

[4]

- Q.4 i. Explain three fundamental characteristics of a receiver. **3**
 ii. Explain each block of Superheterodyne receiver for the reception of AM signal with neat and clean block diagram. What is the advantage of utilizing intermediate frequency? **7**
 OR iii. Explain pre-emphasis and de-emphasis with proper circuit diagram. Why it is necessary in FM communication system? **7**
- Q.5 i. Write three differences between energy signal and power signal. **3**
 ii. What is internal noise? Explain any five types of internal noise. **7**
 OR iii. Derive the expression of Figure of Merit for DSB-SC system with a neat and clean block diagram and proper explanation. **7**
- Q.6 Attempt any two:
 i. State and prove the sampling theorem with all the required waveforms. **5**
 ii. Derive an expression for rectangular pulse sampling with proper circuit diagram, waveforms and proper explanation. **5**
 iii. Explain the demodulation of Pulse Position Modulated signal with neat and clean block diagram. What are the pros and cons of PPM technique? **5**

Total No. of Questions: 6

Total No. of Printed Pages:4

Enrollment No.....



Faculty of Engineering
 End Sem (Even) Examination May-2019
 EC3CO04 Analog Communication

Programme: B.Tech.

Branch/Specialisation: EC

Duration: 3 Hrs.

Maximum Marks: 60

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

- Q.1 i. Amplitude Modulated wave is _____ **1**
 (a) Sum of carrier and modulating wave
 (b) Product of carrier and modulating wave
 (c) Difference of carrier and modulating wave
 (d) Sum of carrier and its product with modulating wave
- ii. For 100% modulation in AM system, power in each sideband is _____ of that of carrier? **1**
 (a) 25% (b) 50% (c) 75% (d) 100%
- iii. A sinusoidal 400Hz modulating signal of 2V amplitude, frequency modulates a carrier and produces 70 kHz frequency deviation. The frequency sensitivity is given by **1**
 (a) 140 kHz per volt (b) 800 Hz per volt
 (c) 200 Hz per volt (d) 35 kHz per volt
- iv. The image frequency rejection is a task of _____ **1**
 (a) IF amplifier and filter stage
 (b) Antenna stage
 (c) RF amplifier and filter stage
 (d) Mixer stage
- v. In Armstrong FM transmitter the mixer is used to _____ **1**
 (a) Match desired carrier frequency
 (b) Increase SNR
 (c) Reduce bandwidth
 (d) Generate DCB-SC signal

P.T.O.

[2]

- vi. The intermediate frequency of a superheterodyne receiver is 500 kHz. What is the image frequency at carrier frequency 1200 kHz? **1**
 (a) 600 kHz (b) 500 kHz (c) 200 kHz (d) 700 kHz
- vii. Which one of the following statement is false? **1**
 (a) High Frequency mixers are generally noisier
 (b) Voltage of impulse noise is independent of bandwidth
 (c) Thermal noise is not dependent on frequency
 (d) Flicker noise occurs at low frequency
- viii. Which one of the following is not a useful quantity for comparing the noise performance of receivers? **1**
 (a) Input noise voltage (b) Signal to Noise Ratio
 (c) Noise Figure (d) Figure of merit
- ix. Calculate the Nyquist rate for sampling when a continuous time signal is given by: **1**
 $x(t) = 5 \cos 400\pi t + 10 \cos 450\pi t - 15 \cos 500\pi t$
 (a) 450 Hz (b) 500 Hz (c) 1000 Hz (d) 250 Hz
- x. In pulse width modulation, **1**
 (a) Synchronization is not required between transmitter and receiver
 (b) Amplitude of the carrier pulse is varied
 (c) Instantaneous power at the transmitter is constant
 (d) Bandwidth requirement is low compared to PAM

- Q.2 i. What are the four fundamental needs of modulation? Explain with an example of each. **4**
- ii. A carrier signal of 1.0 Volt amplitude and a sinusoidal modulating signal of 0.5 Volt are applied to a square law modulator of characteristics, **6**
 $i_0 = 10 + k_1 V_i + k_2 V_i^2 \text{ mA}$
 Where V_i is input voltage in Volts, $k_1 = 2 \text{ mA/V}$ and $k_2 = 0.2 \text{ mA/V}^2$. Considering only the frequency components of the AM signal corresponding to the carrier frequency, find the depth of modulation in the resulting AM signal.

[3]

- OR iii. An amplitude modulated wave is shown in Figure 1. **6**
 (a) Determine modulation index
 (b) Compute the efficiency
 (c) Also, find the amplitude of the carrier which must be added to attain a modulation index of 0.1.

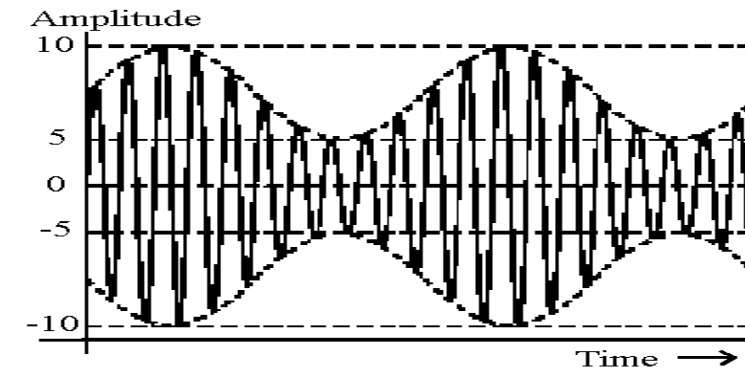


Figure : 1

- Q.3 i. Write proper definition of capture effect of a FM receiver. **2**
- ii. Explain each block of Armstrong FM transmitter with its proper block diagram. An Armstrong FM modulator is required in order to transmit an audio signal of bandwidth 50 Hz to 15 kHz. The narrowband phase modulator used for this purpose utilise a crystal controlled oscillator to provide a carrier frequency $f_{c1} = 200 \text{ kHz}$. The output of the NBPM is multiplied by n_1 by a multiplier and passed to a mixer with a local oscillator frequency $f_{c2} = 9.28 \text{ MHz}$. The desired FM wave at the transmitter output has a carrier frequency $f_c = 108 \text{ MHz}$, and a frequency deviation $\Delta f = 75 \text{ kHz}$, which is obtained by multiplying the mixer output frequency with n_2 using another multiplier. Find the values of n_1 and n_2 with proper explanation. Assume that NBFM produces deviation of 10 Hz for the lowest baseband signal. **8**
- OR iii. Explain the working principle of Foster-Seeley (Centre-Tuned) discriminator with proper circuit diagram, phasor diagram and discriminator characteristics. Also discuss its disadvantages. **8**

P.T.O.

Marking Scheme
EC3CO04 Analog Communication

| | | | |
|-----|-------|--|-----------|
| Q.1 | i. | Amplitude Modulated wave is _____ | 1 |
| | (d) | Sum of carrier and its product with modulating wave | |
| | ii. | For 100% modulation in AM system, power in each sideband is _____ of that of carrier? | 1 |
| | (a) | 25% | |
| | iii. | A sinusoidal 400Hz modulating signal of 2V amplitude, frequency modulates a carrier and produces 70 kHz frequency deviation. The frequency sensitivity is given by | 1 |
| | (d) | 35 kHz per volt | |
| | iv. | The image frequency rejection is a task of | 1 |
| | (c) | RF amplifier and filter stage | |
| | v. | In Armstrong FM transmitter the mixer is used to | 1 |
| | (a) | Match desired carrier frequency | |
| | vi. | The intermediate frequency of a superheterodyne receiver is 500 kHz. What is the image frequency at carrier frequency 1200 kHz? | 1 |
| | (c) | 200 kHz | |
| | vii. | Which one of the following statement is false? | 1 |
| | (b) | Voltage of impulse noise is independent of bandwidth | |
| | viii. | Which one of the following is not a useful quantity for comparing the noise performance of receivers? | 1 |
| | (a) | Input noise voltage | |
| | ix. | Calculate the Nyquist rate for sampling when a continuous time signal is given by: $x(t) = 5\cos 400\pi t + 10\cos 450\pi t - 15\cos 500\pi t$ | 1 |
| | (b) | 500 Hz | |
| | x. | In pulse width modulation, | 1 |
| | (a) | Synchronization is not required between transmitter and receiver | |
| Q.2 | i. | Four fundamental needs of modulation | 4 |
| | | 0.5 mark for each need (0.5 mark * 4) | 2 marks |
| | | 0.5 mark for each example (0.5 mark * 4) | 2 marks |
| | ii. | Find the depth of modulation in the resulting AM signal. | 6 |
| OR | | Up to final expression | 3 marks |
| | | If modulation index is found | + 3 marks |
| | iii. | An amplitude modulated wave is shown in Figure 1. | 6 |
| | (a) | Determine modulation index | 1.5 marks |
| | (b) | Compute the efficiency | 1.5 marks |

(c) Also, find the amplitude of the carrier which must be added to attain a modulation index of 0.1. 3 marks

| | | | |
|-----|------|--|--------------|
| Q.3 | i. | Definition of capture effect of a FM receiver. | 2 |
| | ii. | Block diagram | 2 marks |
| | | Explanation | 2 marks |
| | | Value of n ₁ and n ₂ with proper explanation | 4 marks |
| OR | iii. | Working principle of Foster-Seeley (Centre-Tuned) discriminator | 8 |
| | | Block diagram | 2 marks |
| | | Phasor diagram | 2 marks |
| | | Discriminator characteristics | 1 mark |
| | | Disadvantages. | 2 marks |
| Q.4 | i. | Three fundamental characteristics of a receiver. | 3 |
| | | 1 mark for each | (1 mark * 3) |
| | ii. | Proper block diagram | 2 marks |
| | | Complete explanation | 3 marks |
| OR | | Utilization of IF | 2 marks |
| | iii. | Explain pre-emphasis and de-emphasis with proper circuit diagram. | 7 |
| | | For circuit diagram with explanation | 4 marks |
| | | Answer for necessity | 3 marks |
| Q.5 | i. | Three differences b/w energy signal and power signal. | 3 |
| | | 1 mark for each difference | (1 mark * 3) |
| | ii. | Definition internal noise | 2 marks |
| | | Any five types of internal noise | 5 marks |
| OR | iii. | Expression of Figure of Merit for DSB-SC system | 7 |
| | | 1 mark for each type (1 mark * 5) | |
| | | For block diagram | 2 marks |
| | | For calculation of input signal power | 1 mark |
| | | For calculation of output signal power | 1 mark |
| | | For calculation of input noise power | 1 mark |
| | | For calculation of output signal power | 1 mark |
| Q.6 | | For correct final FOM expression | 1 mark |
| | i. | Attempt any two: | |
| | | Statement | 1 mark |
| | | For proof with all waveforms | 4 marks |

| | | | |
|------|---|---------|----------|
| ii. | Rectangular pulse sampling | | 5 |
| | Circuit diagram | 1 mark | |
| | Waveforms | 1 mark | |
| | Derivation with proper explanation. | 3 marks | |
| iii. | Demodulation of Pulse Position Modulated signal | | 5 |
| | Block diagram | 1 mark | |
| | Explanation | 2 marks | |
| | Pros and cons of PPM technique | 2 marks | |
