generation.
4. Understand and discuss various methods of FM demodulation
5. Understand and discuss the following terms as they relate to FM:
   (i) discriminator,
   (ii) phase-lock loop,
   (iii) limiter,
   (iv) pre-emphasis and de-emphasis,
   (v) Stereophonic FM broadcasting
6. What is demodulation?
7. State the importance of the time constant CR in envelope detection of an AM wave.
8. Draw the circuit arrangement of a practical Linear diode detector

Description

First hour: Bandwidth of a sinusoidally modulated FM signal, power of an FM signal, direct and indirect FM generation.

Second hour: Various methods of FM demodulation, discriminator, phase-lock loop, limiter, pre-emphasis and de-emphasis.

Third hour: Stereophonic FM broadcasting, Discussion and Questions.

Study Question:

1. Insufficient detail, define and discuss the bandwidth of a sinusoidally modulated FM signal.
2. What is the power of an FM signal?
3. What do you understand by the term direct and indirect FM generation? How are they done?
4. Discuss various methods of FM demodulation
5. Write short notes on the following terms as they relate to FM:

(i) discriminator,
(ii) phase-lock loop,
(iii) limiter,
(iv) pre-emphasis and de-emphasis,
(v) Stereophonic FM broadcasting.

6. Write short notes on the following terms as it relates to Frequency modulation
   (i) Varactor Diode modulation
   (ii) Narrow and Wide band FM
7. A 100 MHZ carrier wave has a peak voltage of 5volts. The carrier is frequency modulated (FM) by a sinusoidal modulating signal or wave form of frequency 2khz such that the frequency deviation is 75khz. The modulated wave form passes through zero and is increasing at t=0. Determine the expression for the modulated carrier wave form.

Reading List - Books and materials students can read. Illustration below:

1. Anokh. Singh and A. K. Chhabra. Principles of Communication.
2. Rodger E. Ziemer and William H. Tranter. Communications Principles: Systems, Modulation and Noise by.
3. Dr. J.S Chitode (2009) Principles of Communication by, Technical Publications,. ISBN8184316615, 9788184316612
4. Taub Principles of Communication Systems, (2008), McGraw-Hill Education (India) Pvt Limited. ISBN 0070648115, 97800706481113

- **Week 10:** Noise
- **Objectives**

At the end of the week, the students should be able to:

1. Understand and discuss noise waveforms and their characteristics.
2. Understand, define and discuss Thermal noise, shot noise, noise figure and noise temperature.
3. Discuss noise in cascade networks
4. Describe experimental determination of noise figure.
5. List the effects of noise on AM and FM systems.

Description

First hour: Noise waveforms and characteristics. Thermal noise, shot noise, noise

figure and noise temperature.

Second hour: Cascade network, experimental determination of noise figure.

Third hour: Effects of noise on AM and FM systems.

Study Question:

1. What is noise?
2. In sufficient detail, discuss noise waveforms and their characteristics.
3. Write short notes on the following:
   (i) Thermal noise,
   (ii) Shot noise,
   (iii) Noise figure
   (iv) Noise temperature.
4. Discuss the concept of noise in cascade networks
5. Describe experimental process of determining noise figure.
6. List the effects of noise on AM and FM systems.
7. An FM wave is represented by the voltage equation

   e_{mod}=10 $sin(10\ X\ 10^6 t + 8 Sin\ 3X10^4 t)$

   Calculate:
   (j) The modulating frequency
   (ii) The Carrier frequency
   (iii) The modulating index
   (iv) The frequency deviation
8. The power dissipated in an 8 ohm load.
9. Discuss the concept of signal to noise ratio and noise figure in Communication systems.
10. What is noise in electrical term? Extra Terrestrial noise or otherwise call space noise comprises of solar noise and comic noise. Explain each of these noises.
11. An amplifier operating over the frequency range from 18 to 20 MHZ has 10kΩ input resistor. Calculate the rms Voltage to this amplifier if the ambient temperature is 27^0C. Given that Vn is directly proportional to the square root of 4RTB, and K= 1.38 x10^{-23} Joule $deg^{-1}.k^{-1}$.

Reading List - Books and materials students can read. Illustration below:

1. Anokh. Singh and A. K. Chhabra. Principles of Communication.
2. Rodger E. Ziemer and William H. Tranter. Communications Principles: Systems, Modulation and Noise by.
3. Dr. J.S Chitode (2009) Principles of Communication by, Technical Publications,. ISBN8184316615, 9788184316612
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- **Week 11:** AM Receiver
- **Objectives**

At the end of the week, the students should be able to:

1. Understand, draw the block diagram and discuss the principle of operation of a superheterodyne AM radio receiver.
2. Understand and discuss the following terms as they relate to AM receivers:
   (i) AM broadcast mixer,
   (ii) local oscillator design,
   (iii) intermodulation interference,
   (iv) adjacent channel interference,

(v) ganging,
(vi) tracking error,
(vii) intermediate frequency,
(viii) automatic gain control (AGC),
(ix) delay AGC,
(x) diode detector,
(xi) volume control

Description

First hour: Block diagram of a superheterodyne AM radio receiver, AM broadcast mixer, local oscillator design, intermodulation interference,
Second hour: adjacent channel interference, ganging, tracking error, intermediate frequency, automatic gain control (AGC).
Third hour: delay AGC, diode detector, volume control. Discussion and Questions.

Study Question:

1. With the aid of a block diagram, briefly discuss the principle of operation of a Superheterodyne AM receiver.
2. Write a short note on the main function of a radio receiver.
3. What do you understand by double spotting on radio receiver?
4. State two advantages of RF amplifier.
5. What is a frequency mixer as it relates to Receivers?
6. Briefly discuss the terms selectivity and sensitivity of a heterodyne receiver.
7. Draw the block diagram of a super heterodyne receiver and explain the function of each block.
8. What factors govern the choice of intermediate frequency?

8. **Reading List - Books and materials students can read. Illustration below:**

1. Anokh. Singh and A. K. Chhabra. Principles of Communication.
2. Rodger E. Ziemer and William H. Tranter. Communications Principles: Systems, Modulation and Noise by.
3. Dr. J.S Chitode (2009) Principles of Communication by, Technical Publications,. ISBN8184316615, 9788184316612
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- **Week 12:** FM Radio Receivers
- **Objectives**

At the end of the week, the students should be able to:

1. Understand the basic concept of FM radio receivers and describe the principle involved.
2. Describe FM broadcast band and their specifications.
3. Draw the block diagram of an FM radio receiver and discuss the functions of each block.
4. Describe the principle of operation of FM Mono and Stereo receivers.
5. Understand and discuss the following terms as it relates to FM receivers:
   (i) Image frequency
   (ii) limiter and ratio detectors,
   (iii) automatic frequency control,

(iv) squelch circuit.

Description

First hour: FM broadcast band and specification, Image frequency, block diagram of an FM radio receiver.

Second hour: limiter and ratio detectors, automatic frequency control, squelch circuit,.

Third hour: FM mono and FM stereo receivers. Discussion and Questions.

Study Question:

1. Discuss the basic concept of FM radio receivers and describe the principle involved.
2. Describe FM broadcast band and their specifications.
3. Draw the block diagram of an FM radio receiver and discuss the functions of each block.
4. Describe the principle of operation of FM Mono and Stereo receivers.
5. Discuss the following terms as it relates to FM receivers:
   (v) Image frequency
   (vi) limiter and ratio detectors,
   (vii) automatic frequency control,
   (viii) squelch circuit..

Reading List - Books and materials students can read. Illustration below:

1. Anokh. Singh and A. K. Chhabra. Principles of Communication.
2. Rodger E. Ziemer and William H. Tranter. Communications Principles: Systems, Modulation and Noise by.
3. Dr. J.S Chitode (2009) Principles of Communication by, Technical Publications,. ISBN8184316615, 9788184316612
4. Taub Principles of Communication Systems, (2008), McGraw-Hill Education (India) Pvt Limited. ISBN 0070648115, 9780070648111

- **Week 13:** AM and TV broadcast band and specification
- **Objectives**

At the end of the week, the students should be able to:

1. Understand and discuss AM and TV broadcast band and specification.
2. Discuss TV signal format.
3. Understand and discuss transmitter and receiver block diagrams of black and white TV and colour TV.

Description

First hour: AM and TV broadcast band and specification. TV signal format

Second hour: transmitter and receiver block diagrams of black and white TV.

Third hour: transmitter and receiver block diagrams of Colour TV Discussion and Questions.

9. **Study Question:**

1. In sufficient detail, discuss AM and TV broadcast band specifications.
2. What is scanning?
3. With the aid appropriate diagrams, Illustrate the principle of scanning in a television.
4. Draw and label the block diagram of a black and white Television.
5. Draw and label the block diagram of a colour television.
6. What are the communication principles that are applied in television broadcasting?
7. In a tabular form differentiate between Mono and stereo frequency?
8. In sufficient details, discuss the TV signal format.

Reading List - Books and materials students can read. Illustration below:

1. Anokh. Singh and A. K. Chhabra. Principles of Communication.
2. Rodger E. Ziemer and William H. Tranter. Communications Principles: Systems, Modulation and Noise by.
3. Dr. J.S Chitode (2009) Principles of Communication by, Technical Publications,. ISBN8184316615, 9788184316612
4. Taub Principles of Communication Systems, (2008), McGraw-Hill Education (India) Pvt Limited. ISBN 0070648115, 9780070648111

- **Week 14**

Topic: Revision

Objectives: To briefly review all topics covered in the course

- **Week 15**

Topic: Examination

Objectives:

To examine the students on all that has been taught during the semester.

Reading List:

1. Anokh. Singh and A. K. Chhabra. Principles of Communication.
2. Rodger E. Ziemer and William H. Tranter. Communications Principles: Systems, Modulation and Noise by.
3. Dr. J.S Chitode (2009) Principles of Communication by, Technical Publications,. ISBN8184316615, 9788184316612
4. Taub Principles of Communication Systems, (2008), McGraw-Hill Education (India) Pvt Limited. ISBN 0070648115, 9780070648111