

SC 461

Introduction to Coding Theory and its Applications

Dhirubhai Ambani Institute of Information and Communication Technology (DA-IICT)

Version 1 (Spring 2013)

INSTRUCTIONS:

- There are total 5 printed pages. Ensure that you have all the pages.
- Answer **all questions**, writing clearly in the space provided.
- Show all your work and explain how you arrived at your answers, unless explicitly told to do otherwise.
- Write your name and student number **clearly** at the top of each page.
- You have **two hours** to complete the test
- Marks for each question are indicated in brackets at right. You may use point form for your answers, but make sure the points are clear and unambiguous.
- You can do rough work on supplementary sheet.

FOR MARKER'S USE ONLY

Question	Possible	Received
1	10	
2	10	
3	10	
4	10	
TOTAL	40	

1. (a) In order to construct a field with 22 number of elements which polynomial over \mathbb{Z}_2 should we consider? Using this polynomial construct the field with 22 number of elements. Can we also construct this field as a product of field with 2 number of elements \mathbb{Z}_2 and field with 11 number of elements \mathbb{Z}_{11} ? Explain and Justify the answer. (10)

2. (a) A $[4, 2, 3]$ ternary (over \mathbb{Z}_3) code $\mathcal{C} = \{0000, 0121, 0212, 1022, 1110, 1201, 2011, 2102, 2220\}$. Find its generator matrix G and parity check matrix H . Show that $GH^t = 0$. (10)

3. (a) For a linear code \mathcal{C} with parameters $[n, k, d]$ and $t = \lfloor \frac{d-1}{2} \rfloor$, suppose a codeword $\mathbf{x} \in \mathcal{C}$ is sent over a noisy channel and $\mathbf{y} \in \mathbb{Z}_2^n$ is received. Compare the sphere decoding and array (coset) decoding with an example and tell us which one is better for decoding the received word \mathbf{y} by assuming the fixed number of errors $t = 2$? (10)

4. (a) Let $\mathcal{C} = \{0000, 1010, 0101, 1111\}$ be a binary linear $[4, 2, 2]$ code. Find its dual code \mathcal{C}^\perp . (10)