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MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

V SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, NOVEMBER 2017

SUBJECT: COMMUNICATION SYSTEMS [ELE 3103]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 20 November 2017** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A. What are the basic components of communication system? Draw and explain the block diagram of typical communication system. ***(03)***

1B. An angle modulated signal is given as

$$s(t) = 10 \cos (2\pi*10^6t + 0.1 \sin 10^3\pi t)$$

If s(t) is an FM signal with k_f = 5Hz/volt, then determine the modulating signal m(t).
Instead, if s(t) is a PM signal with k_p =10Hz/volt, then determine m(t) ***(03)***

1C. Explain DSBSC-AM generation and detection with neat block diagram. ***(04)***

2A. The message signal of 15kHz and carrier of 100 kHz is fed to an Armstrong modulator with initial modulation index 0.2 radian. The transmitting signal at the antenna should be at 100MHz, with frequency deviation 75kHz. Use a mixer that produces an intermediate frequency which is the difference of the carrier frequency (9.5MHz) and incoming signal. (f_{LO}-f_{RF})

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

2B. A 10 MHz sinusoidal carrier is frequency modulated by a unit amplitude sinusoid of frequency 1 kHz. The frequency modulation sensitivity k_f=10 radians/sec-volt. Find

(i) Modulation index?
(ii) Bandwidth of the transmitted signal?
(iii) Justify with appropriate reason the type of modulation, NBFM or WBFM ? ***(03)***

2C. Mention the types of sampling with neat diagrams. Explain the method of generating PAM signal and derive the expressions for the following

(i) Time domain representation of the signal, s(t)

(ii) Frequency domain representation S(f)

(iii) Transfer function of H(f) for signal reconstruction at the receiving end. ***(04)***

3A. Explain PCM transmitter and emphasize on the use of regenerative circuit in the transmission channel with neat block diagrams. ***(04)***

3B. The input signal g(t) to a matched filter is a rectangular pulse of amplitude A and duration T. Find the impulse response h(t) and corresponding output signal go(t) of the matched filter. ***(02)***

3C. In the coherent detection of BPSK signal, the phase of the local oscillator signal at the receiving end differs from the carrier phase at transmitting end by θ radians. Find the effect of the phase error θ on the average probability of error of the system. Assume y = $+\sqrt{E}cos\theta + w1$, where w1 is white Gaussian noise, E is the symbol energy as given in fig Q3C. ***(04)***

4A. A binary sequence 10010011 is applied to a DPSK transmitter. Sketch the resulting waveform at the transmitter output by considering the arbitrary reference value of transmitted signal as 1 for the initial bit duration. And then show that the product of encoded sequence and its delayed sequence yields the original data. ***(03)***

4B. Explain with neat block diagram and expressions, generation and detection of binary symbol '1' using the shift keying technique which uses maximum channel bandwidth. ***(04)***

4C. In a (6,3) linear block code the parity bits are b1 = m1 $\oplus$ m2; b2 = m2 $\oplus$ m3; b3 = m1 $\oplus$ m3.

(i) Find the code vector for the message sequence [110]

(ii) If the received sequence is [111010] then evaluate the syndrome vector. If the received sequence erroneous then find the correct sequence. ***(03)***

5A. The trellis diagram of rate $\frac{1}{2}$ and constraint length-3 is shown in fig Q5A. Using Viterbi algorithm, compute the decoded sequence for the received sequence is '**1 0 0 0 1 0 0 0 0'.** ***(03)***

5B. Construct a complete code tree upto 5 levels for the encoder given in fig Q5B. Trace the path through the tree that corresponds to the message sequence '**1 0 1 1 1'**. ***(04)***

5C. With the help of suitable block diagrams explain uplink model and downlink model of a satellite communication system. ***(03)***

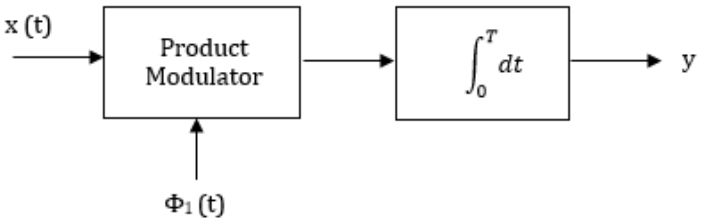

Fig Q3C

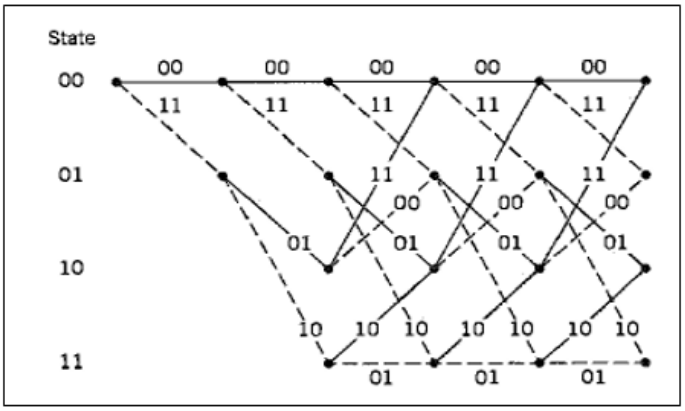

Fig Q5A

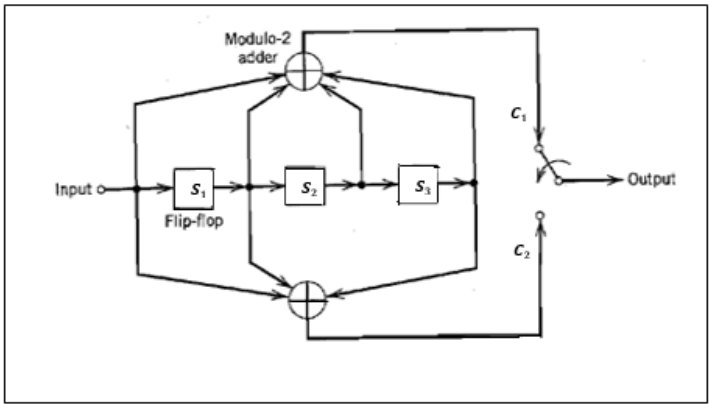

Fig Q5B