Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

V SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2015

SUBJECT: COMMUNICATION SYSTEMS [ELE 305]

REVISED CREDIT SYSTEM

Time: 3 Hours 30 NOVEMBER 2015 MAX. MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL** questions.
- Missing data may be suitably assumed.

1A. A signal Vi=2cos1000πt + 0.05 cos100πt is amplitude modulated by a square law modulator. The non-linear device has the following characteristics Vo = Vi +0.01Vi^2. The output of the square law device is passed through a BPF with frequency range 350 Hz to 650Hz. Sketch the amplitude spectrum of the BPF output signal. (03)

1B. Two signals $x_1(t)$ and $x_2(t)$ having fourier transform $X_1(f)$ and $X_2(f)$ shown in Figure 1B are combined to form $y(t) = x_2(t) + 2x_1(t) \cos 2\pi f_c t$, f_c = 20 kHz. If y(t) is transmitted then

a. Draw the spectrum of the signal y(t).
b. Find the Bandwidth required for transmission.
c. At the receiver side, suggest suitable method to recover $x_1(t)$ and $x_2(t)$ from y(t).

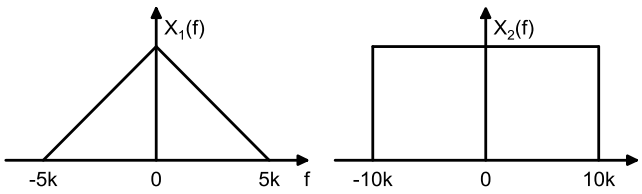

Figure 1B (03)

1C. Discuss the Modulator and demodulator for SSB-SC technique with mathematical expressions and block diagram. (04)

2A. From the fundamental equations of Angle modulation, evaluate the bandwidth requirements for wideband FM. (04)

2B. For a WBFM transmitter using indirect method, modulating the voice signals at 15kHz, the system specifications are: carrier frequency at the transmitter output, fc_t = 100 MHz; Maximum frequency deviation, Δf_t = 75 kHz; Maximum modulation index in the phase modulator = 0.2 radians, crystal carrier frequency =0.1MHz and mixer local oscillator frequency =9.5MHz

a. Calculate the frequency multiplication factors *n1* and *n2* which satisfy these specifications.
b. Specify the values of the carrier frequency and frequency deviation at the output of modulator, mixer and multipliers. (03)

2C. Discuss the solutions to improve Signal to Noise Ratio (SNR) in FM and suggest the circuit level solutions to achieve it. (03)

3A. Let message signal m(t) = cos ($4\pi 10^3$t) and carrier signal c(t) = 5cos($2\pi 10^6$t) are used to generate FM signal. If frequency deviation of the generated FM signal is three times than the transmission bandwidth of AM signal, then find the coefficient of the term cos($2\pi \times 1008 \times 10^3$t) in the FM signal. (02)

3B. Explain flat-top sampling and derive the expression for flat-top PAM signal in frequency domain. (03)

3C. With neat block diagrams, discuss the PCM transmitter and receiver. (05)

4A. With a neat block diagram of coherent receiver, derive an expression for average probability of error of BFSK. (04)

4B. Binary signal is transmitted over an AWGN channel using BPSK at a rate of 1 MBPS. The noise is zero mean with power spectral density No/2 = 10^{-20} W/Hz. The amplitude of received signal in the absence of noise is 1 µV. Determine the average probability of error for coherent detection of BPSK. (02)

4C. For the following signal s(t) shown in Figure 4C , Plot the matched filter output as a function of time.

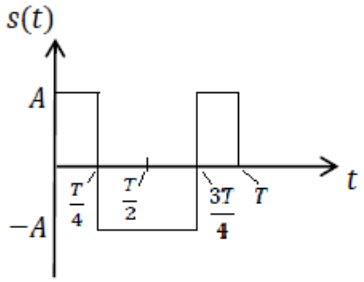

Figure 4C (04)

5A. For a convolutional encoder with constraint length=3 and the generator polynomial coefficients (1 1 0) , (1 1 1) and (1 0 1), Draw the complete trellis diagram upto 5 levels and then find the coded output for an input sequence (1 0 1 1 0) using the same. (05)

5B. If the binary stream 1 1 0 0 1 0 1 1 0 1 is to be transmitted, sketch the modulated signal waveform if the QPSK modulation scheme is employed. (02)

5C. Consider the transmitted signal,

$$S_i(t) = \begin{cases} \sqrt{\frac{2E}{T}} \cos\left(2\pi fct - i\frac{\pi}{4}\right), & 0 \le t \le T \\ 0, & otherwise \end{cases}$$

where i=0,1,2,3.

a)Find the set of co-ordinates and set of orthonormal basis functions to represent this set of signals.

b)Draw the signal constellation diagram. (03)

6A. The parity check matrix of a particular (7,4) linear block code is given by,

$$[H] = \begin{vmatrix} 1 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 \end{vmatrix}$$

Identify the generator matrix and the code word for the message 1011. (03)

6B. Describe the satellite system link model with block diagram. (04)

6C. Write short note on transmission and reception of digital signals using CDMA technology with neat sketches. (03)