Code No: 07A4EC11 **R07** **Set No. 1**

II B.Tech II Semester Examinations,December 2010
ANALOG COMMUNICATIONS
Common to Electronics And Telematics, Electronics And Communication Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Define pulse amplitude modulation Draw the waveform, and explain the operation. [16]
2. Explain the principle of operation of Costa's loop? [16]
3. (a) Show that an AM signal can be recovered, irrespective of the value of percentage modulation by using synchronous detection technique?
   (b) What is the maximum modulating signal frequency that can be used with an AM (DSBFC) system with a 30kHz bandwidth? [8+8]
4. A channel has a uniform noise power density spectrum $S_n(\omega)$=0.5×10^{-3}. A DSB-SC signal with carrier frequency of 200kHz is transmitted over this channel. The modulating signal band limited to 10kHz.the power of the sideband signal is 5kW. The incoming signal at the receiver is filtered through an ideal band pass filter before it is fed to the demodulator.
   (a) What is the transfer function of this filter at the receiver.
   (b) Find the S/N ratio of demodulator input and output.
   (c) Find and sketch the noise power density spectrum at the demodulator output. [16]
5. (a) Show that a low pass filter can be used as a discriminator?
   (b) An FM radio link has a frequency deviation of 30kHz.The modulating frequency is 4kHz.calculate the bandwidth needed for the link. What will be the bandwidth if the deviation is reduced to 10 kHz? [8+8]
6. Draw the circuit and explain the generation of SSB-SC wave using the "third" method? [16]
7. What is three point tracking? How do tracking errors arise in the first place? What is the name given to the element that helps to achieve three point tracking? Where is it placed. [16]
8. Write short note on the following:
   (a) AM transmitters
   (b) Armstrong FM transmitters. [8+8]

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Code No: 07A4EC11 **R07** **Set No. 2**

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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. Explain about AM transmitter? Why feedback is used in the AM transmitter? And explain its uses? [16]
2. (a) A carrier $A\cos\varpi_c t$ is modulated by a signal $2\cos10^4.2\pi t + 5\cos10^3 2\pi t + 2\cos10^4.4\pi t$.find the bandwidth of the FM signal using Carson's rule.Assume K_f=12kHz/V. also find modulation index?
   (b) Draw the circuit for ratio detector and explain how it is derived from phase discriminator? [8+8]
3. (a) Describe the demodulation of AM wave using square law device?
   (b) Define modulation coefficient and percent modulation? [8+8]
4. An amplitude modulated amplifier provides an output of 106 watts at 100% modulation. The internal loss is 20Watt.
   (a) What is the un modulated carrier power.
   (b) What is the sideband power? [16]
5. (a) What, exactly does a noise limiter do in an AM receiver? How does it do this?
   (b) Describe the differences between FM and AM receivers, bearing in mind the different frequency ranges and bandwidths over which they operate? [8+8]
6. Derive the necessary equations to show the SNR improvement with pre emphasis circuit? [16]
7. How to obtain PWM from PPM. Explain the various components in the block diagram. [16]
8. Describe how single sideband suppressed carrier is used with frequency division multiplexing? [16]

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Code No: 07A4EC11 **R07** **Set No. 3**

II B.Tech II Semester Examinations,December 2010
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Common to Electronics And Telematics, Electronics And Communication Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. (a) Compare and contrast the performance of various types of frequency demodulators?
   (b) An angle modulated signal is given by $X_c(t) = 5\cos[2\pi(10^6)t + 0.2\cos 200\pi t]$. Can you identify whether $X_c(t)$ is a PM or an FM signal? [8+8]
2. With the aid of vector diagrams, explain what happens when a carrier is modulated by a single noise frequency? [16]
3. Describe the operation of a phase locked loop direct FM transmitters? [16]
4. Using circuit diagrams ,explain the operation of the self excited transistor mixer by the three frequency approach? [16]
5. (a) Show that if every frequency component of a signal f(t) is shifted by $\pi/2$, the resultant signal is the Hilbert transform of f(t)?
   (b) Draw the circuit and explain the generation of SSB-SC wave using phase shift method? [8+8]
6. (a) Sketch the envelope for a maximum positive envelope voltage of 12V and a minimum positive envelope amplitude of 4V,determine the modulation coefficient & percent modulation?
   (b) Describe the demodulation of AM wane using square law device? [8+8]
7. (a) What is single polarity and double polarity in PAM.
   (b) How is TDM different from FDM. [8+8]
8. The modulating signal f(t) in an DSB-SC system is multiple-tone signal given by $f(t)=E_1\cos\omega_1 t + E_2\cos\omega_2 t + E_3\cos\omega_3 t$. The signal f(t) modulates a carrier $E_c\cos\omega_c t$. Plot the single sided trigonometric spectrum and find the bandwidth of the modulated signal. Assume that $\omega_3 > \omega_2 > \omega_1$ and $E_3 > E_2 > E_1$. [16]

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Code No: 07A4EC11 **R07** **Set No. 4**

II B.Tech II Semester Examinations,December 2010
ANALOG COMMUNICATIONS
Common to Electronics And Telematics, Electronics And Communication Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. In an DSB-SC system the modulating signal is single tone sinusoid 10cos (2π 10t) which modulates a carrier signal 10 cos(2π 1000t).Plot the spectrum of the modulated wave? [16]

2. Discuss the generation & demodulation of PWM. [16]

3. (a) Define phase deviation and modulation index?
   (b) Compare the advantages and disadvantages of angle modulation with amplitude modulation? [8+8]

4. Describe the operation of direct FM transmitters? Describe two methods to up convert the frequency of angle modulated waves? [16]

5. A channel has a uniform noise power density spectrum $S_n(\omega)=0.5\times10^{-3}$. A SSB-SC signal with carrier frequency of 200kHz is transmitted over this channel. The modulating signal band limited to 10kHz.the power of the sideband signal is 5kW. The incoming signal at the receiver is filtered through an ideal band pass filter(upper side bands) before it is fed to the demodulator.
   (a) What is the transfer function of this filter at the receiver.
   (b) Find the S/N ratio of demodulator input and output.
   (c) Find and sketch the noise power density spectrum at the demodulator output. [16]

6. (a) Explain what double spotting is and how it arises.
   (b) Describe the general process of frequency changing in a super hetero dyne receiver. [16]

7. Compare the three methods of SSB generation by drawing a table with its outstanding characteristics? [16]

8. One input to an AM modulator is a 500kHz carrier with a peak amplitude of 32V.The second input is a 12-kHz modulating signal whose amplitude is sufficient to provide a 14-Vp change in the amplitude of the envelope. determine the following:
   (a) upper and lower side frequencies.
   (b) modulation coefficient, percent modulation?
   (c) maximum and minimum amplitudes of the envelope.

(d) draw the output envelope.
(e) draw the output frequency spectrum. [16]

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Code No: R05220405 **Set No. 1**

II B.Tech II Semester Regular Examinations, Apr/May 2008
ANALOG COMMUNICATIONS
(Common to Electronics & Communication Engineering and Electronics & Telematics)

Time: 3 hours Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) With necessary expressions, waveforms and spectrums, Explain AM for an arbitrary baseband signal m(t).
   (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%. [10+6]

2. (a) Draw the circuit diagram for balanced ring modulator and explain its operation indicating all the waveforms and spectrums.
   (b) In an AM-SC system, modulating signal is a single tone sinusoid 4 cos $2\Pi\ 10^3$t, which modulates a carrier signal 6 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. [8+8]

3. (a) Describe the time domain band-pass representation of SSB with necessary sketches.
   (b) Find the percentage of power saved in SSB when compared with AM system. [12+4]

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?
   (b) Compute the bandwidth requirement for the transmission of FM signal having a frequency deviation 75 KHz and an audio bandwidth of 10KHz. [12+4]

5. Explain how S/N ratio is a figure of merit incase of performance of a communication channel. [16]

6. (a) Draw the block diagram of an SSB - SC transmitter employing sideband suppression filter and explain.
   (b) Why are limiters and preemphasis filters used in FM radio. [16]

7. (a) With the aid of the block diagram explain TRF receiver. Also explain the basic superheterodyne principle.
   (b) List out the advantages and disadvantages of TRF receiver. [16]

8. (a) Describe the synchronization procedure for PAM, PWM and PPM signals.

Code No: R05220405 **Set No. 2**

II B.Tech II Semester Regular Examinations, Apr/May 2008
ANALOG COMMUNICATIONS
(Common to Electronics & Communication Engineering and Electronics & Telematics)

Time: 3 hours Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What are the main objectives of a communication system design? What are the primary resources of any communication system.
   (b) The RC load for a diode envelope detector consists of a 1000 pF capacitor in parallel with a 10-KΩ resistor. Calculate the maximum modulation depth that can be handled for sinusoidal modulation at a frequency of 10 KHz if diagonal peak clipping is to be avoided.
   (c) A broadcast AM transmitter radiates 50 KW of carrier power. What will be the radiated power at 85 % of modulation and what is the side band power? [6+6+4]

2. Considering the modulating and carrier waves as sinusoids, Explain the single tone modulation and demodulation of DSB-SC wave with necessary expressions, waveforms and spectrums and explain how only one side band is necessary for transmission of information. [16]

3. A synchronous detection of SSB signal shows phase and frequency discrepancy. Consider $S(t) = \sum_{i=1}^{N} \cos\left[(\omega_c t)\cos(\omega_i t + \Phi_i) - \sin(\omega_c t)\sin(\omega_i t + \Phi_i)\right]$ is an SSB signal. The signal is multiplied by the locally generated carrier $\cos\omega_c t$ and then passed through a low-pass filter.
   (a) Prove that the modulating signal can be completely recovered if the cut-off frequency of the filter is $f_N < f_o < 2f_c$.
   (b) Determine the recovered signal when the multiplying signal is $\cos[\omega_c + \Phi]$.
   (c) Determine the recovered signal when the multiplying signal is $\cos[(\omega_c t + \Delta\omega)t]$. Give $\Delta\Phi << \Phi_i$ where $\omega_c = 2\Pi f_c$, $\Delta\omega = 2\prod \Delta f$. [16]

4. Explain demodulation of FM signal with the help of PLL. [16]

5. Compare noise performance of PM and FM system. [16]

6. (a) Draw the block diagram of an SSB - SC transmitter employing sideband suppression filter and explain.
   (b) Why are limiters and preemphasis filters used in FM radio. [16]

7. (a) Explain the working of TRF receiver with its block diagram.

(b) A TRF receiver is turned to 1000 KHz AM radio broadcast signal by a variable tuned circuit with 1 KHz bandwidth. Find the bandwidth when receiver is returned to 1550 KHz and 550 KHz. Determined the recovered baseband. [16]

8. (a) Describe the generation and demodulation of PPM with the help of block diagram and hence discuss its spectral characteristics.

(b) Define and distinguish between PTM and PAM schemes. Sketch and explain their waveform for a single tone sinusoidal input signal. [16]

Code No: R05220405 **Set No. 3**

II B.Tech II Semester Regular Examinations, Apr/May 2008
ANALOG COMMUNICATIONS
(Common to Electronics & Communication Engineering and Electronics & Telematics)

Time: 3 hours Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) Draw the one cycle of AM wave and calculate the modulation index of it in terms of V_{max} and V_{min} voltages.
   (b) A modulating signal consists of a symmetrical triangular wave having zero dc component and peak to peak voltage of 12V. It is used to amplitude modulate a carrier of peak voltage 10V. Calculate the modulation index and the ratio of the side lengths L_1/L_2 of the corresponding trapezoidal pattern.
   (c) The rms antenna current of an AM transmitter is 10 A when un-modulated and 12 A when sinusoidally modulated. Calculate the modulation index. [6+6+4]

2. (a) Explain about the quadrature null effect of coherent detector.
   (b) In DSB-SC, suppression of carrier so as to save transmitter power results in receiver complexity - Justify this statement. [8+8]

3. (a) Why SSB transmission is the preferred than DSB-SC?
   (b) i. Prove that the signal $s(t) = \sum_{i=1}^{N} \cos\left[(\omega_c t)\cos(\omega_i t + \Phi_i) - \sin(\omega_c t)\sin(\omega_i t + \Phi_i)\right]$ is an SSB signal ($f_c >> f_N$), where $\omega_c = 2f_c$, carrier angular frequency and $\omega_i = 2\Pi f_i$ is modulating angular frequency. Identify the side band.
   ii. Obtain an expression for missing side band.
   iii. Obtain an expression of the total DSB-SC signal. [4+12]

4. (a) Describe generation of FM carrier by Transistor reactance modulator with necessary diagrams.
   (b) Compare the phasor diagram of narrow band FM signal and AM signal and discuss about the similarities and differences of the two signals. [8+8]

5. (a) Derive the expression for figure of merit of AM system for large case.
   (b) Given an analog base band communication system with additive white noise having power spectral density $\frac{\eta}{2}$ and a distorting channel having the frequency response. The distortion is equalized by a receiver filter having the frequency response
   $H_c(w) = \frac{1}{1+Jw/w}$
   $H_{eq}(w) = \begin{cases} \frac{1}{H_c(w)} & 0 \leq |w| \leq w \\ 0 & otherwise \end{cases}$ Obtain an expression for the output SNR. [16]

6. (a) Classify radio transmitters based on the type of modulation and Service involved.
   (b) Explain AM transmitters with modulation at high carrier power level with the help of its block diagram. [16]

7. (a) With the aid of the block diagram explain TRF receiver. Also explain the basic superheterodyne principle.
   (b) List out the advantages and disadvantages of TRF receiver. [16]

8. (a) How is PDM wave converted into PPM system.
   (b) Explain why a single channel PPM of system requires the transmission of synchronization signal, where as a single channel PAM or PDM system does not it. [16]

Code No: R05220405 **Set No. 4**

II B.Tech II Semester Regular Examinations, Apr/May 2008
ANALOG COMMUNICATIONS
(Common to Electronics & Communication Engineering and Electronics & Telematics)

Time: 3 hours Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Draw the one cycle of AM wave and calculate the modulation index of it in terms of V_{max} and V_{min} voltages.
   (b) A modulating signal consists of a symmetrical triangular wave having zero dc component and peak to peak voltage of 12V. It is used to amplitude modulate a carrier of peak voltage 10V. Calculate the modulation index and the ratio of the side lengths L_1/L_2 of the corresponding trapezoidal pattern.
   (c) The rms antenna current of an AM transmitter is 10 A when un-modulated and 12 A when sinusoidally modulated. Calculate the modulation index. [6+6+4]

2. (a) Explain the DSB-SC generation by balanced modulator using diodes.
   (b) The modulating signal in an AM-SC system is a multiple-tone signal given by $m(t) = A_1 \cos \omega_1 t + A_2 \cos \omega_2 t + A_3 \cos \omega_3 t$. The signal m(t) modulates a carrier $A_c \cos \omega_c t$. Plot the single-sided spectrum and find the bandwidth of the modulated signal. Assume that $\omega_3 > \omega_2 > \omega_1$ and $A_1 > A_2 > A_3$. [8+8]

3. (a) Why VSB system is widely used for TV broadcasting - Explain?
   (b) An AM transmitter of 1KW power is fully modulated. Calculate the power transmitted if it is transmitted as SSB.
   (c) Calculate the filter requirement to convert DSB signal to SSB Signal, given that the two side bands are separated by 200HZ. The suppressed carrier is 29 MHZ. [6+4+6]

4. (a) Give the procedure to determine the effective bandwidth of an FM signal.
   (b) Which method of FM signal generation is the preferred choice, when the stability of the carrier frequency is of major concern? Discuss about the method in detail. [8+8]

5. (a) Find the output SNR in a PM system for tone modulation.
   (b) A phase modulation (PM) system, with the modulated wave defined by $S(t) = A_c \, Cos\,[2\pi \, f_c t + k_p m\,(t)]$
   where k_p is a constant and m(t) is the message signal. The additive noise n(t) at the phase detector input is
   $n(t) = n_I(t) \ \cos \ (2\pi f_c \, t) - n_Q\,(t) \ \sin 2\pi f_c \, t$ Assuming that the carrier-to-noise ratio at the detector input is high compared with unity, determine
      i. the output signal-to-noise ratio and

ii. the figure of merit of the system. [16]

6. (a) Classify radio transmitters in detail.
   (b) Compare low level modulation and high level modulation of radio transmitters. [16]

7. (a) Describe the circuit of an FET amplitude limiter, and with the aid of the transfer characteristic explain the operation of the circuit.
   (b) What can be done to improve the overall limiting performance of an FM receiver ? Explain the operation of the double limiter and also AGC in addition to a limier. [16]

8. (a) What is the fundamental difference between pulse modulation, on the one hand, and frequency and amplitude modulation on the other?
   (b) What is pulse width modulation? What other names does it have? How is it demodulated? [16]