EE321A
Communication Systems
Computer Assignment
Submission date: 12th April 2019

<div align="right">Max. marks: 10</div>

Instructions:

- Upload your assignment on Acadly as a single pdf file.

- Do not email the pdf files to the instructor/TAs.

- Do not upload MATLAB/Scilab/Octave/Mathematica/C program, doc, docx files.

- Assignment submitted after the due date may not be accepted.

- Mention your name and roll number on the assignment.

1. (a) Using the union bound, derive the average probability of symbol error for the 32-PSK constellation having unity radius.

   (b) Plot the theoretical symbol-error-rate vs the average SNR per bit and compare with the computer simulations, in the same plot. Take the average SNR per bit in the range 0 to 24 dB (both inclusive), in steps of 1 dB.

   (c) Clearly define the average SNR per bit. $(1 + 3 + 1$ marks$)$

2. Let $p(t)$ denote the time response corresponding to the root-raised cosine frequency spectrum [Vas18], with $B = 5$ MHz and $\rho = 0.11$.

   (a) What is the minimum sampling frequency, which is also an integer multiple of the symbol-rate? Denote this sampling frequency as $F_s = 1/T_s$. $(1$ mark$)$

   (b) Obtain $p_1(nT_s) = p(nT_s - \alpha)$, for $\alpha = 0.3T_s$ and $-20 \leq n \leq 20$, for integer n.

   (c) Obtain $p_2(nT_s)$ that is matched to $p_1(nT_s)$.

   (d) Obtain $p_3(nT_s) = p_1(nT_s) \star p_2(nT_s)$, where "$\star$" denotes convolution.

   (e) Plot $p_1(nT_s)$, $p_2(nT_s)$ and $p_3(nT_s)$ in three separate figures one below the other. Does it verify Figure E.4 in [Vas18]? $(2$ marks$)$

   (f) Repeat (b) – (e) for $\alpha = 0$. Does it verify Figure E.3 in [Vas18]?
                       $(2$ marks$)$

References

[Vas18] K. Vasudevan. Digital Communications and Signal Processing, Third edition, 2018. [accessed: 2018-01-01].