**Unit IV: Group Theory, Group Codes**

**Two marks Questions:**

1. Define Group.
2. Define Abelian Group.
3. State finite and infinite group.
4. List the properties to be satisfied by a set, for it to be group.
5. Is the set of integers a group under multiplication? Give reasons for your answer.
6. State Sub group and give an example.
7. Define Coset.
8. Define cyclic group
9. Prove that “If is generator of cyclic group G, then is also a generator of G”

**Five Marks Questions:**

1. Prove that “In a group, there exists only one identity element”.
2. Prove that “In a group G, every element has only one inverse”.
3. Check whether Ƶ6 is an abelian group under addition modulo 6.
4. Define cyclic groups. Consider the group U={1,2,4,5,7,8} under the binary operation multiplication. Check whether U is cyclic and find its generator if it is cyclic.
5. Prove that the group is cyclic. Find all its generators.
6. Prove that is a cyclic group. Find all its generator.
7. Suppose the encoding function is defined as follows

where

Find the code words assigned by E to the following message in .

.

1. Suppose the encoding function is defined as follows

Find the decode words assigned by D to the following received message in .

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1. The parity check matrix for an encoding function is given by
   1. Determine the associated generator matrix.
   2. Does this code correct all single errors in transmission?

**Seven Marks Questions:**

1. Prove that, for any elements a, b in a group G we have
2. Let G be the set of all non-zero real numbers and let . Show that is an abelian group.
3. If is an operation on Z defined by , prove that is an abelian group.
4. State and prove Lagrange’s theorem.
5. The word is transmitted through a binary symmetric channel. If is the error pattern, find the word received. If is that probability that a signal is incorrectly received, find that probability with which is received.
6. The word is sent through through a binary symmetric channel. If is the probability of incorrect receipt of a signal, find that probability that c is received as . Determine the error pattern.
7. An encoding function is given by the generator matrix

* 1. Determine all the code words. What can be said about the error detection capability of this code? What about its error correction capability?
  2. Find the associated parity check matrix H.
  3. Use H to decode the received words: 11101, 11011.

**Unit V: Group Codes**

**Two marks Questions:**

1. Define Group Codes and give an example.
2. Define hamming matrices.

**Five Marks Questions:**

1. Prove that “let C be a group code in . If is received word and r is decoded as the code word , then
2. Illustrate Group codes and hamming matrices with example

**Seven Marks Questions:**

1. Prove that “In a group code, the minimum distance between distinct code words is the minimum of the weights of the nonzero elements of the code”.
2. A Group code C is defined by the generator matrix Decode the following received words using costs of C