Roll No. ☐☐☐☐☐☐☐☐☐☐☐☐ **Total No. of Pages : 02**

Total No. of Questions : 07

M.Sc Mathematics E-I (2017 Batch) (Sem.–3)

CODING THEORY

Subject Code : MSM-501

Paper ID : [75385]

Time : 3 Hrs. **Max. Marks : 80**

INSTRUCTION TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of EIGHT questions carrying TWO marks each.**
2. **SECTION - B & C. have THREE questions in each section carrying SIXTEEN marks each.**
3. **Select atleast TWO questions from SECTION - B & C EACH.**

SECTION-A

Q1. Answer briefly :

a) Explain nearest neighbourhood decoding principal.

b) Define triple repetition code.

c) Give an example of a group code which is not a matrix code.

d) Give the procedure of parity check decoding.

e) Define Hammering code.

f) Define Vandermonde determinant.

g) How are Reed-Solomon codes and BCH codes related?

h) Define Cyclic codes.

SECTION-B

Q2. a) For a code (D, E) to correct all sets of k or fewer errors, prove that it is necessary that the minimum distance between code words be at least $2k + 1$ (it being given that the nearest neighbour decoding principle holds).

b) A binary code with minimum distance $2k + 1$ is capable of correcting any pattern of k or fewer errors.

Q3. a) Establish that $(m, m + 1)$ parity check code is a group code.

b) Prove that the minimum distance of any Hamming code is 3.

Q4. a) When are two codes C and C' of length n, said to be equivalent?

b) Enlist the steps of Syndrome decoding procedure.

SECTION-C

Q5. a) Let F be a field and f(X)eF[X] be an irreducible polynomial. Then prove that F[X]/(/(X)) is a field.

b) Let F be a field and f(X)eF[X]. Then prove that there exists a splitting field of f(X) over F.

Q6. a) Establish that the polynomial code with symbols in F and encoding polynomial g(X) has minimum distance at least d.

b) Prove that the only binary MDS codes are the trivial codes.

Q7. Let C be a linear [n, k, d] code over F with a parity check matrix H. Then prove that C is an MDS code if every n - k columns of H are linearly independent.