23 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Communication System I *(EX652)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Distinguish between external and internal nose. List out the sources of interferences. Write the needs of modulation in communication system. [2+2+4]
2. Define Hilbert transformation. Show that impulse response of an ideal low pass filter is non-causal. [2+6]
3. Define energy spectral density and power spectral density function of a signal and hence derive the auto correlation function of white noise utilizing power spectral density along with necessary diagrams. [4+4]
4. How does SSB differ from conventional AM and DSB-SC? Describe the process of generation of DSB-SC AM wave using Balance modulator. [3+5]
5. An Amplitude modulated wave is given by [3+2+2+1]

   $s(t) = 100\cos(2\pi * 10^6 t) + 30\cos(2\pi * 10^6 t)\cos(2\pi * 10^3 t) + 40\cos(2\pi * 10^6 t)\cos(4\pi * 10^2 t)\text{Volt}$

   a) Draw the frequency spectrum of modulated wave

   b) Net modulation index

   c) Total modulated power

   d) Efficiency
6. Describe any one method of demodulating DSB-FC AM signal. [8]
7. Derive the expression for single tone modulated FM signal in terms of Bessel coefficients. [8]
8. Describe the process of demodulation of FM using PLL. [8]
9. Why pre-emphasis and de-emphasis circuits are used in commercial FM broadcasting? Explain the functional block diagram of stereo encoder. [3+5]
10. What is frequency division multiplexing (FDM)? Describe the method of FDM in telephony. [2+6]

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35 TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2075 Baisakh

Exam.	Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Communication System I *(EX652)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Distinguish between noise and interference? How their effects can be minimized? Also explain why modulation is needed in communication system. [4+2+2]
2. Define Hilbert Transform; describe it with mathematical expression and frequency response. Mention the properties of Hilbert Transform. Explain distortionless transmission channel with its frequency response. [3+2+3]
3. State and prove Rayleigh energy theorem for a given energy signal x(t). [2+6]
4. Find the time domain and frequency domain expressions for single tone DSB-FC AM modulated wave. Also, show the spectrum of the modulated signal. [3+3+3]
5. A cosine carrier of frequency 750 KHz is amplitude modulated by another cosine wave of frequency 325 Hz resulting in maximum and minimum carrier amplitudes of 110V and 90V respectively: [2+3+2]
   a) Draw the waveform of AM wave thus created.
   b) Write the expression of the resulting AM wave.
   c) Find the total power radiated and efficiency.
6. Explain the phase shift method of generation of SSB AM modulated wave. What are the pros and cons of this method? [6+2]
7. Explain the envelope detection method for the demodulation of AM wave with necessary conditions for time constants and waveforms. [4+2+2]
8. What is angle modulation? Find the time domain and frequency domain expression of single tone modulated FM signal. [2+3+3]
9. A 102.4 MHz carrier signal is frequency modulated by a 5 KHz sine wave. The resultant FM signal has frequency deviation of 75 KHz. Now, determine the followings: (a) carrier swing of FM signal, (b) the bandwidth occupied by FM signal and (c) modulation index. [3+3+3]
10. What is frequency division multiplexing (FDM)? Describe the FDM hierarchy in telephony. [2+5]

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35 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Magh

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Communication System I *(EX652)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. What do you mean by channel in communication system? Classify the channel with example. [4+6]
2. Define Hilbert transform? How is it different from Fourier transform? State the properties of HT. [4+2+4]
3. Compare DSB-AM and SSB wave in terms of transmission power and bandwidth. Describe how ring modulator can be used to generate DSB-SC. [4+6]
4. What is power spectral density function (PSDF)? Derive an expression for PSDF of an arbitrary signal X(t). [4+6]
5. With block diagram and necessary mathematics, show that the Costas loop can be used as a practical synchronous receiving system suitable for use with the DSB-SC modulated wave. [10]
6. What is angle modulation? Explain with the help of equation and block diagram, the Armstrong method of generating FM signal. [4+6]
7. The angle modulated signal is given by $S(t) = 20\cos(6\times10^8 t + 7\sin 1250t)$ [2.5×4]

   Determine:

   i) The carrier and modulating frequency
   ii) The modulation index
   iii) Maximum frequency deviation
   iv) Power dissipated in 10 Ω resistor
8. Write short notes on: [5+5]

   i) Filter and oscillator requirements in FDM
   ii) Stereo FM encoder

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35 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Communication System I *(EX652)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. How does noise limit the performance of communication system? Describe the types and causes of any four types of internal noise that may affect the communication system. [2+8]
2. a) What do you understand by Impluse response and transfer functions of a system? Explain its significance. [4+2]
   b) Define Energy and Power Signal. Explain the meaning of bandwidth of a system along with necessary diagrams. [2+2]
3. Define power Spectral Density (PSD). Find expression for PSD and its relationship with autocorrelation function. [2+4+4]
4. Why is conventional AM wasteful of power and bandwidth? Explain the method of conventional AM generation by using switching modulator. [4+6]
5. An amplitude modulated wave is given by
   $s(t) = 50(1 + 0.3\cos 3141.60t + 0.2\cos 2513.28t)\cos 10^6 t$ [4+3+3]
   i) Draw the amplitude spectrum of s(t)
   ii) Determine the bandwidth of s(t)
   iii) Calculate the power efficiency
6. Draw the block diagram of Costas Loop detector and explain how it demodulates DSB-SC AM and corrects for phase error. [4+4+2]
7. Find the time domain expression for Narrowband FM signal. How NBFM can be used to generate Wideband FM signal? [6+4]
8. Write short notes on: (any two) [2×5]
   i) Frequency Division Multiplexing (FDM)
   ii) FDMA in Satellite Communication
   iii) Filter and Oscillator requirements in FDM

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35 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Bhadra

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Communication System I *(EX652)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Define noise, interference and distortion? What will be their effects in communication? Explain briefly thermal and high frequency noise. [3+1+3]
2. Define LTI system. Find the expression (in time domain) for the output of a LTI. [2+5]
3. What do you understand by Energy Spectral Density (ESD)? Find ESD and total energy for sinc pulse defined by g(t) = A sinc (2Wt). [2+3+2]
4. a) What do you understand by modulation? Why modulation is needed? Find the frequency domain expression for standard AM wave for single tone message signal. [2+2+3]
   b) With the help of block diagram and expression explain the phase shift method for generation of SSB-AM wave. [6]
   c) An AM wave is represented by $S_{AM}(t) = 20(1 + 0.8 \cos 2\pi\ 1000\ t) \cos (9424777.96\ t)$ volts. Find [2×4]
      i) Amplitude of all frequency components
      ii) Modulation index
      iii) Maximum and minimum amplitude of AM wave
      iv) Frequency of USB and LSB
5. a) Draw the circuit diagram and the waveforms and describe how envelope detector can be used for demodulation of standard AM wave. [5]
   b) Describe the operation of PLL and show that it can be used to demodulate AM. [6]
6. a) Find the time domain expression for single tone FM modulated waves interms of Bessel coefficients. [6]
   b) Describe the limiter-discriminator method for demodulation of FM wave. [7]
   c) A modulating signal m(t) = 5 cos 18849.55 t is applied to an FM modulator that has a frequency sensitivity of 9 KHz/V. Compute (i) peak frequency deviation, (ii) modulation index, (iii) frequency swing and (iv) Carson's bandwidth. [2×4]
7. Describe the principle of frequency division multiplexing (FDM). Briefly explain SCPC and DAMA types of FDMA. [2+4]

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10/068

35 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Magh

Exam.	New Back (2066 & Later Batch)		
Level	BE	**Full Marks**	80
Programme	BEX	**Pass Marks**	32
Year / Part	III / II	**Time**	3 hrs.

Subject: - Communication System I *(EX652)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Draw the block diagram of communication system and explain each component briefly. [6]
2. Define Hilbert transformation. State and explain the properties of LTI system. [2+4]
3. Define white noise. Establish relation between psdf and the AC function of a white noise. [3+3]
4. What are the advantages of SSB-AM over DSBFC-AM? Derive the expression for SSB signal. [2+4]
5. Explain the generation of DSB-FC AM using switching modulator with the help of diagrams and expressions. [8]
6. Show the effect of phase error in coherent detection of DSB-SC AM. Explain the demodulation of AM using PLL. [4+4]
7. Explain the operation of FM super heterodyne radio receiver. [8]
8. The equation of an angle modulation voltage is $E = 10 \sin (10^8 t + 3 \sin 10^4 t)$. Calculate the carrier and modulating frequency, modulating index and power dissipated in 100 Ω resistor. [2+2+2+2]
9. Explain demodulation of FM using limiter-discriminator method. Why pre-emphases is needed in FM during transmission? [6+2]
10. Define FDMA. Write about FDM in telephone hierarchy. [2+6]
11. Write short notes on: [4+4]
    a) Stereo encoder
    b) Distortion and interference

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10/06 D.

45 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Magh

Exam.	**OLD Back (2065 & Earlier Batch)**		
Level	BE	**Full Marks**	80
Programme	BCT	**Pass Marks**	32
Year / Part	III / II	**Time**	3 hrs.

Subject: - Communication Systems *(EG679CT)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Discuss linear, non linear, causal and time invariant systems used in communication. Prove that the output of any system is given by convolution of input and impulse response of the system. [4+4]
2. What do you mean by square law approximation? How can you use it for the modulation of DSB-AM? [2+6]
3. Compare DSB-AM, DSB-SC and SSB in terms of complexity, power and bandwidth efficiency. [8]
4. Derive the general expression for frequency modulation. Explain with the block diagram how can you generate FM using phase modulator. [3+5]
5. State any four properties of the Fourier Transform. Derive the expression for the Rayleigh Energy Theorem. [4+4]
6. Derive the expression for the SQNR of uniformly quantized PCM. What is the relation between SQNR value and bit used for coding? [6+2]
7. Prove that signaling rate for time division multiplexing of 24 voice channels is equal to 1.544 Mbps. [8]
8. An audio signal given as 15 $\sin 2\pi$ (1500t) and amplitude modulates a carrier given as 60 sin 2π (100,000t) determine the following: [2×4]
   a) Sketch the audio signal
   b) Construct the modulated wave
   c) Determine the modulation index and percent modulation
   d) What frequencies would present in a spectrum analysis of modulated wave?
9. State the Shannon Channel Capacity Theorem. Discuss the implication of this theory in communication system. [8]
10. Write short notes on: [2×4]
    a) Convolutional codes
    b) Threshold effect in demodulation of FM

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35 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Communication System I *(EX652)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Differentiate between noise and interference. What are the limitations posed by them in communication system? [3+3]
2. Define linear time invariant system. What is the significance of such system in communication engineering? [2+3]
3. List out any three the properties of autocorrelation function. Mention the autocorrelation function of white noise. [3+3]
4. How is SSB different from conventional full carrier AM? Describe how ring modulator can be used to generate DSB-SC. [2+5]
5. What is vestigial side band modulation? What is the motivation behind using VSB? Why is VSB suitable for television transmission? [2+2+2]
6. The amplitude modulated signal is given by $x(t) = 50\cos(2\pi \times 10^6 t) + 15\cos(2\pi \times 10^6 t)\cos(2\pi \times 10^3 t) + 20\cos(2\pi \times 10^6 t)\cos(4\pi \times 10^2 t)$. [3+2+2]
   a) Draw the spectrum.
   b) Find the total modulated power.
   c) Find the net modulation index.
7. Explain envelope detector. Include in your explanation how the values of capacitor and resistors be chosen so that the output of detector is the envelope of the signal as its input. [6]
8. How can synchronous demodulator be used to detect DSB-SC wave? Explain mathematically, the effects of phase error and frequency error in local oscillator while demodulating DSB-SC. [3+3]
9. How is the spectrum of Narrow band FM similar to and different from the spectrum of conventional AM? Explain how NBFM is generated by using Armstrong's method. [2+5]
10. Explain with necessary mathematical relations, the demodulation of FM wave using non-synchronous method. [6]
11. What are the requirements for a good radio receiver? Explain the operation of a superheterodyne receiver. [3+5]
12. Write short notes on: [5+5]
    a) FDM Telephone Hierarchy
    b) Distortionless Transmission

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35 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Magh

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Communication System I *(EX652)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. a) Define modulation and explain the reasons for modulation. Compare noise, distortion and interference. [2+4]

   b) Differentiate between energy spectral density function and power spectral density function. Derive the expression of power spectral density function of a arbitrary signal z(t) [2+6]

2. a) Compare various types of AM systems in terms of transmission power and transmission bandwidth. Expalin any one method generating DSB-FC AM. [2+4]

   b) Given the modulated wave, $u(t)=[20+2\cos 3000\pi t+10\cos 6000\pi t]\cos 2\pi f_c t$ where $f_c=10^5$Hz. [2×4]

      i) Sketch the spectrum of the signal
      ii) Find power contained in each frequency component
      iii) Calculate efficiency
      iv) Transmission bandwidth of the system

3. a) Derive the expression for SSB wave modulated by a low pass signal m(t). [6]

   b) What is the limitation of square law detector for DSB-AM detection? Explain the operation of envelope detector with required diagrams and conditions. [2+6]

4. a) Derive the expression for signal tone modulated FM signal interm of Bessel coefficients. [6]

   b) Explain the role of amplitude limiter used in limiter discriminator method. Prove that PLL can be used as FM demodulator. [2+6]

5. a) Why pre-emphasis and de-emphasis circuits are required in commercial FM broadcasting? Explain the functional block diagram of stereo encoder. [2+4]

   b) In an FM system a baseband signal band limited to 10 KHZ modulates 100 MHZ carrier wave so that the frequency deviation is 75 KHZ. [4+4]
   Find:
      i) Carrier frequency swing in the FM signal and modulation index
      ii) The practical bandwidth of the fm signal

6. Short notes on: (any two) [2×5]

   i) Distortionless Transmission
   ii) Frequency Division Multiplexing (FDM)
   iii) Superheterodyne Receiver

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.34 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division.
2069 Bhadra

Exam.	Regular (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Communication System I *(EX652)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. What are the main components of analog communication system? Describe briefly about each component. Find the transfer function for distortionless system. [2+5+3]
2. Define energy and power spectral density functions. Find power spectral density and average power for the periodic signal defined by $g(t) = A\cos(2\pi f_c t+\theta)$. [4+6]
3. What do you understand by modulation? Why modulation is needed? Find the time and frequency domain expressions for standard AM wave for single tone message signal. [2+2+6]
4. An AM wave is represented by $S_{AM}(t) = 10\ (1+0.8\cos\ 25132.74t)\ \cos\ (9424777.96t)$ volts. [2×5]

   Find:

   i) Amplitude of all frequency components
   ii) Modulation index
   iii) Maximum and minimum amplitude of AM wave
   iv) Bandwidth of the signal
   v) Power spectrum of the modulated signal.
5. Describe how envelope detector can be used for demodulation of standard AM wave. Explain why DSB-SC and SSB can not be demodulated using envelop detector. [6+4]
6. Find the time domain expression for signal tone FM modulated wave, in terms of Bessel coefficients. Derive the expression for estimating practical bandwith of a FM signal. [6+4]
7. A sinusoidal modulating signal $m(t) = 5\cos\ 18849.55t$ is applied to an FM modulator that has a frequency sensitivity of 9 KHz/V. The amplitude of the carrier is 25V and the frequency is 88.7Mhz. Compute: [2×5]

   i) Peak frequency deviation ii) Modulation index
   iii) Frequency swing iv) Carson's bandwidth and
   v) Total power delivered in 10Ω resistor.
8. Describe the principle of frequency division multiplexing (FDM) with its standard hierarchy in telephony system. [4+6]

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45 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2068 Jestha

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject:- Communication Systems

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Draw and explain the functional block diagram of analog communication system. Define modulation and justify its use in communications. (4+4+2)
2. Express the single side-band modulated signal in-terms of the band-limited modulating signal m(t) and its Hilbert transformation. Briefly discuss filtering method of generating SSB signal. (6+4)
3. Differentiate between FDM and TDM. Draw spectral details and explain various standard groups of FDM telephone hierarchy. (4+6)
4. With examples, differentiate between distortion, noise and interference. Briefly explain any four types of noise encountered in communication. (6+4)
5. Evaluate the maximum data rate that can be transmitted error free through a channel with a bandwidth of 1 Mhz and a minimum of 10 dB SNR at the input of the channel decoder. (10)
6. Define information. Derive the expression for evaluating the average amount of information contained in a statistically independent long sequence of symbols. (4+6)
7. Derive the expression for the impulse response of a matched filter for an arbitrary input signal z(t). (10)
8. Write short notes on: (5+5)
   a) Threshold effect in FM
   b) Convolutional coding

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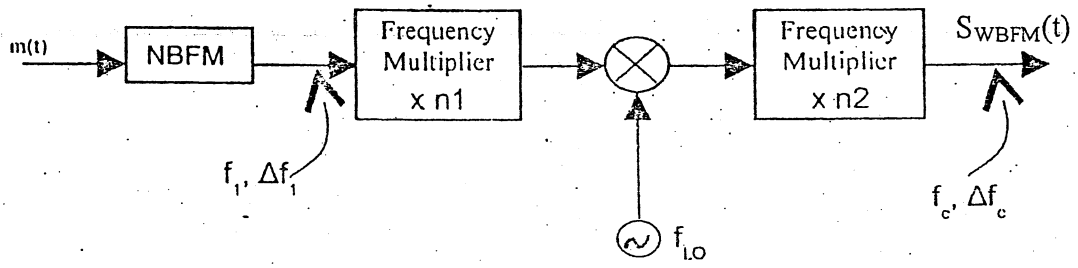
32 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2068 Bhadra

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Communication System I

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. What major elements does a communication system contains? "Communication over long distance is impossible without modulation. Modulation is must to mitigate several constraints in transmission." Justify. [4+4]
2. Define Band pass signal and Band Limited signal with example. Write the properties of LTI system. [4+4]
3. Derive the expression for double side band full carrier amplitude wave where the massage contains a single tone frequency component. Also find the expression for modulation index. [6+2]
4. Determine the percentage power saving of SSB modulated wave for modulation depth equal to: (i) 100%, and (ii) 50%. [4+4]
5. Explain the effect of phase and frequency error in local oscillator in demodulating DSB and SSB using PLL. [8]
6. Express the sinusoidal angle modulated wave interms of Bessel function, Jn(β) of first kind of order n and argument β. [8]
7. For the following Armstrong FM transmitter, compute maximum frequency deviation and the carrier frequency f_c if, $f_1 = 200kHz$, $f_{LO} = 10.8MHz$, $\Delta f_1 = 24Hz$, $n_1 = 65$ and $n_2 = 50$. [8]



8. Define white noise with PSDF and auto correlation function. State the properties of auto correlation function. [4+4]
9. Explain any one method of demodulating DPSK signal. [8]
10. Write short notes on: [2×4]
    a) Filter and oscillator requirement in FDM
    b) Satellite Communication

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32 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2067 Shrawan

Exam.	Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Communication Systems I

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt All questions.*
- ✓ *The figures in the margin indicate Full Marks.*
- ✓ *Assume suitable data if necessary.*

1. Define modulation. Explain the reasons for modulation. Draw the functional block diagram of analog communication system and briefly explain each block. (2+4+4)

2. Derive the equation for Single Side-Band modulated signal in terms of Hilbert Transformation of modulating signal m(t). Briefly discuss any one method of generating SSB signal. (6+4)

3. A harmonic signal $m(t) = 20 \cos (2 \pi 2000 t)$, Volt is used to frequency modulate the carrier signal $c(t) = 50 \cos (2\pi 10^7 t)$, Volt. Assuming the frequency sensitivity of the frequency modulator to be 200 Hz/Volt, calculate: (2.5x4=10)
   a) peak frequency deviation
   b) modulation index
   c) bandwidth of modulated signal for over 98% of FM power
   d) total modulated signal power

4. Define energy spectrum and power spectrum density functions. Briefly explain the operation of analog spectrum analyzer. (4+6)

5. With functional block diagrams and spectral details, explain the operation of stereo encoder and decoder. (5+5)

6. Define FDM. Explain FDM hierarchy used in telephony. (4+6)

7. Define unipolar, polar, bi-polar, unipolar RZ and Manchester line codes (5x2=10)

8. Write short notes on: (5+5)
   a) Autocorrelation function and its properties
   b) Phase Locked Loop

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32 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2067 Mangsir

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Communication System I

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt All questions.*
- ✓ *The figures in the margin indicate Full Marks.*
- ✓ *Assume suitable data if necessary.*

1. Define with examples periodic and non-periodic signals. Prove that for a linear time invariant system, the output is the convolution of the input and the impulse response of the system. (4+6)

2. State and explain the following properties of Fourier Transform: (2x5)
   a) Modulation
   b) Duality (symmetry)
   c) Time shifting
   d) Scaling
   e) Convolution

3. Define Amplitude Modulation. With block diagram and necessary derivations, show that switching modulator can be used to generate Double Sideband Full Carrier AM signal. (2+8)

4. Derive the expression for the USB – SSB signal in terms of the carrier $c(t) = A_c \cos(\omega_c t)$ and a random band limited signal m(t). (10)

5. A modulated signal has the expression: (2x5)

   $Z(t) = 50 \cos\{98.6 \times 10^6 \times 2\pi t + 15 \sin(2 \times 10^3 \times 2\pi t)\}$, volts

   Determine: a) type of modulation, b) frequency deviation, c) frequency sensitivity of the modulator d) modulation index and e) power delivered to a 50 Ohms impedance transmitting antenna.

6. With block diagram and necessary derivations, proye that PLL can be used to demodulated FM signal. (10)

7. Derive the expression for power spectral density function (psdf) for a power type signal. Give the interpretation of psdf. (6+4)

8. Write notes on: (5+5)
   a) FDM telephone hierarchy
   b) Analog spectrum analyzer

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INSTITUTE OF ENGINEERING
Examination Control Division
2065 Kartik

Exam.	Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Communication Systems I

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Define energy type and power type signals. Find whether the signal $x(t) = A\cos 2\pi ft$ is energy type of power type signal. [2+6]
2. Show how can a square law modulator be used to generate DSB-AM signal, explain with neat diagrams. What are the basis characteristics of DSB-AM? [6+2]
3. Explain the working principle of the super heterodyne AM receiver with the help of block diagram. Why standard AM is used in AM radio broadcasting? [6+2]
4. Show that the output of the balanced modulator is DSB-SC modulated wave. Draw DSB-SC modulated wave for sinusoidal modulating signal. [6+2]
5. How can you generate FM wave using Armstrong modulator (Indirect method)? Explain with the help of block diagram. Why pre-emphasis and de-emphasis networks are used in FM? [6+2]
6. A modulating signal $m(t) = 3\cos(2000t)$ modulates the carrier signal $c(t) = 9\cos(70000t)$ to produce the modulated signal $s(t) = 9\cos(70000t + 16\sin 2000t)$. Calculate: the total modulated signal power, modulation index, peak frequency deviation and the bandwidth of modulated signal. [2+2+2+2]
7. Explain stereo FM transmitter and receiver with the help of block diagrams. If mono FM receiver is used to receive the signal from stereo FM transmitter, what will be the output of FM receiver? Explain. [6+2]
8. Explain the working principle of Analog spectrum analyzer with the help of block diagrams. [8]
9. Explain ASK and FSK modulators and demodulators with the help of block diagrams. Can PSK wave be detected using envelope detector? Explain. [6+2]
10. Write notes on: [4+4]
    a) FDM in Telephony
    b) Phase Modulation

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2064 Shrawan

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1a. Explain how can you classify *systems* according to their basic properties. Show that an ideal LPF is non-casual. (4+4)

b) Explain in detail with a neat functional block diagram of a superheterodyne receiver used in a commercial standard AM radio. Why Standard AM is used in AM radio broadcasting? (6+2)

2a) Show how can a ring modulator be used to generate DSB-SC signal, explain with neat diagrams. What are the basic characteristics of DSB-SC? (5+3)

b) Explain how frequency modulated signals can be generated by direct method using a varactor diode. What are the disadvantages of such a method? (6+2)

3a) Why do we use shift keying technique in communication system? Distinguish between ASK, FSK and PSK. (3+5)

b) Show how DSB-AM signal can be detected using an envelope detector in details. Why envelope detector cannot be used to demodulate DSB-SC wave? (5+3)

4a) Derive a general expression for an energy spectral density of an energy signal with an example of an ideal BPF. Mention basic properties of the energy spectral density. (5+3)

b) A low frequency signal $m(t)=2\cos(5000t)$ modulates the carrier signal $c(t)=10\cos(100{,}000t)$ to produce the modulated signal $u(t)=10\cos(100{,}000t+10\sin 5000t)$. Calculate: the total modulated signal power; modulation index; peak frequency deviation; the bandwidth of modulated signal. (4×2)

5a) Discuss a block diagram of an analog communication system. Explain FDM system with neat diagrams, assuming three different message signals are to be transmitted simultaneously. (4+4)

b) Show that PLL can be used to demodulate FM signal with a neat diagram. What are the basic uses of PLL? (6+2)

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