

Register Number.....

**B.E., DEGREE EXAMINATIONS: NOV/DEC 2012**

Fifth Semester

**ELECTRONICS AND COMMUNICATIONS ENGINEERING**

ECE110: Communication Theory

**Time: Three Hours**

**Maximum Marks: 100**

**Answer All Questions:-**

**PART A (10 x 1 = 10 Marks)**

1. A 400W carrier is amplitude modulated to a depth of 75%. The total power in the modulated wave is  
(A) 512.5 W                      (B) 112.5W                      (C) 56.25 W                      (D) 400W
2. A 100KHz carrier is amplitude modulated by a modulating signal of highest frequency 500Hz . The bandwidth required for the transmission of this AM signal is  
(A) 100.5 KHz                      (B) 99.5 KHz                      (C) 1 KHz                      (D) 10 KHz
3. In a frequency modulated signal, the frequency deviation is proportional to  
(A) frequency of the modulating signal                      (B) amplitude of the modulating  
(C) Both (A) & (B)                      (D) phase of the modulating signal
4. FCC allows a maximum frequency deviation of \_\_\_\_\_  
(A) 75 KHz                      (B) 150 KHz                      (C) 100 KHz                      (D) 110 KHz
5. The sensitivity of radio receivers usually lie in the range of  
(A) millivolts                      (B) microvolts                      (C) volts                      D) Pico volts
6. Intermediate frequency amplifiers are tuned voltage amplifiers operated in ----- mode.  
(A) Class A                      (B) Class B                      (C) ) Class C                      (D) Class D
7. Two resistors 20kilo ohms and 50 kilo ohms are at room temperature connected in series.  
The thermal noise voltage in a bandwidth of 100KHz is -----  
(A) 10.77 microvolts                      (B) 9.1 microvolts  
(C) 4.864 microvolts                      (D) 1.38 microvolts
8. The figure of merit in an FM receiver is quadratic function of -----  
(A) Bandwidth of FM                      (B) Deviation ratio of FM  
(C) Power of FM Gain                      (D) phase of FM
9. The maximum of value of entropy of a source emitting 4 symbols with equal probability of occurrence is  
(A) 2                      (B) 4                      (C) 6                      (D) 8

10. A binary symmetric channel emits two symbols at a rate of 1000 symbols per second with equal probability. The rate of information transmission is  
(A) 1000bps                      (B) 500bps                      (C) 100bps                      (D) 5000bps

**PART B (10x2=20 Marks)**

11. Calculate the modulation index and percentage modulation if the instantaneous voltages of modulating signal and carrier are  $40 \sin \omega_m t$  and  $50 \sin \omega_c t$
12. State the advantages and applications of VSB modulation.
13. A carrier is frequency modulated by a sinusoidal signal of 2 KHz resulting in a maximum frequency deviation of 5 KHz. Find the modulation index and bandwidth of the FM signal.
14. Differentiate between narrowband and wideband FM in their spectrum.
15. Find the tuning range of a local oscillator capacitor in an AM receiver which tunes over the range of signals from 500KHz to 1600KHz and uses intermediate frequency of 465 KHz if the local oscillator frequency is higher than the signal frequency.
16. State the reasons for maintaining 30% to 40% modulation in the AM broadcasting transmitter stations.
17. Draw the power spectral density and autocorrelation function of White noise.
18. What is threshold effect in FM receivers?
19. An information source which emits 2 symbols X and Y. The probability of occurrence of X is twice that of the occurrence of Y. Find the entropy of the information source.
20. Prove that the mutual information is always positive.

**PART C (5x 14=70 Marks)**

21. a) (i) With the help of mathematical expressions and sketches, explain the principle of Amplitude modulation in time domain and in frequency domain. (7)
- (ii) Draw the circuit diagram of Ring modulator and explain its operation (7)
- (OR)
- b) (i) Discuss how a SSBSC signal is generated using phase shift method. (7)
- (ii) Draw the block diagram of an AM transmitter and explain the function of each block. (7)
22. a) (i) With the help of mathematical expressions and sketches, explain the principle of Frequency modulation in time domain and in frequency domain. (7)
- (ii) Illustrate the method of generation of FM using reactance modulator. (7)

(OR)

- b) (i) Explain how PM can be generated from FM signal. (7)  
(ii) Discuss the operation of an FM transmitter with necessary block diagram. (7)

23. a) (i) Discuss the operation of FM broadcast receiver. (7)  
(ii) Explain the working of an AFC in an FM receiver (7)

(OR)

- b) (i) Derive the condition necessary for avoiding the diagonal clipping an AM envelope detector. (7)  
(ii) Discuss the various factors influencing the choice of IF in radio receivers. (7)

24. a) (i) A single stage amplifier has an input resistance  $R_i$ , output resistance  $R_o$ , and a voltage gain  $A$ . Derive an expression for the total equivalent noise input resistance of this amplifier. (7)  
(ii) Derive an expression for the signal to noise ratio in an AM system that uses envelope detector in the presence of AWGN. (7)

(OR)

- b) (i) Derive an expression for the signal to noise ratio in an FM system. (7)  
(ii) Explain the capture effect in FM system. (7)

25. a) (i) State and prove Shannon's channel capacity theorem. (7)  
(ii) For an AWGN channel with a 4 KHZ bandwidth and noise power spectral density of 10-12 Watts/Hz, the signal power required at the receiver is 0.1mW. Calculate the capacity if this channel. (7)

(OR)

- b) (i) Encode the following source alphabets  $\{a_1, a_2, a_3, a_4, a_5, a_6, a_7, a_8\}$  with probabilities ( 0.05, 0.1, 0.15, 0.4, 0.02, 0.03, 0.15, 0.1) Using shamon – Fano and Huffman coding techniques. Compare the coding efficiency. (12)  
(ii) What is mutual information's?

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