EE4330/5361
Fundamentals of Telecommunication Systems
Instructor: Dr. K.R.Rao

Test 2
April/05/05 Tuesday
3:30pm-4:50pm

(1) Closed books and closed notes
(2) Any additional information required is attached to the test, you can only use
   the four-page cheat sheet handout
(3) Choose only one answer from the options given
(4) Please print your name and last four digits of your ID
(5) Once the test is returned to you, please do not make any corrections, we will
   keep copies of all your tests

Student Name:
Student ID:
Course No: ___________4330__________5361
1. The radio receiver of AM modulation is called _______. (5 points)
   (a) Super heterodyne
   (b) Rake receiver
   (c) Monophronic receiver
   (d) Stereo Receiver

2. Selectivity in super heterodyne Receiver is realized in which section ______? (5 points)
   (a) RF section
   (b) Mixer section
   (c) LO section
   (d) IF section

3. If in super heterodyne receiver (up-conversion) IF frequency = 95 KHz and incoming carrier frequency = 40 KHz then what is LO frequency ______? (5 points)
   (a) 95 KHz
   (b) 55 KHz
   (c) 45 KHz
   (d) 135 KHz

4. E(t) is the angle modulated signal.
   \[ E(t) = 10 \cos (\omega_c + \sin 3000t + 10 \sin (2\pi f \pm t)) \] Here, \( \omega_c = 2\pi \times 100000 \) (10 points)
   (a) Find the power of the modulated signal = ________
   (b) Find the frequency deviation in Hz ________
   (c) Find the deviation ratio = ________
   (d) Find the phase deviation = ________
   (e) Estimate the bandwidth of E(t) in Hz = ________
5. The primary reason for using angle modulation is microwave radio relay system is ______ (5 points)

(a) Easy to implement the modulating circuit
(b) Low bandwidth
(c) Immunity to nonlinearity
(d) High bandwidth

6. Which of the following is not practical Frequency Demodulator? ______ (5 points)

(a) Balanced demodulator
(b) PLL
(c) Zero crossing detector
(d) Rectifier demodulator

7. Fill in the right block (5 points)

8. If \( m(t) = 4 \cos(8\pi t) \) and \( K_v = 8 \pi \) (10 points)

(a) peak frequency deviation in Hz = ________
(b) modulation index = ________
(c) The FM modulated signal for above \( m(t) \) is 
\[ E(t) = 10 \cos(100\pi t + \phi(t)) \]

If it is passed through filter with gain 1, centered at frequency 54 Hz and following characteristic
(d) Find the power at the output of the filter = __________? (use Bessel function)

9. The amplitude variations of the angle modulated carrier can be eliminated by __________? (5 points)
   
   (a) Differentiator
   (b) Integrator
   (c) Band pass filter
   (d) Band pass limiter

10. We are using Phase-Locked Loop (PLL) as a FM demodulator. How do you modify this system to demodulate a FM signal? __________ (5 points)
11. In small error analysis of PLL as a FM demodulator, for a first order loop with 
$H(s) = \frac{1}{s}$, the signal can not be tracked if__________ . (5 points) 
(a) The instantaneous frequency is varying linearly with time 
(b) The amplitude is varying linearly with time 
(c) The instantaneous frequency is constant 
(d) The amplitude is constant

12. The channel noise acts as interference in an angle-modulated signal. In 
__________, the interference increases linearly with frequency? (5 points) 
(a) FM 
(b) FM 
(c) FM with preemphasis-deemphasis 
(d) None of the above

13. At intermediate frequencies, pre-emphasis behaves like a . _______. (5 points) 
(a) Adder 
(b) Differentiator 
(c) Integrator 
(d) Subtractor

14. What is the main purpose of using PDE in FM broadcasting? _______. (5 points) 
(a) To reduce interference by channel noise at higher frequencies. 
(b) To attenuate the lower frequency components of the message signal 
(c) To reduce the bandwidth of the modulated signal 
(d) None of the above

15. In FM stereo transmission, if we ignore the pilot, frequency deviation $\Delta f$ of 
composite signal is practically _______ that of the monaural signal. This can 
be explained by intermodulation effect. (5 points) 
(a) higher than 
(b) lower than 
(c) equal to 
(d) higher or equal to
16. Consider a signal $g(t)$ whose spectrum is band-limited to $B$ Hz, what is Nyquist rate for signal $g^\prime(t)$? __________ (5 points)
   (a) $B$ Hz
   (b) $2B$ Hz
   (c) $B/2$ Hz
   (d) $4B$ Hz

17. Anti-aliasing filter is used to solve spectral folding problem. The anti-aliasing operation must be performed ____ the signal is sampled? (5 points)
   (a) before
   (b) after
   (c) either before or after

18. Considering the implementation of realistic filter, we sample the signal in practice at a rate ______ the Nyquist rate? (5 points)
   (a) higher than
   (b) lower than
   (c) equal to