Printed Pages—3   **EEC502**

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2118   **Roll No.** [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

B. Tech.

(SEM. V) ODD SEMESTER THEORY EXAMINATION 2010-11

PRINCIPLES OF COMMUNICATIONS

Time : 3 Hours   *Total Marks : 100*

Note :   (1) Attempt **all** questions.

(2) Each question carries equal marks.

1.   Attempt any **four** of the following :   **(5×4=20)**

(a)   With the help of block diagram explain the working of Communication System.

(b)   What is the need for modulation of signal before transmitting it to distant place ?

(c)   With the support of mathematical expressions explain the working of Balanced modulator.

(d)   How DSB-SC and DSD-C Demodulator works ? Explain.

(e)   What is the importance of Quadrature Amplitude Modulator ? Explain receiving system for Amplitude Modulated Signal.

(f)   The signal $v(t) = (1 + 0.1 \cos w_1 t + 0.1 \cos 2w_1 t) \cdot \cos w_c t$ is detected by a square-law detector, $v_o = 2v^2$.

2.   Attempt any **four** of the following :   **(5×4=20)**

(a)   Relate phase and frequency Modulation. Show that phase Modulation is not linear.

(b) Consider an angle modulated signal :

$$x(t) = 3 \cos[2\pi \, 10^6 t + 2 \sin (2\pi \, 10^3 t)].$$

Find its instantaneous frequency at time $t = 0.5$ ms and maximum phase deviation.

(c) Derive Carson's rule. Discuss the effect of Modulation index β on Bandwidth in Tone Modulated FM signals.

(d) Illustrate the principle of Armstrong system of generating PM signal.

(e) With the help of Block diagram explain the working of FM demodulator.

(f) With relevant figure explain the working of stereophonic broadcasting transmitter receiver.

3. Attempt any **two** of the following :   (10×2=20)

(a) What is sampling theorem ? What is the relevance of Discrete Fourier transform in relation to Nyquist criterion ?

(b) Discuss and compare pulse width Modulation and pulse position Modulation. Three signals m_1, m_2 and m_3 are to be multiplexed. m_1 and m_2 have a 50 kHz bandwidth and m_3 has a 10 kHz bandwidth. Design a commutator switching system so that each signal is sampled at its Nyquist rate.

(c) (i) Explain FDM and TDM. Discuss T1 Digital System.

(ii) Explain the working of PCM Communication System.

4. Attempt any **two** of the following :   (10×2=20)

(a) With the help of Block diagram explain the working of Delta Modulation. How adaptive Delta Modulator improves the performance of Delta Modulator ?

(b) Discuss the classification, working advantages and one application of each type of vocoders.

(c) Gaussian noise n(t) of zero mean has a power spectral density :

$$G_n(f) = 2\mu V^2 / Hz \text{ for } |f| \le kHz$$
$$= 0 \qquad \text{elsewhere.}$$

(i) What is the normalized power of noise ?

(ii) Write the probability density function f(n) of the noise.

(iii) The noise n(t) is passed through a filter. The power output of the filter is one-half the power of n(t). Write the probability density function for the output noise of the filter.

5. Attempt any two of the following :   (10×2=20)

(a) Analyze Noises present in Analog Modulation System and derive its signal to Noise Ratio.

(b) What are various noises present in Frequency Modulation ? What is pre-emphasis and de-emphasis and how SNR improves ? Comment.

(c) Classify various types of Noises and represent them by their mathematical model. Explain the working of Digital Phase Locked loop.

Printed Pages—3   **EEC502**

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2118 **Roll No.** ☐☐☐☐☐☐☐☐☐☐☐

B.Tech.

(SEM. V) THEORY EXAMINATION 2011-12

PRINCIPLES OF COMMUNICATIONS

Time : 3 Hours   *Total Marks : 100*

Note :– Attempt **all** the questions. Each question carries equal marks.

1.   Attempt any **four** parts :   (5×4=20)

   (a)   Explain the working of square law Modulator for AM wave.

   (b)   Draw the block diagram of phase shift method for generating the SSB signal and explain its working.

   (c)   Explain the concept of heterodyning. What are the advantages of heterodyning ?

   (d)   Discuss how the VSB Modulation is used in commercial TV signal. Discuss its merits and demerits.

   (e)   Determine the image frequency for a standard broadcast band AM receiver using a 455 kHz IF and tuned to a station at 640 kHz.

   (f)   Prove that the broadcast transmitter for AM, the maximum average power transmitted by an antenna is 1.5 times the carrier power.

2.   Attempt any **four** parts :   (5×4=20)

   (a)   Given the angle-modulated signal

   $S_Q(t) = 10 \cos (2\pi 10^8 t + 200 \cos 2\pi 10^3 t)$. What is its bandwidth ?

   (b)   Derive an expression for a single tone frequency modulated wave.

   (c)   Explain the Armstrong method for the generation of wideband FM.

   (d)   Given an angle-modulated signal

   $x_c(t) = 10 \cos [(10^8) \pi t + 5 \sin 2\pi (10^3)t]$.

   Determine the maximum phase deviation and the maximum frequency deviation.

   (e)   In an FM system a 7 kHz modulating signal modulates 107.6 MHz carrier wave, so that the frequency deviation is 50 kHz. Determine :

   (i)   Carrier swing in the FM signal and modulation index.

   (ii)   The highest and lowest frequency attained by the FM signal.

   (f)   Explain the Foster-Seeley Discriminator Method.

3.   Attempt any **two** parts :   (10×2=20)

   (a)   Define the sampling process and explain its necessity in the communication systems. Also compare PAM, PWM and PPM systems.

   (b)   For the binary sequence 011010110 construct NRZ, RZ, AMI and Manchester format.

   (c)   Write notes on TDM, PCM hierarchy from T_1 to T_4.

4.   Attempt any **two** parts :   **(10×2=20)**

(a) The output signal to quantizing noise ratio (SNR)$_0$ in a PCM system is defined as the ratio of average signal power to average quantizing noise power. For a full scale sinusoidal modulating signal with amplitude A, prove that

$$(SNR)_0 = \left(\frac{S}{N_q}\right)_0 = \frac{3L^2}{2}$$

where L is the number of quantizing levels.

(b) Derive an expression for signal to quantization noise power ratio for delta modulation. Assume that no slope overload distortion exists.

(c) ASCII has characters that are binary-coded, if a computer generates 100000 characters per second, determine :

(i)   The number of bits required per character.

(ii) The data rate or bit rate are required to transmit the computer output.

5.   Attempt any **two** parts :   **(10×2=20)**

(a) Determine the overall noise figure of a three stage cascaded amplifier, each stage having a power gain of 10dB, and noise figure of 6 dB.

(b) What do you mean by figure of merit ? Why it is necessary to employ pre-emphasis and de-emphasis in FM system ?

(c) What is digital Phase Locked Loop ? Explain the working of an EX-OR Gate based digital phase comparator.

Printed Pages—4   **EEC502**

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2118   **Roll No.** [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

B.Tech.

(SEM. V) ODD SEMESTER THEORY EXAMINATION 2012-13
PRINCIPLES OF COMMUNICATIONS

Time : 3 Hours   *Total Marks : 100*

Note : *Attempt **all** the questions. Each question carries equal marks.*

1. Attempt any **FOUR** parts of the following :   **(5×4=20)**

    (a) What is baseband and passband signals ? Why is modulation of signal required for transmission over the channel ?

    (b) Prove that the balanced modulator produces an output consisting of sidebands only with the carrier removed.

    (c) Explain the working principle of phase shift method generation of single sideband (AM) with the help of suitable diagram.

    (d) Calculate the percentage power saving when the carrier and one of the sideband are suppressed in an AM wave modulated to a depth of (i) 100% (ii) 75%.

    (e) The antenna current of an AM transmitter is 8 amp when only the carrier is sent, but it increase to 8.93 A when the carrier is modulated by a single sine wave.

EEC502/DLT-44161   **1**   *[Turn Over*

Find the percentage of modulation. Determine the antenna current when the percentage of modulation changes to 0.8.

(f)   What is the advantage of Quadrature Amplitude Modulator ? Explain with the help of suitable block diagram.

2.   Attempt any **FOUR** parts of the following :   **(5×4=20)**

(a)   Draw the circuit diagram of a Reactance Modulator and explain its principle of operation. Derive an expression for the equivalent capacitance in terms of the g_m of the device and the circuit component.

(b)   What are the advantages of frequency modulation ? The carrier frequency of an FM broadcast transmitter is 100 MHz and maximum frequency deviation is 75 kHz. If the highest audio frequency modulating the carrier is 15 kHz, what is the approximate bandwidth of the signal ?

(c)   Draw the block diagram of the indirect method of generation of frequency modulation system and explain the functions of each block.

(d)   In an FM system when the audio frequency is 500 Hz and the AF voltage is 2.4 V, the deviation is 4.8 kHz. If the AF voltage is now increased to 7.2 V, what is the new deviation ? If the AF voltage is raised to 10 V, while the AF is dropped to 200 Hz, what is the deviation ? Find the modulation index in each case.

EEC502/DLT-44161   2

(e) Explain the working of a balanced frequency discriminator with the help of circuit diagram.

(f) Why is pre-emphasis and de-emphasis used in the frequency modulation ? Draw pre-emphasis and de-emphasis networks and characteristics.

3. Attempt any **TWO** parts of the following :   (10×2=20)

(a) What do you understand by PCM (Pulse Code Modulation) ? How quantizing and coding is done ? Explain with suitable waveform.

(b) For the given binary sequence 011010110 construct unipolar NRZ, unipolar RZ, bipolar NRZ, bipolar RZ, Alternate Mark Inversion (AMI) and Manchester format.

(c) Using suitable circuit diagram, show how is the PPM (Pulse Position Modulation) is generated through PWM (Pulse Width Modulation).

4. Attempt any **TWO** parts of the following :   (10×2=20)

(a) What is Differential Pulse Code Modulation ? Explain the working of Differential Pulse Code Modulation.

(b) What is delta modulation ? Discuss the errors in Delta Modulation. How they are overcome in adaptive Delta Modulation ?

(c) Discuss the multiplexing of PCM system. Describe T1 digital system in detail.

5. Attempt any **TWO** parts of the following :   (10×2=20)

(a) What do you mean by figure of merit ? Derive an expression of figure of merit for a DSB-SC system.

EEC502/DLT-44161   3   *[Turn Over*

(b) What is frequency division multiplexing ? Explain the working operation of frequency division multiplexing with the help of block diagram.

(c) What is the advantage of Digital Phase Locked Loop ? Explain the working of a D-flip-flop based digital phase frequency detector.

Printed Pages—3   **EEC502**

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2118 **Roll No.** ☐☐☐☐☐☐☐☐☐☐

B.Tech.

(SEM. V) ODD SEMESTER THEORY
EXAMINATION 2013-14
PRINCIPLES OF COMMUNICATIONS

Time : 3 Hours   *Total Marks : 100*

Note :– Attempt **all** the questions. Each question carries equal marks.

1. Attempt any **four** parts of the following :   **(5×4=20)**

    (a) What is Modulation ? Why modulation is needed ?

    (b) Derive the relation between the output power of an AM transmitter and the depth of modulation.

    (c) Prove that the balanced modulator produces an output consisting of sidebands only, with the carrier removed.

    (d) Draw the block diagram of phase cancellation SSB generation and explain how the carrier and the unwanted sideband are suppressed.

    (e) When a broadcast AM transmitter is 50 percent modulated, its antenna current is 12 A. What will be the current when the modulation depth is increased to 0.9 ?

    (f) What is VSB modulation ? What is the application of VSB modulation ?

EEC502/DNG-51943   1   *[Turn Over*

2. Attempt any **four** parts of the following :   (5×4=20)

   (a) Derive the expression for the instantaneous value of an FM voltage and define the modulation index.

   (b) Draw the block diagram of balance frequency discriminator and explain it for demodulation of FM signal.

   (c) Illustrate the principle of Armstrong system of generating FM and PM signal.

   (d) With the help of suitable diagram explain the working of stereophonic broadcasting transmitter receiver.

   (e) What do you understand by instantaneous frequency, frequency deviation and bandwidth of FM wave ? A carrier wave of frequency 100 MHz is frequency modulated by a sinusoidal wave of amplitude 20 V and frequency 100 kHz. The frequency sensitivity of the modulator is 25 kHz per volt. Determine approximate band-width of FM Signal.

   (f) Draw the circuit diagram of a Foster-Seeley discrimination. Explain its principle of operation with the help of relevant phasor diagrams.

3. Attempt any **two** parts of the following :   (10×2=20)

   (a) What is Quantization ? How can you minimize the quantization error ? How quantizing and coding is done ? Explain with suitable waveform.

   (b) Explain the Modulation and Demodulation of pulse width modulation system using suitable waveform. Also discuss how is the Pulse Position Modulation (PPM) generated through PWM (Pulse Width Modulation).

EEC502/DNG-51943   **2**

(c) (i) For the given binary sequence 1011001011 construct unipolar NRZ, unipolar RZ, bipolar NRZ, bipolar RZ, Alternate Mark Inversion (AMI) and Manchester format.

(ii) What is Companding ? What is the advantage of Companding ?

4. Attempt any **two** parts of the following :   (10×2=20)

(a) What is the advantage of Differential Pulse Code Modulation over Pulse Code Modulation ? What is the limitation of Delta Modulation ?

(b) Discuss the classification, working advantages and one application of each type of Vocoders.

(c) What is Noise ? What are various forms and sources of noise ? Discuss the importance of S/N ratio in a radio-receiver.

5. Attempt any **two** parts of the following :   (10×2=20)

(a) Analyze Noises present in Amplitude Modulation System and derive its signal to Noise Ratio. Find out the figure of merit in DSB-SC System.

(b) What is pre-emphasis and de-emphasis and how SNR improves by using pre-emphasis and de-emphasis ? Find out the figure of merit in SSB-SC System.

(c) What is Digital Phase Locked Loop ? Explain the working of an Ex-OR gate based digital phase comparator.

EEC502/DNG-51943   **3**   *14575*

Printed Pages : 4

EEC-502

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 131502

Roll No.

B. Tech.

(SEM. V) (ODD SEM.) THEORY EXAMINATION, 2014-15

PRINCIPLE OF COMMUNICATION

Time : Hours]　　　　　　　　　　[Total Marks :

1　Attempt any FOUR parts :

(a)　Discuss the basic needs of modulation for the communication over a channel.

(b)　An amplitude modulated signal is given by

$$\Psi_{AM}(t) = 10\cos(2\pi.10^6 t) + 5\cos(2\pi.10^6 t)$$

$$\cos(2\pi.10^3 t) + 2\cos(2\pi.10^6 t)\cos(4\pi.10^3 t) \text{ Volt}$$

　　i)　Find various frequency components present and the corresponding modulation indices.

　　ii)　Calculate power contained in the signal and efficiency of the signal.

(c)　Draw the phasor diagram of AM modulated signal and also draw the spectrum of AM modulated signals.

(d)　Draw the block diagram of generating SSB signals using balance modulator and explain each block.

(e)　Describe the working principle of ring modulator to generate DSB-SC amplitude modulated signal.

(f)　An AM commercial broadcast-band receiver (535kHz - 1605 kHz), an input filter is used with Q-factor of 54. Determine its bandwith at low and high ends of RF spectrum. Comment on the received signal quality.

Attempt any FOUR parts :

(a)　An angle-modulated signal with carrier frequency $\omega_c = 2\pi \times 10^5$ is described by the equation

$$\Psi_{FM}(t) = 10\cos(\omega_c t + 5\sin 3000t + 10\sin 2000\pi t)$$

　　i)　Find the power of the modulated signal.

　　ii)　Find the frequency deviation Δf.

　　iii)　Estimate bandwidth of the FM signals.

(b)　A PM modulator has a phase deviation sensitivity of 2.5 radians/V, and a modulating signal of $m(t) = 2\cos(2\pi \times 2000t)$. Determine the peak phase deviation and phase-modulation index.

(c)　Explain the working of FM signal modulator using indirect method (Armstrong's method) to obtained FM signal having carrier frequency 91.2 MHz.

(d) Explain the working of ratio detector used to demodulate the FM signal with neat sketch.

(e) Derive the expression for narrow band frequency modulated (NBFM) signal. Draw the phasor diagram of NBFM signal.

(f) Consider a frequency modulated signal is given by

$$v_{FM}(t) = 20\cos[2\pi \times 10^6 t + 0.1\sin(10^4 \pi t)]. \quad \text{Given}$$

$k_f = 10\pi$, derive the expression for the modulating signal.

3 Attempt any TWO parts :

(a) (i) Explain different types of non-uniform quantization.

(ii) Calculate the quantization noise power in Pulse Code Modulation.

(b) (i) A speech signal is sampled with 8 kHz sampling frequency and then quantized with 256 levels. Calculate the data rate and bandwidth required to transmit this signal.

(ii) Three signals m_1, m_2 and m_3 are to be multiplexed. m_1 and m_2 have a 5-KHz bandwidth and m_3 has a 10 KHz bandwidth. Design a commutator switching system so that each signal is sampled at its Nyquist rate.

(c) Explain the different types of pulse modulation. Explain with the waveforms how PWM and PPM can be derived from PAM signal. Compare among them.

4 Attempt any TWO parts :

(a) What is delta modulation? How delta modulation defers from PCM and PAM? Explain the noises introduced in delta modulation. How can they be reduced?

(b) Draw and explain the block diagram of transmitter and receiver of DPCM system. Write down the objectives of design of vocoders.

(c) (i) Show that the equivalent noise bandwidth of a low-pass filter is 1.57 time of its 3 dB bandwidth f_c.

(ii) A typical satellite microwave communication receiver is shown in figure below.
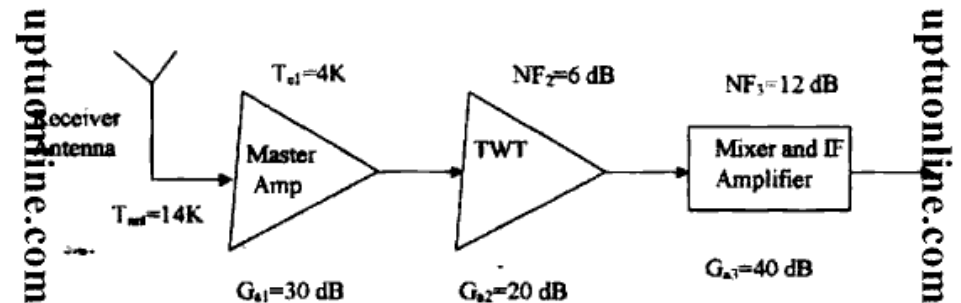
Calculate the overall noise figure of the receiver, neglecting effect of receiving antenna.

Attempt any TWO parts :

(a) Derive the output SNR of AM envelop detector. Also calculate figure of merit.

(b) Calculate the signal to noise ratio of frequency modulation. Also calculate noise figure. Explain the scheme to reduce the noise in FM system.

(c) (i) Write the short note on Pre-emphasis and De-emphasis.

(ii) Explain the functional blocks of phase lock loop (PLL)

Printed Pages: | 563 | EEC-502/NEC-502

(Following Paper ID and Roll No. to be filled in your Answer Book)

Paper ID : 131522
131502

Roll No. [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

B.Tech.

(SEM. V)(ODD SEM) THEORY EXAMINATION, 2015-16

PRINCIPLES OF COMMUNICATION

[Time:3 hours]   [MaximumMarks:100

Section-A

Q1. Attempt **all** parts. All parts carry equal marks. Write answer of each part in short.   (2×10=20)

(a) Draw the Block diagram of SSb synchronous demodulation system.

(b) List the advantages of DSB-FC modulation shceme.

(c) Write two properties of Bessel's Function $J_n(\beta)$

(d) Mention three direct methods of FM generation.

(e) A signal has frequency components from 300 Hz to 1.8 KHz. What is the minimum possible rate at which the signal has to be sampled?

(f) Mention the exact data rates for T-1, T-2, T-3 and T-4 carrier systems.

(g) Which scheme utilizes the most number of bits per symbol- Delta modulation of Adaptive delta modulation?

(h) Define noise bandwidth.

(i) What is the shape of autocorrelatiion function of a random process having power spectral density (PSD) with only DV term?

(j) Convert 120 μ W into dBm.

Section-B

Note: Attempt any five questions from this section. 10×5=50

Q2. What is the basic limitation SSb modulation scheme? How it is eliminated by Vestigial Side Band modulation.

Q3. Mention advantages and applications of VSB modulatiion. Two signals m1 (t) and m2 (t), both band-limited to 5000 rad/sec, are to be transmitted simultaneously over a channel by the multiplexing shceme as shown in figure 1 below. The single at point b is the signal at point c is transmitted over a channel.

(i) Sjetch the signal spectra at a, b, c.
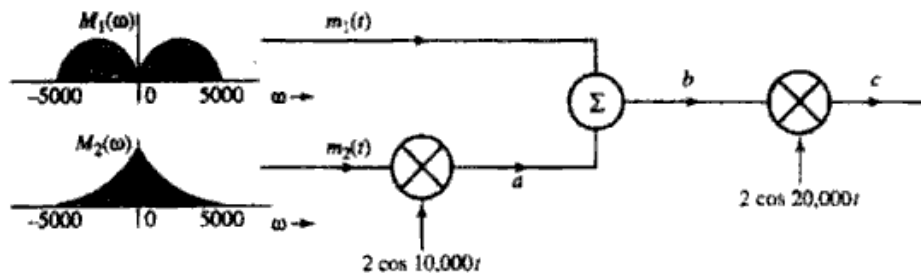
(ii) What must be the bandwidth of the channel?

Figure: 1

Q4. Prove that bandwisth of an FM wave is infinity. Also represent the single tone FM wava as a function of Bessel's Function.

Q5. Discuss Armstrong's method of indirect FM generation in detail.

Q6. Explain the TDM principle. Draw a circuit diagram to illustrate the flat-top smapling. Draw the block diagram of PCM shceme and explain its functionality.

Q7. Show that the equivalent noise bandwidth of a low pass filter is $\frac{\pi}{2}$ times of its 3dB bandwidth F_{3dB}.

Q8. Describe PWM and PPM generation with a neat labeled diagram.

Q9. Quantify the noise performance of frequency modulated systems in detail.

Section-C

Note: Attempt any two questions from this section.(15×2=30)

Q10. A compact disk (CD) recorsing system smaples each of two stereo signals with a 16-bit analog-to digital converter (ADC) at 44.1 kb/s.

(i) Determine the output signal-to-quantizing ratio for a full-scale sinusoid.

(ii) The bit stream of digitized data is augmented by the addition of error-correcting bits, clock extraction bits, and display and control bit fields. These additional bits represent 100 percent overhead. Determine the output bit rate of the CD recording system.

(iii) The CD can record an hour's worth of musci. Determine the number of bits recorder on a CD.

(iv) For a comparison, a high-grade collegiate disctionary amy contain 1500 pages, 2 columns per page, 100 lines per columns, 8 words per line, 6 letters per word, and 7 b per letter on average. Determine the number of bits required to describe the dictionary, and estimate the number of comparable books.

Q11. Write a short note on AWGN. Calculate the Power Spectrum Density (PSD) corresponding to the autocorrelation function x (t) of a random process shown in figure 2 below:
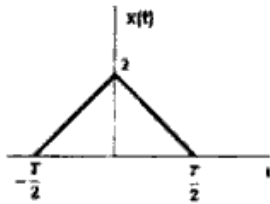

Figure: 2

Q12. How is the human voice modeled? What do you mean by VOCODER? Explain the generation of LPC VOCODER system.

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