Reg. No.	

B.E/B.TECH (Full Time) DEGREE END SEMESTER EXAMINATIONS, APR/MAY 2013

B.E. Electronics and Communication Engineering

IV Semester

23

EC 9253 - Communication systems

(Regulation 2008)

Time: 3 hours **Max. Marks: 100**

Answer ALL questions

Part – A (10 x 2 =20 Marks)

1. What is the need for modulation?
2. Suppose that the modulating signal is a sinusoid of the form

   $m(t) = \cos 2\pi f_m t\,, \quad f_m \ll f_c\,.$

   Determine the two possible SSB-AM signals and also draw the corresponding spectrum of the signal.
3. Define noise figure and noise temperature.
4. What is companding technique in baseband modulation?
5. A baseband signal is given by $x(t) = 5\cos 1000\,\pi\, t + \cos 4000\,\pi\, t$. Find the minimum sampling rate obeying Nyquist sampling rule. If the sampling rate is increased by 25% over the minimum sampling rate, what will be the maximum guard band?
6. Calculate the bit rate if a binary signal with the following formats are sent over a leased telephone line of bandwidth 2.7 kHz. (a) bipolar scheme (b) polar scheme.
7. Compare the BPSK and BFSK modulation schemes in terms of data rate, band width and error probability.
8. Draw the block diagram of non coherent DPSK detector.
9. What is the required power in an FM system with $\beta = 5$ if W=15 kHz and $N_o = 10^{-14}$ W/Hz? The power of the normalized message signal is assumed to be 0.1 watt and the required SNR after demodulation is 60 dB.
10. What is threshold effect in FM system?

Part – B (5 x 16 =80 Marks)

11. (i) The carrier $c(t) = A\cos 2\pi\, 10^6\, t$ is angle modulated by the sinusoid signal $m(t) = 2\cos 2000\,\pi\, t$. The deviation constant k_f = 3000 Hz/v.
    a) Determine β_f. (2)
    b) Determine the bandwidth in each case using Carson's rule. (2)
    c) Plot the spectrum of the modulated signal in each case.(Plot only those frequency components that lie within the bandwidth derived in Part (b)). (6)
    d) If the amplitude of m(t) is decreased by a factor of two, how would your answer to Parts (a)-(c)change? (2)

    (ii) Explain the coherent detection of DSBSC waves in detail. (4)

12. a) (i) Draw the block diagram of the superheterodyne FM receiver and explain the functionality of each block in detail. (12)

    (ii) A superheterodyne FM receiver operates in the frequency range of 88-108 MHz. The IF and local-oscillator frequencies are chosen such that $f_{IF} < f_{LO}$. We require that the image frequency f_c' fall outside of the 88-108 MHz region. Determine the minimum required f_{IF} and the range of variation in f_{LO}. (4)

(OR)

12. b) An AM is generated by modulating the carrier f_c = 800 kHz by the signal m(t) = sin2000 π t + 5 cos 4000 π t. The AM signal u(t) = 100 [1+m(t) cos 2 π f_c t] is fed to a 50 Ω load.
    a) Determine and sketch the spectrum of the AM signal. (6)
    b) Determine the average power in the carrier and in the side bands. (4)
    c) what is modulation index and the peak power delivered to the load? (6)

13. a) (i) Explain the pulse code modulation technique with neat block diagram. (12)

    (ii) Consider an audio signal with spectral components limited to the frequency band 300 to 3300 Hz. Assume that a sampling rate of 8000 samples/s will be used to generate a PCM signal. Assume that the ratio of peak signal power to average quantization noise power at the output needs to be 30 dB.
    1. What is the minimum number of uniform quantization levels needed, and what is the minimum number of bits per sample needed?
    2. Calculate the system bandwidth required for the detection of such a PCM signal. (4)

(OR)

13. b) (i) Explain the Delta Modulation in detail. (8)

(ii) Discuss DPCM in detail. (8)

14. a) Derive the expression for probability of error for QPSK modulation technique. (16)

(OR)

14. b) Obtain the expression for Coherent and non coherent FSK modulation in detail and compare the above two schemes. (16)

15. a) Discuss the noise performance of AM by deriving the essential expressions. (16)

(OR)

15. b) A system using matched filter detection of equally likely BPSK signals, $S_1(t) = \sqrt{2E/T}\cos\omega_0 t$ and , $S_2(t) = \sqrt{2E/T}\cos(\omega_0 t + \pi)$, operates in AWGN with a received E_b/N_o of 6.8 dB. Assume that E{z(T)} = $\pm\sqrt{E}$.

1. Find the minimum probability of bit error, P_B for this signal set and E_b/N_o (6)
2. If the decision threshold is $\gamma = 0.1\sqrt{E}$ find P_B. (4)
3. The threshold of $\gamma = 0.1\sqrt{E}$ is optimum for a particular set of a prior probabilities, $P(S_1)$ and $P(S_2)$. Find the values of these probabilities. (6)