Roll No.:.....

National Institute of Technology, Delhi

Name of the Examination: B. Tech.

Branch	: ECE	Semester	: 4th
Title of the Course	:Analog communication	Course Code	: ECB253

Time: 3 Hours | Maximum Marks: 50

Note :

Guidelines:

Section A: Contains Five (05) questions and all parts are compulsory.

Section B: Contains Five (05) questions of 5 marks each and any four (04) are to be attempted.

Section C: Contains Two (02) questions of ten (10) marks each and any two (02) are to be attempted.

Section A

Q1. What are the various types of amplitude modulation techniques? Give their relative merits and demerits. How can you measure modulation index using CRO? **2**

Q2. Define Carson's rule for single-tone and multiple-tone FM and PM signals. **2**

Q3. Define and explain the terms: noise figure and noise temperature of a 2 port network? How are they related? **2**

Q4. The most noisy stage of an AM broadcast receiver is

a. the RF stage b. the mixer stage

c. the IF stage d. the audio stage **1**

Q5. A pre-emphasis circuit provides extra noise immunity by

a. boosting the bass frequencies b. amplifying the higher audio frequencies

c. pre amplifying the whole audio band d. converting PM to FM **1**

Q6. What is aliasing? How can it be reduced or avoided? **2**

Section B

Q7. An amplitude modulated amplifier has a radio frequency output of 50W at 100% modulation. The internal loss in the modulator is 10 W:

a) What is the unmodulated carrier power?

b) What power output is required from the modulator (baseband signal)? **5**

c) If the percentage modulation is reduced to 75%how much power is needed from the modulator?

Q8. A carrier is frequency modulated by $m(t) = A_m \sin w_m t$ with frequency modulation sensitivity constant k_f. The resulting modulation index is β_f. The same carrier is phase modulated by m(t) with phase modulation sensitivity constant k_p. The resulting modulation index is β_p.Obtain the relationship between k_f and k_p so that $\beta_f = \beta_p$. **5**

Q9. A satellite receiving system consists of a low- noise amplifier (LNA) that has a gain of 47dB and a noise temperature of 120k, a cable with a loss of 6.5 dB and the main receiver with a noise factor of 7 dB. Calculate the equivalent noise temperature of the overall system referred to the input for the following system connections. **5**

a) LNA at the input followed by the cable connecting to the main receiver.

b) The input direct to the cable, which is then connected to LNA, which in turn, is connected to the main receiver.

Q10. A double conversion receiver is tuned to an incoming signal of 25 MHz at which frequency its tank circuit has a Q of 65. The receiver is using a first IF of 1.5 MHz and a second IF of 150 kHz. Calculate (in decibles) the image frequency rejection. Make reasonable assumption, if necessary. **5**

Q11. Explain how a PPM signal may be converted into PAM signal. **5**

Section C

Q12. Derive an expression for the figure of merit γ when the modulating signal f(t) is a single tone sinusoid given by $f(t) = m_a A \cos(w_m t)$, where m_a is the modulation index, and A is the carrier amplitude and n(t) is noise. Find the value of γ when the depth of modulation is: (a) 100% (b) 50% and (c) 30%. **10**

Q13. Consider the modulating signal $m(t) = 10 \sin(2\pi 10^4 t)$,that is used to modulate a carrier frequency of 25 MHz.

a) Find the bandwidth for 98% power transmission for phase modulation and frequency modulation using $\beta_f = \beta_p = 10$. **10**

b) Repeat (a) when modulating frequency is doubled.

c) Repeat (b) when amplitude of the modulating signal is halved.