

Name :

Roll No. :

Invigilator's Signature :

CS/B.TECH/ECE-N/SEM-5/EC-501/2012-13

2012

ANALOG COMMUNICATION

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable*

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : 10 × 1 = 10

- i) The length of the antenna to transmit a signal must be at least

- | | |
|-----------------------------|------------------------------|
| a) $\frac{1}{3}$ wavelength | b) $\frac{2}{3}$ wavelength |
| c) $\frac{1}{4}$ wavelength | d) $\frac{3}{4}$ wavelength. |

- ii) Two sinusoidal signals are simultaneously modulating a carrier, the modulation indices being 0.3 and 0.4. The overall modulation index is

- | | |
|--------|----------|
| a) 0.5 | b) 0.1 |
| c) 0.7 | d) 0.12. |

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iii) For video transmission of television, which of the following is used ?

- a) AM
- b) DSB-SC
- c) VSB
- d) SSB-SC.

iv) A balance modulator circuit is used to reject

- a) Carrier
- b) LSB
- c) USB
- d) LSB and USB.

v) The envelope detector is a/an

- a) Synchronous detector
- b) Asynchronous Detector
- c) Product modulator
- d) Coherent detector.

vi) When modulating frequency is doubled, the modulation index is halved and the modulating voltage remains constant. The modulation system is

- a) AM
- b) FM
- c) PM
- d) any of these.

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- vii) De-emphasis in FM system involves
- a) Compression of the modulating signal
 - b) Expansion of the modulating signal
 - c) Amplification of lower frequency signal of modulating signal
 - d) Amplification of higher frequency signal of modulating signal.
- viii) Armstrong's method is used for the generation of
- a) FM from PM
 - b) WBFM from NBFM
 - c) PM from FM
 - d) All of these
- ix) A PLL can be used to demodulate
- a) PAM signals b) PCM signals
 - c) FM signals d) DSB-SC signals.
- x) The main advantage of TDM over FDM is that it
- a) needs less power
 - b) needs less bandwidth
 - c) needs simple circuitry
 - d) gives better S/N ratio.

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xi) The intermediate frequency used for a superheterodyne AM receiver is

- a) 455 kHz b) 755 kHz
- c) 545 kHz d) None of these.

xii) White noise is specified by

- a) Gaussian distribution
- b) Rician distribution
- c) Binomial distribution
- d) Maxwell-Boltzman distribution.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. a) What are the basic components of a communication system ?
- b) Which of the above components affect the signal most with noise, in a communication system ?
- c) Describe why modulation is necessary for communication. 2 + 1 + 2

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3. A carrier signal $A_c \cos \omega_c t$ is amplitude modulated by a message signal $A_m \cos \omega_m t$, where $A_m < A_c$.
- Write down the expression for the modulated signal.
 - Write down the expression for carrier component and side band components.
 - Draw the phasor diagram of the modulated signal.
- 2 + 2 + 1
4. Explain briefly the VSB-SC modulation. 5
5.
 - What is angle modulation ?
 - Show that FM and PM are basically same. 2 + 3
6. Explain FM demodulation scheme using PLL. Mention the advantages of PLL demodulator. 4 + 1
7. Derive the expression for overall noise figure of a cascaded system 5

GROUP – C**(Long Answer Type Questions)**Answer any *three* of the following. 3 × 15 = 45

8.
 - What do you mean by DSB-SC modulation ? Explain the function of ring modulator in DSB-SC generation.

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- b) Prove that the efficiency for a single tone AM is 33.33 % for perfect modulation. What will be the efficiency if the value of modulation index is 0.5 ?
- c) An AM transmitter has an unmodulated carrier power of 10 kW. It can be modulated by a sinusoidal modulating voltage to a maximum depth of 40%, without overloading. If the maximum modulation index is reduced to 30%, what is the extent up to which the unmodulated carrier power can be increased without overloading ? (1 + 4) + (3 + 2) + 5
9. a) Compare AM and NBFM.
- b) An angle modulated signal is described by the equation $s(t) = 12 \sin [6 \times 10^8 t + 5 \sin 1250 t]$.
Calculate :
- carrier frequency
 - modulating frequency
 - modulation index
 - frequency deviation
 - power dissipated in 10Ω resistor.
- c) Explain with suitable block diagram the generation of FM signal using Armstrong method.
- d) What is Carson's rule ? Explain it. 2 + 5 + 5 + 3
10. a) Explain the terms — 'selectivity', 'sensitivity', and 'fidelity' of a receiver.
- b) Draw the block diagram of a superheterodyne receiver and explain the function of each block.

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- c) For a broadcast superheterodyne AM receiver having no RF amplifier, the loaded quality factor Q of the antenna coupling circuit is 100. Now if the intermediate frequency is 455 kHz, then determine the image frequency and its rejection ratio at an incoming frequency of 1 MHz. 5 + 7 + 3

11. a) What do you mean by thermal and white noise ?
- b) An amplifier operating over the frequency range from 18 MHz to 20 MHz has a $10\text{ k}\Omega$ input resistor. What is the r.m.s. noise voltage at the input to this amplifier if the ambient temperature is 27°C .
- c) Define SNR and Noise Figure. Why is the noise performance of the first stage of a cascade receiver so important ? If each stage of a two-stage cascade amplifier has a gain of 10 dB and noise figure of 10 dB, calculate the total noise figure in dB.
- d) Calculate the signal to noise ratio $(S/N)_0$ at the output of a synchronous SSB-SC demodulator.

$$2 + 3 + (3 + 1 + 2) + 4$$

12. Write short notes on any *three* of the following : 3 × 5

- a) P e-emphasis and De-emphasis
- b) Foster-Seeley Detector
- c) Noise performance in FM system
- d) FDM
- e) VCO.
