

II B. Tech II Semester Regular/Supplementary Examinations, April/May-2017**ANALOG COMMUNICATIONS**

(Electronics and communication Engineering)

Time: 3 hours

Max. Marks: 70

- Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
 2. Answer **ALL** the question in **Part-A**
 3. Answer any **THREE** Questions from **Part-B**
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PART -A

1. a) With necessary equation, define transmission efficiency of an AM wave? (4M)
- b) What is Quadrature null effect? Explain (3M)
- c) For an angle modulated signal $s(t)=10\cos(2\pi 10^6 t + 5\sin 8\pi 10^3 t)$, determine the Frequency deviation and power? (4M)
- d) Why pre-emphasis and de-emphasis are needed in F.M but not in A.M? Explain. (4M)
- e) A super heterodyne receiver having R.F amplifier is tuned to 555kHz .The local oscillator is adjusted to 1010kHz. Then calculate the I.F and image frequency. (4M)
- f) Why noise immunity of PWM is better than that of PAM? (3M)

PART -B

2. a) Derive the equation and power relation of a single tone modulation of AM system. (8M)
- b) The antenna current of an AM transmitter is 9A when only carrier is transmitted but it increases to 10.6A when the carrier is modulated by a single sine wave. Find the percentage of modulation? Determine the antenna current when the percentage of modulation changes to 0.8? (8M)
3. a) Explain the principle of V.S.B Transmission. What are its advantages over S.S.B? (8M)
- b) With a neat block diagram, explain the operation of phase discrimination method. (8M)
4. a) With necessary equations. Explain the generation of N.B.F.M using narrow band P.M generator. (8M)
- b) Explain the comparisons between FM and A.M techniques. (8M)
5. a) What is noise? Explain the difference between thermal noise and shot noise. (6M)
- b) Explain about noise effect in DSB-SC and obtain necessary expression for figure of merit (10M)
6. a) What is the need for amplitude limiter in FM Receiver? Explain in detail. (8M)
- b) What are the salient features of broadcast radio receivers? Explain in detail. (8M)
7. a) For a PAM transmission of voice signal having maximum frequency equal to $f_m=3\text{KHz}$ calculate the transmission bandwidth. It is given that the sampling frequency $f_s=8\text{KHz}$ and the pulse duration $\tau=0.1 T_s$. (8M)
- b) Explain the generation of PAM with neat block diagram. (8M)



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PART -A

1. a) What is an over modulation in an AM and what is its effect on AM signal. (4M)
- b) Draw the block diagram for the detection of SSB-SC signal using phase discrimination method. (4M)
- c) An unmodulated carrier frequency is given by 1MHz. After frequency modulation, maximum frequency is given by 1.4 MHz. Then find Δf and f_{\min} . (4M)
- d) Write short notes on (i) shot noise (ii) Thermal noise (4M)
- e) Define the term fidelity? (3M)
- f) Draw the waveforms of PPM and PWM signals for a sinusoidal modulating signal. (3M)

PART -B

2. a) With a neat block diagram, explain the operation of Frequency division multiplexing technique. (8M)
- b) Explain about diagonal clipping in a diode detector. How it can be eliminated? (8M)
3. a) A carrier signal $c(t)=20\cos 2\pi 10^6 t$ is modulated by a message $m(t)= 5\cos 8\pi 10^3 t$ to generate DSB-SC signal. Sketch the spectrum and calculate band width, power, and modulation efficiency. (8M)
- b) Explain the applications of various A.M Systems. (8M)
4. a) Briefly explain about the spectra of NBFM and WBFM. (8M)
- b) Explain the demodulation of F.M signal with the help of PLL. (8M)
5. a) Derive the expression to find the figure of merit of a DSB-SC System. (8M)
- b) What is FM threshold effect? How threshold reduction is achieved in FM receiver? (8M)
6. a) Explain the function of Mixer stage in FM Receiver. (8M)
- b) What are the main functions served by an I.F amplifier? Explain in detail. (8M)
7. a) Explain the process of generation of PWM with neat diagrams. (8M)
- b) Write short notes on transmission bandwidth of PAM. (8M)



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PART -A

1. a) Why an AM signal is get severely affected due to noise. (3M)
- b) Explain the applications of A.M ,DSB-SC,SSB-SC. (3M)
- c) Compare F.M and A.M. (4M)
- d) Explain the necessity of pre-emphasis? (4M)
- e) Explain the image frequency rejection of a radio receiver. (4M)
- f) Compare continuous wave and pulse modulation techniques. (4M)

PART -B

2. a) A carrier signal $c(t)=20\cos 2\pi 10^6 t$ is modulated by a message signal having three frequencies 5kHz,10 kHz and 20 kHz. The corresponding modulation indices are 0.4,0.5 and 0.6. Sketch the spectrum and calculate bandwidth, power and modulation efficiency. (8M)
- b) Explain the benefits of suppressed carrier AM systems. (8M)
3. a) Derive the equation for SSB-SC signal for an modulating sinusoidal input $m(t)=A_m \cos(w_m t)$. (8M)
- b) Compare AM, D.S.B-SC, S.S.B-SC and V.S.B transmission. (8M)
4. a) Define angle modulation? Explain different types of angle modulations with mathematical expressions. (8M)
- b) A Sinusoidal carrier of 20V, 2 MHz is frequency modulated by sinusoidal message signal of 10V, 50 kHz and $K_f=55$ kHz/V. Find Δf , β , band width and power. (8M)
5. a) Explain about the noise performance of an FM receiver. (8M)
- b) Derive the expression for the figure of merit of an SSB-SC System. (8M)
6. a) With neat block diagram, explain the operation of super heterodyne F.M. receiver. (8M)
- b) In a broad cast Super Heterodyne Receiver having no RF amplifier is tuned to 555kHz. The local oscillator frequency is adjusted to 1010kHz and the quality factor is 50. Calculate the intermediate frequency, image frequency and image rejection ratio. (8M)
7. a) Define Pulse Amplitude Modulation (PAM)? Give merits and demerits of PAM. (8M)
- b) With neat block diagram and waveforms, explain the generation of a PWM signal (8M)



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PART -A

1. a) A 400W carrier is modulated to a depth of 75%. Calculate the total power in the modulated wave. (4M)
- b) Explain the method of frequency translation? (3M)
- c) Draw the phasor diagram of narrow band FM (4M)
- d) Define SNR and Figure of merit of a communication system? (4M)
- e) What is image frequency and how it can be rejected? (3M)
- f) Explain the single polarity and double polarity PAM. (4M)

PART -B

2. a) What is the principle of Amplitude modulation? Derive expression for the AM wave and draw its spectrum (8M)
- b) An audio frequency signal $10\sin(1000\pi t)$ is used to amplitude modulate a carrier of $50\sin(5\pi 10^5 t)$. Calculate (i) Modulation index (ii) Side band frequencies (iii) BW required and (iv) Total power delivered to the load of 600Ω (8M)
3. a) Draw the circuit diagram of Ring modulator. Explain its operation including all the waveforms. (8M)
- b) With neat diagrams, explain about the VSB modulation system and also explain its applications. (8M)
4. a) Explain how a PLL can be used as an FM demodulator. (8M)
- b) In angle modulation, explain frequency deviation, percent modulation, phase deviation and modulation index. (8M)
5. a) Why pre-emphasis and de-emphasis are needed in F.M but not in A.M? Explain. (8M)
- b) Explain about noise effect in AM and obtain expression for figure of merit. (8M)
6. a) How F.M Receivers are different from A.M receivers? Explain in detail. (8M)
- b) Define the terms sensitivity, selectivity and fidelity of a radio receiver. (8M)
7. a) Compare PAM, PWM and PPM systems. (8M)
- b) For a PAM transmission of voice signal having maximum frequency equal to $f_m=3\text{KHz}$ calculate the transmission bandwidth. It is given that the sampling frequency $f_s=8\text{KHz}$ and the pulse duration $\tau=0.1 T_s$. (8M)



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**PART –A**

1. a) Define modulation. Why is modulation required? (3M)
- b) What are the Advantages of SSB systems? List Application of SSB? (4M)
- c) Define frequency deviation? What is wideband FM and Narrowband FM? (4M)
- d) Define (i) Average noise figure. (ii) Average Noise Temperature (4M)
- e) Define Sensitivity and Selectivity. (3M)
- f) Compare Continuous wave and pulse modulation technique. (4M)

**PART –B**

2. a) With necessary expressions, waveforms and spectrums, Explain AM for an arbitrary baseband signal  $m(t)$ . (10M)
- b) The output power of an AM transmitter is 1KW when sinusoidally modulated to a depth of 100%. Calculate the power in each side band when the modulation depth is reduced to 50%. (6M)
3. a) Derive the expression for SSB containing upper sideband in time domain. (10M)
- b) Explain the phase discrimination method for generating SSB. (6M)
4. a) Explain clearly about pre-emphasis and de-emphasis in FM wave. (8M)
- b) Explain different modes in a phase locked loop. (8M)
5. a) Define the following along the related equations (10M)
  - (i) noise equivalent bandwidth (ii) narrow band noise
  - (iii) ideal band pass filtered noise.
- b) A mixer has a noise figure of 30db. It is preceded by an amplifier which has a noise figure of 10db and an available power gain of 12db. Calculate the overall noise figure with referred to the input. (6M)
6. a) Derive the expression for the figure of merit of DSBSC receiver that uses coherent detection. (10M)
- b) Write a short notes on amplitude limiting. (6M)
7. Mention and explain different methods for generation of PWM (16M)



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PART -A

1. a) Define modulation index and mention the range of modulation index? (4M)
- b) Write the expression for SSB and VSB Waves. (4M)
- c) Compare AM and FM? (3M)
- d) Define White noise and Shot noise. (4M)
- e) State Sampling Theorem with suitable figure. (4M)
- f) Write Merits and Demerits of PAM. (3M)

PART -B

2. a) Define a standard form of amplitude modulation and explain the time and frequency domain expression of an AM wave. (8M)
- b) Explain with the help of a neat sketch, how a square law modulator is used to generate an AM. (8M)
3. a) With a neat diagram explain the balanced modulator method of generating DSBSC (8M)
- b) With block diagram and relevant equations explain the coherent detection of a DSB-SC wave. What is its disadvantage? Explain the synchronous receiving system. (8M)
4. a) Derive an expression for the spectrum of FM wave with sinusoidal modulation (10M)
- b) Compare narrow band and wide band FM (6M)
5. Explain the terms (16M)
 - (a) shot noise
 - (b) thermal noise
 - (c) white noise
 - (d) noise figure and
 - (e) transit time noise.
6. a) Why are limiters and pre-emphasis filters used in FM radio. (10M)
- b) Write a notes on vestigial sideband modulation (6M)
7. a) With neat sketch explain the generation of PPM from PWM. (10M)
- b) Compare merits and demerits of TDM and FDM. (6M)



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**PART -A**

1. a) Compare Square law detector with envelope detector? (4M)
- b) Compare different AM systems? (3M)
- c) What are Advantages & Applications of FM? (4M)
- d) List out various noise sources. (4M)
- e) Write Merits and Demerits of PAM. (3M)
- f) List the Classification of receivers. (4M)

**PART -B**

2. a) Explain the generation technique of an AM wave using the square law modulator. (8M)
- b) Explain the working of an envelope detector (8M)
3. a) Draw the circuit diagram for balanced ring modulator and explain its operation indicating all the waveforms and spectrums. (10M)
- b) In an DSB-SC system, modulating signal is a single tone sinusoid  $6 \cos(2\pi 10^3 t)$  (6M) which modulates a carrier signal  $8 \cos(2\pi 10^6 t)$ . Write the equation of modulated wave. Plot the two sided spectrum of the modulated wave. Calculate the amount of power transmitted.
4. a) Derive an expression for the spectrum of FM wave with sinusoidal modulation. (8M)
- b) With a neat block diagram explain the Armstrong method of FM generation. (8M)
5. a) Explain the Threshold effect in angle modulation system. (8M)
- b) Explain the noise performance in DSB-SC system and obtain necessary expression for figure of merit (8M)
6. a) With the aid of the block diagram explain TRF receiver. Also explain the basic superheterodyne principle. (10M)
- b) List out the advantages and disadvantages of TRF receiver. (6M)
7. a) Describe the synchronization procedure for PAM, PWM and PPM signals. (8M)
- b) Discuss about the spectra of PWM and PPM signals. (8M)



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PART -A

1. a) Why frequency translation is required? (3M)
- b) List Application of different AM systems? (4M)
- c) Plot FM wave taking modulating wave $m(t)$ as (i) Sine wave (ii) Square wave (4M)
- d) Define figure of merit? (3M)
- e) Define Image frequency and Image frequency rejection ratio. (4M)
- f) Compare PAM,PPM and PWM. (4M)

PART -B

2. a) Draw and explain switching modulator along with the related transfer characteristics and equation (8M)
- b) The efficiency of an AM wave is defined by $\eta = (P_s/P_t) \times 100$. Find the efficiency for $\mu = 0.5$. (8M)
3. a) What are DSBSC generation methods? Explain the generation of DSBSC using Ring modulator. (10M)
- b) Explain the phase discrimination method for generating SSB. (6M)
4. a) Explain the operation of the balanced slope detector using a circuit diagram and draw its response characteristics. Discuss in particular the method of combining the outputs of the individual diodes. In what way is this circuit, an improvement on the slope detector and in turn what are the advantages? (10M)
- b) Compute the bandwidth requirement for the transmission of FM signal having a frequency deviation 75 KHz and an audio bandwidth of 10KHz. (6M)
5. a) Define noise figure and explain its significance with derivation. (6M)
- b) What is significance of Pre-emphasis and De-emphasis explain with neat sketch. (10M)
6. a) With the aid of the block diagram explain TRF receiver. Also explain the basic superheterodyne principle. (10M)
- b) List out the advantages and disadvantages of TRF receiver. (6M)
7. a) With a block diagram approach explain the operation of FDM scheme. (10M)
- b) Compare PAM, PWM and PPM systems. (6M)



II B. Tech II Semester Supplementary Examinations, Nov/Dec-2016
ANALOG COMMUNICATIONS
 (Electronics and communication Engineering)

Time: 3 hours

Max. Marks: 70

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 2. Answer **ALL** the questions in **Part-A**
 3. Answer any **THREE** Questions from **Part-B**

PART -A

1. a) What is the need for modulation? Explain the main advantages of modulation? (4M)
- b) State the applications of different AM Systems. (4M)
- c) Write down the expressions for WBFM, NBFM and PM? (3M)
- d) Define Detection gain and write down the expression for it. (4M)
- e) List out the drawbacks of pulse amplitude modulated signal? (4M)
- f) Classify radio transmitters based on the type of modulation and Service involved. (3M)

PART -B

2. a) Draw the Envelope detector and illustrate the process of detection of AM wave? (8M)
- b) An amplitude modulated signal represented in time domain as $4\cos(1800\pi t) + 10\cos(2000\pi t) + 4\cos(2200\pi t)$. Sketch the spectrum and calculate the band width and total power? (8M)
3. a) What is DSB-SC modulator? Explain how the ring modulator for generation of DSB-SC wave act as a demodulator? (8M)
- b) A DSB signal is to be generated with a carrier frequency of 1MHz using a non-linear device with input and output characteristics $v_0 = a v_i + b v_i^3$. The output of the non-linear device can be filtered by an appropriate BPF and $v_i = m(t) + \cos(2\pi f_1 t)$. Find the value of f_1 . (8M)
4. a) What is the difference between direct and indirect methods of FM generation? Explain the working of a balanced frequency discriminator with the help of circuit diagram. (8M)
- b) An FM signal is represented in time domain as $s(t) = 10 \cos(2\pi \cdot 10^6 t + 5 \sin 8\pi \cdot 10^3 t)$. Calculate the frequency deviation, modulation index, power and band width. (8M)
5. a) What is FM threshold effect? How to achieve threshold reduction in FM system? (8M)
- b) Discuss the noise performance of AM system using envelop detection? (8M)
6. a) Explain the methods for demodulation of PAM signals? (8M)
- b) Write the comparisons among PAM, PWM and PPM? (8M)
7. a) With the aid of the block diagram explain TRF receiver. Also explain the basic super heterodyne principle. (8M)
- b) List out the advantages and disadvantages of TRF receiver. (8M)



II B. Tech II Semester Regular Examinations, May/June - 2015
ANALOG COMMUNICATIONS
(Electronics and communication Engineering)

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2. Answer **ALL** the question in **Part-A**
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PART-A

1. a) Explain the need of modulation in communication system?
b) Describe VSB modulation and give its applications?
c) Define the following terms?
 i) Carrier swing ii) Frequency Deviation iii) Percent Modulation
d) What is threshold effect in an envelope detector? Explain?
e) Write the main requirements of AM broadcast transmitters?
f) Discuss the types of pulse Modulation. (3M+3M+4M+4M+4M+4M)

PART-B

2. a) Describe an expression for AM wave and sketch its frequency spectrum.
b) Explain the square law detection of AM signals.
3. a) Prove that the balanced modulator produces an output consisting of sidebands only with the carrier removed.
b) Explain the principle of coherent detector of DSB-SC modulated more with a neat block diagram.
4. a) For an FM modulator with a modulating signal $m(t) = V_m \sin 300\omega t$, the carrier Signal $V_c(t) = 8 \sin(6.5 \times 10^6)t$ and the modulator index $\beta = 2$. Find out the significant side frequencies and their amplitudes.
b) Explain the difference between Narrow band FM and Wide band FM.
5. a) Calculate the figure of merit for a DSB-SC system.
b) Prove that narrowband FM offers no improvement in SNR over AM.
6. a) Draw the block diagram of superhetrodyne receiver and the function of each block.
b) Discuss the factors influencing the choice of intermediate frequency (IF) for a radio Receiver.
7. Write short notes on the following
 - i) Double polarity PAM
 - ii) Demodulation of PWM



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PART-A

1. a) Explain the need for modulator.
 b) Compare the DSB and SSB systems.
 c) Explain the terms of Narrow band FM and wide band FM
 d) Explain, how noise can be calculated in a communication system.
 e) What is the significance of Harmonic generator in transmitters?
 f) Write short notes on “ Time division multiplexing”. (3M+3M+4M+4M+4M+4M)

PART-B

2. a) Explain the generation of AM wave using square law modulator.
 b) A tone modulated AM-signal with a modulation index of “m” and base band signal Frequency of ω_m is detected using envelope detector, whose time constant is RC, for Effective demodulation, show that $(1/RC) \geq [m \omega_m / (\sqrt{1-m^2})]$.
3. a) Explain the concept of frequency translation using the spectrum of DSB-SC wave.
 b) In an AM-SC system, modulating signal is a single tone sinusoidal signal $4\cos 2\pi 10^3 t$, which Modulates carrier signal $6\cos 2\pi 10^6 t$. Write the equation of the modulated wave. Plot the two Sided spectrum of the modulated wave. Calculate the amount of power transmitted.
4. a) Give the phasor comparison of narrowband FM and AM waves for sinusoidal modulation.
 b) Compute the bandwidth requirement for the transmission of FM signal having a frequency Deviation of 75 kHz and an audio bandwidth of 10kHz. What will be the change in the Bandwidth, if modulating frequency is doubled? Determine the bandwidth when modulating Signal amplitude is also doubled.
5. a) Explain about pre-emphasis and de-emphasis.
 b) Explain the noise performance of SSB-SC receiver and prove its S/N ratio is unity.
6. a) List out the advantages and disadvantages of TRF receivers.
 b) What is an image frequency? How is image frequency rejection achieved?
7. a) Explain, how a PPM signal can be generated from PWM signal?
 b) Explain the generating and demodulation of PPM.



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PART-A

1. a) Derive P_t in Amplitude modulation.
 b) Discuss Quadrature null effect of DSB-SC and SSB-SC.
 c) Write short notes on Pre-emphasis and de-emphasis.
 d) Define noise figure, noise equivalent temperature.
 e) define sensitivity, selectivity, fidelity.
 f) Distinguish between TDM and FDM. (3M+3M+4M+4M+4M+4M)

PART-B

2. a) What is modulation? Why is modulation used in communication system?
 b) What do you understand of modulation index? What is its significance?
3. a) With a neat block diagram explain the demodulation process of DSB-SC signal.
 b) Prove that the balanced modulator produces an output consisting of sidebands only with the carrier removed.
4. a) An angle modulated signal has the form $v(t) = 100\cos[2\pi f_c t + 4 \sin 2000\pi t]$ where $f_c = 5\text{MHz}$
 i) Determine the average transmitted power ii) Determine the peak phase deviation
 iii) Determine the peak frequency deviation iv) Is this FM or a PM signal? Explain
 b) Explain the detection of FM wave using balanced frequency discrimination.
5. a) Prove that the figure of merit for SSB-SC is 1.
 b) Discuss the threshold effect for AM with envelope detector.
6. a) Mention the advantages of superhetrodyne receiver over TRF receiver
 b) Distinguish between simple AGC and delayed AGC
 c) Draw the block Schematic for FM broad cast receiver and explain the function of each unit.
7. Write short notes on
 i) Single polarity PAM ii) Generation of PWM



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**PART-A**

1. a) Explain the need for modulator.  
b) Discuss Quadrature null effect of DSB-SC and SSB-SC  
c) Explain the terms of Narrow band FM and wide band FM  
d) What is threshold effect in an envelope detector? Explain?  
e) Write the main requirements of AM broadcast transmitters?  
f) Distinguish between PAM & PWM. (3M+3M+4M+4M+4M+4M)

**PART-B**

2. a) Describe an expression for AM wave and sketch its frequency spectrum.  
b) Explain the square law detection of AM signals.
3. a) Explain the generation of double side band suppressed carrier (DSB-SC) modulator. Write the necessary equations,  
b) Discuss the effect of frequency and phase error in demodulation of DSB-SC wave using synchronous detector.
4. a) Give the phasor comparison of narrowband FM and AM waves for sinusoidal modulation.  
b) Compute the bandwidth requirement for the transmission of FM signal having a frequency deviation of 75 kHz and an audio bandwidth of 10kHz. What will be the change in the bandwidth, if modulating frequency is doubled? Determine the bandwidth when modulating signal amplitude is also doubled.
5. a) Derive an expression for the S/N ratio for an FM System.  
b) Explain the difference between DSB & SSB system.
6. a) Draw the block diagram of superhetrodyne receiver and the function of each block.  
b) Discuss the factors influencing the choice of intermediate frequency (IF) for a radio receiver.
7. a) Explain the PPM generation from PWM with a neat block diagram and necessary figures.  
b) Draw the circuit of PPM demodulator and explain the operation.

