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**End Semester Examination – Nov/Dec– 2018**

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| **Code :** | **14EC2065** | **Duration :** | **3hrs** |
| **Sub. Name :** | **INFORMATION THEORY AND CODING** | **Max. marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. | a. | Apply Shannon Fano coding procedure for the following message ensemble.  [X]= [X1,X2,X3,X4,X5,X6,X7]  [P]=[0.4,0.2,0.12,0.08,0.08,0.08,0.04].  Find the efficiency | CO1 | 10 |
| b. | Determine (i) Entropy of occurrence of rain and snow (ii) Entropy of occurring rain to snow using Markov chain statistical approach. Assume all state probabilities is equal to 1/3. | CO1 | 10 |
| (OR) | | | | |
| 2. | a. | An analog signal is band limited to “B” Hz, sampled at the Nyquest rate, and the samples are quantized into four levels. The quantizationlevels Q1,Q2,Q3,Q4 are assumed independent and occur with probabilities P1=P2=1/8 and P3=P4=3/8. Find the information rate of the source. Compute the values of H and R if the quantization levels are so chosen that they are equally likely to occur. | CO1 | 5 |
| b. | In the message, each letter occurs the following percentage of times:  Letter: A B C D E F  % of occurrence: 23 20 11 9 15 22  Calculate entropy, average codeword length and efficiency using Shannon-Fano technique. | CO2 | 15 |
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| 3. | a. | A transmitter has an alphabet consisting of 5 letters{a1,a2,a3,a4,a5} and the receiver has an alphabet of 5 letters{b1,b2,b3,b4}. The joint probabilities of the system are shown as  P(a,b)= b1 b2 b3 b4  A1 0.25 0 0 0  A2 0.10 0.30 0 0  A3 0 0.05 0.10 0  A4 0 0 0.05 0.10  A5 0 0 0.05 0  Find mutual information. | CO2 | 15 |
| b. | Distinguish mutual entropy and mutual information. | CO1 | 5 |
| (OR) | | | | |
| 4. | a. | Design a Convolutional encoder of code rate r=1/2 and constraint length of K=3 for the given generator polynomial (i)input-top adder output path is 111 (ii) input-top adder output path is 101.   1. Encode the message sequence 10011 2. Draw the code trellis and state diagram for encoding. | CO3 | 15 |
| b. | Consider a set of events with probability of occurrence as P(x1)=1/2, P(x2)=1/4, P(x3)=1/8. Compute entropy H(X) | CO1 | 5 |
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| 5. | a. | Consider (6,3) linear block code defined by the generating matrix,  . Fin the parity matrix. | CO3 | 5 |
| b. | List the properties of mutual information | CO2 | 5 |
| c. | A Linear block code having a parity check matrix    and the message bit transmitted by the transmitter . Calculate the code vector and syndrome if the received bit from the transmitter. Show that the error occurred in the received bit in the second position. | CO3 | 10 |
| (OR) | | | | |
| 6. | a. | Express differential entropy H(x) of a continuous random variable x with probability distribution function. | CO2 | 5 |
| b. | Classify the methods used in the error control coding techniques. | CO3 | 5 |
| c. | The convolution encoder has a single shift register with 2 stages, constraint length = 3, 3 modulo-2 adders and an output multiplexer. The generated sequence of an encoder are G1=(1,0,1); G2=(1,1,0); G3=(1,1,1). Realize the convolution encoder. | CO3 | 10 |
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| 7. | a. | Determine the code word for the code “BACA” using arithmetic coding for the given probability P(A)=0.5, P(B)=0.25, P(C)=0.25. | CO3 | 15 |
| b. | List the properties of algibric coding. | CO3 | 5 |
| (OR) | | | | |
| 8. | a. | A Gaussian channel has 1MHz bandwidth. Calculate the channel capacity if the signal power to noise spectral density ration S/N is 105Hz. | CO2 | 5 |
| b. | Explain briefly on Turbo coding and their applications. | CO3 | 15 |
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|  | | **Compulsory**: |  |  |
| 9. | a. | Describe in detail about concatenated convolutional code with a neat sketch. | CO3 | 10 |
| b. | Explain spatial channels and spatial multiplexing. | CO3 | 10 |