Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

Manipal University, Manipal – 576 104

VI SEMESTER B.Tech. (BME) DEGREE END SEMESTER EXAMINATIONS, MAY 2016

SUBJECT: TELEMETRY SYSTEMS (BME 308)

(REVISED CREDIT SYSTEM)

Wednesday, May 11, 2016, 2.00 - 5.00 p.m

TIME: 3 HOURS **MAX. MARKS: 100**

Instructions to Candidates:

1. **Answer any FIVE full questions.**
2. **Draw labeled diagram wherever necessary**

1. (a) (i) Define AM DSB FC modulation. Why are the values of amplitude modulation index greater than one, not used in full-carrier AM transmission systems? (2+2)
(ii) The power transmitted by a SSB transmitter is 10KW. It is required to be replaced by standard AM transmission having a modulation index of 0.8 and same power. Determine the power contents of the carrier and each of the sidebands. Also, calculate the ratio (in %) of the power in the sidebands to the total power. (4)

(b) Explain the effect of errors in phase and frequency associated with the carrier signal used at the DSB-SC demodulator. Suggest a solution to the problem. (6)

(c) Show that, when an SSB signal is accompanied by a carrier, the diode demodulator recovers the signal. (6)

2. (a) (i) A modulating signal with an instantaneous value of -2V modulates the frequency of a carrier signal whose frequency is f_c = 108MHz.The deviation constant of FM modulator is given by k_f = 30KHz/V. Find the frequency of the resultant FM wave. (3)

(ii) Compare the salient features of amplitude modulation and angle modulation. (5)

(b) (i) Why is the amplitude (or power level) of the carrier signal in FM spectrum not constant? (2)

(ii) Explain the features of the Bessel's coefficients. (5)

(c) Consider an angle-modulated signal generated by frequency-modulation process: $V_{FM}(t) = 20 \cos [2\pi 10^6 t + 0.1 \sin (10^4 \pi t)]$. Given $k_f = 10\pi$, derive the expression for the modulating signal. [Assume $V_m(t) = V_m \cos (10^4 \pi t)$] (5)

3. (a) (i) What is the advantage of non-linear demodulation over linear synchronous demodulation? (2)
(ii) An audio signal of 4KHz bandwidth is to be transmitted through a channel that introduces 30dB loss, and white noise of power spectral density 10^{-9}W/Hz. Calculate the required minimum transmitter power, if the message is sent by SSB, DSB-SC and DSB-FC modulation. The output SNR at the receiver should be more than 40dB. For DSB-FC, energy in the sideband is half the energy in the carrier. (5)

(b) (i) At poor signal conditions, which of the demodulators (square law or envelope demodulator) would perform better? Why? (2)
(ii) Explain the performance of the synchronous demodulator for AM-DSB-SC detection in the presence of noise (Note: Calculate the noise power using quadrature noise components). (5)

(c) With suitable examples, explain the process of frequency division multiplexing. (6)

4. (a) (i) Show that each increase in the bandwidth by a factor of 2, increases the ratio of γ_{FM}/γ_{AM} by a factor of 4. (3)

(b) (i) Calculate the noise power in the FM demodulator. (8)

(ii) Why does the FM demodulators also exhibit the threshold effect. (3)

(c) Consider an angle modulated signal $x(t) = 3cos[2\pi 10^6 t + 2sin(2\pi 10^3 t)]$. Find its (i) instantaneous frequency at time t =0.25msec and t = 0.5msec (ii) maximum phase deviation and, (iii) maximum frequency deviation. (6)

5. (a) (i) With a suitable example, explain the basic operation of a Pulse code modulation system in the transmitter section. Also, list the advantages and disadvantages if the PCM technique. (6+4)
(ii) An analog signal with a baseband frequency range from zero to 4MHz is transmitted by PCM, using 8 bits/sample and a sampling rate of 10MHz. Determine the number of quantization levels, the transmission bit rate and the code-word length. (3)

(b) Pulse modulation systems are not completely digital in nature. Justify. (2)

(c) With a neat figure, explain the process of multiplexing in time domain and write a note on the maximum sample duration. (3+2)

6. (a) (i) What are the advantages of using DPSK over coherent methods? (1)

(ii) Explain the method of generating the DPSK signal. Assume the binary message data to be 11010010 and the initial bit to be 1. (6)

(iii) Sketch the detected signal from the DPSK detector. (3)

(b) Differentiate BASK from BPSK. Also, sketch the waveforms for each of the above mentioned methods. (5)

(c) Differentiate synchronous and asynchronous service. Give two examples for each type. (3+2)