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Apply the Shannon-Fano coding procedure to find coding efficiency for the following message ensemble (take $M = 2$)

$$\begin{array}{l} [X] = [x_1 \quad x_2 \quad x_3 \quad x_4 \quad x_5 \quad x_6 \quad x_7 \quad x_8] \\ [P] = [1/4 \quad 1/8 \quad 1/16 \quad 1/16 \quad 1/16 \quad 1/4 \quad 1/16 \quad 1/8] \end{array}$$

Total No. of Questions : 5]

[Total No. of Printed Pages : 4

Roll No

CS/EE/IT-405

B.E. IV Semester

Examination, December 2016

Analog and Digital Communication

Time : Three Hours

Maximum Marks : 70

- Note:** i) Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.
ii) All parts of each questions are to be attempted at one place.
iii) All questions carry equal marks, out of which part A and B (Max.50 words) carry 2 marks, part C (Max.100 words) carry 3 marks, part D (Max.400 words) carry 7 marks.
iv) Except numericals, Derivation, Design and Drawing etc.

Unit-I

1. a) Define Fourier transform and explain how it is useful for both periodic and a periodic signal.
b) Find the Fourier transform of a single sided exponential function $e^{-bt} u(t)$.
c) State and prove following properties of Fourier transform.
 - i) Time Shifting Property
 - ii) Time Scaling Property
d) State and prove Parseval's theorem for energy signals.

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OR

Show that convolution of a function $f(t)$ with a unit impulse function results the function itself.

Unit-II

2. a) What is the need of Modulation? Explain.
- b) Define FM and PM.
- c) What is Modulation index in AM? What is Over modulation? How can you detect an over modulated signal?
- d) Draw and explain the circuit diagram of a envelope detector and derive the condition for choice of time constant.

OR

A carrier $A \cos \omega_c t$ is frequency modulated by a single tone modulating signal $f(t) = E_m \cos \omega_m t$ find an expression for the FM wave.

Unit-III

3. a) State sampling theorem.
- b) What is Quantization?
- c) Explain Instantaneous, Natural and Flat top sampling.
- d) Draw and explain PAM modulator and demodulator circuit.

OR

Draw PCM transmitter and receiver block diagram and explain its working.

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Unit-IV

4. a) What is the Need for further modulation of PCM signal?
- b) ASK is simplest among the keying system still it is rarely used? Why?
- c) Differentiate between offset QPSK and non offset QPSK.
- d) Explain BPSK and DPSK compare the two.

OR

Describe coherent detection of BFSK signals. What should be the relationship between bit rate and frequency shift for a better performance?

Unit-V

5. a) Define information. What are the Units of information?
- b) What is the Significance of binary symmetric channel?
- c) What is Entropy? Show that the entropy is maximum when all the symbols are equiprobable.
- d) A continuous signal is band limited to 5 KHz the signal is quantized in 8 levels of a PCM system with the probabilities

0.25, 0.2, 0.1, 0.1, 0.05, 0.05 and 0.05

Calculate the entropy and the rate of information.

OR