Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
A Constituent Institution of Manipal University

6th SEMESTER B.Tech. (BME) DEGREE MAKE UP EXAMINATIONS JUNE 2017

SUBJECT: TELEMETRY SYSTEMS (BME 308)

(REVISED CREDIT SYSTEM)

Saturday, 17th June 2017, 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) Explain how the modulating signal can be recovered using a square law detector. (7)
(ii) Draw the AM envelopes for m=1; m=0.5 and m=0. Assume the input to be a sinusoidal signal. (3)

(b) (i) A carrier signal having 10V peak amplitude is amplitude modulated by three different modulating frequencies with peak amplitude levels of 2V, 3V and 4V respectively. Compute the modulation index of the resultant complex AM signal. (3)

(c) Show that when a SSB signal is accompanied by a carrier, the diode demodulator demodulates the signal. (7)

2. (a) (i) Explain the synchronous method for the detection of AM-DSB-SC. Also, show the effect of phase error in coherent detection of DSB-SC signal. (3+2)
(ii) The baseband signal is a voice signal which extends over a frequency range from 300 Hz to 3400 Hz. It is transmitted by amplitude –modulation process using 1MHz carrier-frequency signal. Compute the signal transmission bandwidths by DSB-SC and SSB AM technique. What is the percentage reduction in bandwidth in SSB transmission? (3)

(b) (i) Show that DSB-SC amplitude modulation is linear, while frequency modulation is not. (6)

(ii) The power transmitted by a (Single Sideband) SSB transmitter is 10KW. It is required to be replaced by standard AM transmission having modulation index of 0.8 and having the same power. Determine the power content of the carrier and power in each of the sidebands. (4)

(c) Explain the generation of VSB modulated signal. (2)

3. (a) (i) What are the features of the Bessel's coefficients? (6)

(ii) A modulating signal with the instantaneous value of 150mV modulates the frequency of a carrier signal, f_c=100MHz. The deviation constant of FM modulator is specified as k_f = 30KHz/V. Find the output signal frequency of the resultant FM wave. (4)

(b) (i) Explain the indirect method for the generation of FM signal. (7)

(ii) A 10 MHz carrier signal is frequency-modulated by an analog- modulating signal. The maximum frequency deviation is 75KHz. Determine the modulation index and the approximate transmission bandwidth of the FM signal, if the frequency of the modulating signal is 75KHz and 300KHz. (3)

4. (a) (i) Using quadrature components, calculate the output noise power in AM-DSB-SC using synchronous demodulator. (4)

(ii) Consider an angle modulated signal, $x_c(t) = 100 \cos [2\pi f_c t + 5 \sin (2\pi f_m t)]$. Assume frequency modulation and f_m=1KHz. Compute the frequency modulation index and the approximate bandwidth of the FM signal. Determine the approximate bandwidth of the FM signal when (i) f_m is halved, and (ii) f_m is doubled. (5)

(b) (i) Show that the output SNR is equal to the input SNR for the coherent detector used in SSB detection. (7)

(ii) A phase modulated signal is given as $V_{PM}(t) = 20 \cos [2\pi\ 10^6 t + 0.1 \sin(10^3 \pi t)]$ Given k_p = 10, determine the frequency of the modulating signal. (4)

5. (a) (i) Give a comparison of FM and AM. (4)

(ii) Find the figure of merit in case of a FM signal for sinusoidal modulation with maximum frequency deviation of 75KHz and baseband filter bandwidth equal to 15KHz. (4)

(b) (i) A modulating signal $m(t) = 10[\cos^2 2\pi 100t][\cos^2 2\pi 1000t]$ is to be sampled periodically. Determine the minimum sampling rate so that the signal can be uniquely reconstructed. (3)

(ii) Differentiate TDM from FDM. (3)

(c) Explain the detection process of pulse time modulated signal. (6)

6. (a) (i) Explain the non-coherent method of detection of BASK. (5)

(ii) Show that for 100% modulation, each sideband of an AM signal contains only $1/6^{th}$ of the total transmitted power. (3)

(b) Explain the process of detection of DPSK (5)

(c) Give atleast six medical applications of telemetry (7)