SEAT No. :

**P-7591**

## [6180]-106
## T.E. (E & TC)
## DIGITAL COMMUNICATION
### (2019 Pattern) (Semester - I) (304181)

*Time : 2½ Hours]*          *[Max. Marks : 70*

*Instructions to the candidates:*

1) *Answer any one Question out of Q. No. 1 or 2, Q. No. 3 or 4, Q5 or Q6 and Q7 Or Q8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary.*

**Q1)** a) With the help of neat block diagram and waveforms describe QAM system in detail. Draw signal space diagram for 16-QAM. **[8]**

b) Explain the performance of MSK with suitable block schematic and detail waveforms. **[9]**

**OR**

**Q2)** a) Draw and explain block diagram of generation and reception of M-ary FSK with waveforms. **[8]**

b) Compare M-ary PSK and M-ary QAM, **[9]**

**Q3)** a) With neat block schematic and waveforms explain DSSS generation and detection. **[9]**

b) What is PN sequence? Explain properties of PN sequence with 3-stage shift register. **[8]**

**OR**

**Q4)** a) Write a short note on : **[8]**

     i)   CDMA          ii)   FHSS

b) With the help of neat schematic describe Ranging using DSSS in detail. **[9]**

*P.T.O.*

*Q5)* a) Define entropy. Show that the entropy is maximum when binary message has 50% probability of occurrence. **[9]**

b) Prove that **[9]**

$$H(X, Y) = H(X/Y) + H(Y) \text{ and } H(X, Y) = H(Y/X) + H(X).$$

OR

*Q6)* a) Compare Shannon-Fano and Huffman coding techniques. **[5]**

b) A source puts out one of the six messages during each message interval with probabilities 1/2, 1/4, 1/8, 1/8, 1/16, 1/32 and 1/32. Find the entropy of the system. Also find the rate of information if there are 16 outcomes per second. **[4]**

c) Apply Huffman coding for the following message ensembles [X] = [x1 x2 x3 x4 x5 x6 x7] [P] = [0.45 0.15 0.1 0.1 0.08 0.08 0.04] and find coding efficiency with M = 2. **[9]**

*Q7)* a) Define and Explain following terms, **[10]**
   i) Hamming distance
   ii) Hamming weight
   iii) Code rate
   iv) Constraint length
   v) Generator polynomial

b) The generator matrix for (7, 4) linear block code is given below. Find all code vector. Calculate syndrome for C4 without error. **[8]**

$$G = \begin{bmatrix} 1 & 0 & 0 & 0 & : & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & : & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & : & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & : & 1 & 1 & 1 \end{bmatrix}$$

OR

*Q8)* Write a short note on (Any Three) : **[18]**
   a) Turbo Codes
   b) Cyclic Codes
   c) Convolution Codes
   d) LPDC Codes

□□□