Department of Electrical, Electronics and Computer Engineering
Kathmandu Engineering College
Electronic Circuit-II (3EA, 3EB & 3EC)

Assignment No.:1   Instructor: Ajay Kumar Kadel
Issued Date: Due Date:

Group A (Descriptive Questions)

1. Define modulation. Explain the need for modulation.
2. Distinguish between baseband and carrier communications.
3. What are the advantages of AM over FM?
4. What are the advantages of FM over AM?
5. Distinguish between analog and digital modulation.
6. What do you understand by demodulation? What are the requirements for a detector circuit? Describe envelope diode detector with the necessary waveforms.
7. Draw and describe the amplitude modulation circuit using BJT and FET amplifier.
8. Write short notes of Phase Locked Loop.
9. What are the drawbacks of Tuned radio frequency receiver?
10. Draw and explain the circuit diagram of frequency modulation.
11. Describe the operation of balanced phase discriminator method of FM demodulation.
12. Describe the operation of ratio detector method of FM demodulation.
13. Distinguish between low level and high level AM modulations with the necessary block diagrams.
14. Draw the block diagram of superheterodyne receiver and describe its working principle.
15. Why the quality of sound in AM is poor as compared to FM?
16. Why is over modulation avoided in Amplitude modulation?
17. Define a discriminator.

Group B (Numerical Questions)

1. An audio signal 15 sin(3000 πt) amplitude modulates a carrier 60sin(200000 πt).
   a. Construct all the signals
   b. Determine the modulation index.
   c. What are the frequencies of audio signal and the carrier?
   d. What frequencies would show up in the spectrum analysis of the modulated wave?

2. A sinusoidal modulating signal, m(t)=4 cos 2π (4 × 10^3) t, is applied to an FM modulator that has a frequency sensitivity of 10 kHz/V. Compute the peak frequency deviation, modulation index, frequency swing and Carson's bandwidth?

3. An AM wave is represented by U_{AM} (t) = 15(1+ 0.7 cos9424t)cos 4976282t volts. Find
   a. Amplitude of all frequency components,
   b. Modulation index
   c. Maximum and minimum amplitude of AM
   d. Frequency of USB and LSB
   e. Efficiency
   f. Show frequency spectrum

4. A certain transmitter radiates 10KW of power with the carrier unmodulated and 11.8 KW with the carrier sinusoidally modulated.
   a. Find the modulation factor.
   b. If another wave is modulated to 40% is also transmitted, calculate the radiated power.

5. If a 1MHz carrier is modulated by audio signals varying between 500 to 5000Hz. What is the
   (i) Frequency span of the side bands
   (ii) Maximum upper side frequency
   (iii) Minimum lower side frequency
   (iv) The width of the channel

6. A tuned circuit oscillator in an A.M transmitter uses 40μH coil and 1nf capacitor. If the carrier wave produced by the oscillator is modulated by audio of frequencies up to 10 KHz, calculate the frequency band occupied by sideband and channel width. Also find the carrier frequency.

7. Determine the percentage modulation of an FM signal with a frequency deviation of 15 KHz when it is being broadcasted for general reception in commercial FM broadcast band. What would be the percentage modulation if this FM signal were broadcast as the audio information of a commercial TV (NTSC) system? *(Hint: In an NTSC TV broadcasting system, the maximum allowed deviation is 50 kHz)*

8. An audio signal of 1000 Hz frequency modulates a carrier of 100 MHz. The frequency deviation is 10 KHz.
   a. Calculate the modulation index
   b. What would be the modulation index if the amplitude is doubled and frequency is halved?

9. Determine the maximum sideband power if the carrier output is 1KW and calculate the total maximum transmitted power. *(Hint: Modulation index greater than 1 is always avoided in AM systems so maximum sideband power occurs when m=1)*

10. The antenna current of an AM transmitter is 12A when unmodulated but increases to 13 A when modulated. Calculate the percentage modulation.

11. An intelligence signal is amplified by a 70 % efficient amplifier before being combined with a 10 KW carrier to generate the AM signal. If it is desired to operate at 100% modulation, what is the dc input power to the final intelligence amplifier?

12. If a 1500 KHz radio wave is modulated by a 2 KHz sine-wave tone, what frequencies are contained in the amplitude modulated wave?

13. An FM signal, $2000 \sin(2\pi \times 10^8 t + 2 \sin \pi \times 10^4 t)$ is applied to a 50 Ω antenna. Determine
    a. The carrier frequency
    b. The transmitted power
    c. Modulation index
    d. Instantaneous frequency (f_i)
    e. Carson's Bandwidth

Group C (Additional Questions)

- Determine the transmitter output power of the following FM stations by referring to the website of Ministry of Information and Communication.
Kantipur F.M, Image F.M., Kantiput F.M. Bhedetar, Pokhara F.M.
- Read the *Radio Act 2014* of Nepal and explain how a radio machine is defined in the act.