

**DA-IICT**  
**CT 303, Autumn 2021-2022**  
**End-Sem Exam: Part 2, B. Tech. (ICT and ICT-CS)**  
**Date: 17/12/2021, Duration: 1 Hour**  
**Marks: 60, Instructors: Dr. D. Ghodgaonkar and Dr. A. Jindal**

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General Instructions

- Answer all questions.
  - Use of Scientific Calculator is allowed.
  - Text Editor and Equation Editor are required.
  - There is no need to use Diagrams/Figures in your answers.
  - Limit answers of each question in 15 lines (or 250 words) or less.
  - Closed Books and Closed Notes Examination in Online Proctored Mode.
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1. (a) What is the main difference between coherent and noncoherent digital modulations? What are main features of phase-recovery circuit in receivers. Give 3 examples of coherent digital modulations and 3 examples of noncoherent digital modulations. **(8 marks)**  
(b) What is the concept of M-ary modulations? Give 3 examples of M-ary modulations. How bandwidth reduction by the factor  $n$  is accomplished in M-ary modulations? Assume there are  $M$  signals of symbol duration  $T$  and  $T = nT_b$ .  $T_b$  is the bit duration. **(8 marks)**  
(c) What is the full form of ASK, FSK, PSK and APK modulations? Why PSK and FSK types of modulations are preferred in microwave radio and satellite applications? **(4 marks)**

2. (a) A binary digital communication system employs the signals

$$\begin{aligned}s_o(t) &= 0, & 0 \leq t \leq 2T \\ s_1(t) &= 3A, & 0 \leq t \leq 2T\end{aligned}\tag{1}$$

for transmitting the information. This is called on-off signaling. The demodulator cross correlates the received signal  $r(t)$  with  $s_1(t)$  and samples the output of the correlator at  $t = T$ . Determine the optimum detector for an AWGN channel and the optimum threshold, assuming that the signals are equally probable. **(12 Marks)**

- (b) Elaborate on the equivalence of a QPSK system as two BPSK systems working on the in-phase and quadrature carriers independently. **(8 Marks)**
3. The Fourier transform  $P(f)$  of the basic pulse  $p(t)$  used in a certain binary communication systems is shown in Fig. 1 below. Note that in the figure, y-axis corresponds to  $P(f)$  and the value shown is  $10^{-6}$ , while on the x-axis the values are  $-2\pi \times 10^{-6}$  and  $2\pi \times 10^{-6}$ .
  - (a) From the shape of  $P(f)$ , explain at what pulse rate this pulse would satisfy Nyquist's criterion. **(4 Marks)**
  - (b) Find  $p(t)$  and verify that this pulse does (or does not) satisfy the Nyquist's criterion. **(10 Marks)**

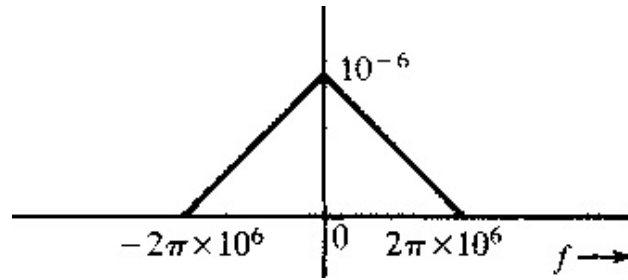


Figure 1: For question 3

- (c) If the pulse does satisfy the Nyquist criterion, what is the transmission rate (in bits per second) and what is the roll-off factor? **(6 Marks)**