

**TIME: 3 HOURS** 

# MANIPAL INSTITUTE OF TECHNOLOGY

Manipal University, Manipal – 576 104



## 6<sup>th</sup> SEMESTER B.Tech. (BME) DEGREE MAKE-UP EXAMINATIONS JUNE/JULY 2016

### **SUBJECT: TELEMETRY SYSTEMS (BME 308)**

(REVISED CREDIT SYSTEM)

### Monday 4<sup>th</sup> July, 2016, 2.00 - 5.00 p.m

**MAX. MARKS: 100** 

#### **Instructions to Candidates:** Answer any FIVE full questions. 1. 2. Draw labeled diagram wherever necessary (i) List and explain the different types of communication systems with one (2+2+4)(a) 1. application of each system. Also, explain the need for modulation. Which type of modulation would be well suited for the transmission of voice (3+4)(b) signals? Give reasons. Explain the method of detection of the AM-DSB-SC signal. (c) Show that the power contained in DSB-SC signal is only 1/3<sup>rd</sup> that of total power (5)transmitted in AM signal, when the carrier signal is amplitude modulated with modulation index of unity. An AM signal is given by the expression 2. (a) $V_{AM} = 10 [1 + 0.5 \sin (2\pi 10^3 t) + 0.2 \sin (4\pi 10^3 t)] \sin (2\pi 10^6 t)$ volts. Find: (5) (i) The net modulation index, (ii) Unmodulated carrier power, (iii) Sideband power and (iv) Total power of the AM signal. (b) (i) Draw and explain the process of FM detection in detail. (7)(ii) Show that a frequency modulated signal can be obtained using a phase (4)modulator. A sinusoidal signal of 4K Hz modulates an analog carrier signal using FM process, (c) (4)producing maximum frequency deviation of 10KHz.(i) Determine the bandwidth of the FM signal using Carson's rule.(ii) If the frequency of the modulating signal is decreased to 2KHz and its amplitude is increased by a factor of 3. Determine the

frequency modulation index, maximum frequency deviation and the bandwidth of

the FM signal.

| 3. | (a) | A received DSB-SC signal of strength 1mW has a power spectrum which extends<br>over the frequency range $f_c - f_m = 0.995$ MHz to $f_c + f_m = 1.005$ MHz. The accompanied<br>noise has a uniform power spectrum density of $10^{-9}$ W/Hz. This is multiplied by a<br>carrier of frequency 1MHz and then followed by a baseband filter (having cut-off<br>frequency $f_m$ ) to retrieve the message signal. What is the massage bandwidth? Find<br>the signal and the noise energy at the output of the baseband filter and calculate the<br>output SNR. How does the SNR change if the bandwidth of the message signal is<br>reduced by 25%? | (5)  |
|----|-----|---|------|
|    | (b) | Define 'threshold effect' in the square law detector, used for the detection of AM-<br>DSB-FC. Calculate the output SNR of the square law detector when the noise is<br>considerably large compared to the signal.  | (9)  |
|    | (c) | Explain the performance of the coherent detector for the detection of AM-SSB in the presence of noise.  | (6)  |
| 4. | (a) | (i) Show that DSB-SC amplitude modulation is linear, while phase modulation is  | (5)  |
|    |     | not.<br>(ii) What are the different types of noise that can affect the communication system?  | (3)  |
|    | (b) | Draw the block diagram of the FM demodulator and calculate the output signal power for the FM demodulator.  | (8)  |
|    | (c) | Consider a modulating signal $m(t) = 2 \sin (2\pi 10^3 t)$ used to modulate a carrier of frequency 10 <sup>6</sup> Hz. Find the bandwidth for (i) Phase modulation and frequency modulation (use the modulation index to be 10 for both FM and PM)  | (4)  |
| 5. | (a) | With a neat diagram, explain the process of detection of pulse time modulated signal.   | (5)  |
|    | (b) | Consider a pulse amplitude modulated-Time Division Multiplexed (PAM-TDM) system. There are five messages multiplexed in the system and the time period of one cycle is 1msec. (i) Assuming the pulse width to be 150µsec, find the guard time. (ii) Maintaining the same guard time, if there is a need to transmit 10 PAM messages (time multiplexed), how narrow should the pulses be?  | (6)  |
|    | (c) | (i)Explain the process of detection of the pulse code modulated signal.   | (5)  |
|    |     | (ii) Differentiate PAM and PDM signal. Also draw suitable waveforms to illustrate the PAM and PDM wave.   | (4)  |
| 6. | (a) | Explain the generation and detection of the DPSK signal   | (10) |
|    | (b) | What are the three types of digital modulation techniques? Explain  | (10) |