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Code No.: 22501 M

**VASAVI COLLEGE OF ENGINEERING (Autonomous), HYDERABAD**  
**M.E. (ECE: CBCS) II-Semester Make Up Examinations, September-2017**  
(Communication Engineering & Signal Processing)  
**Coding Theory and Techniques**

Time: 3 hours

Max. Marks: 70

Note: Answer ALL questions in Part-A and any FIVE from Part-B

**Part-A (10 × 2 = 20 Marks)**

1. State Shannon Hartley capacity theorem and explain in brief.
2. Define channel coding gain with illustration.
3. Determine whether  $X^3 + X + 1$  is an irreducible polynomial or not.
4. Consider an (255, 247) RS code. For a block of 255 how many symbol errors can this code correct?
5. What is catastrophe error propagation in convolutional code?
6. Write structural properties of convolutional codes.
7. Why is puncturing used for Turbo codes?
8. Describe the significance of extrinsic probability used in Turbo decoding.
9. Why is MIMO preferred over SISO systems?
10. Describe diversity gain.

**Part-B (5 × 10 = 50 Marks)**

11. a) Show BER performance for various modulation schemes. [6]  
b) For error correcting codes describe trade-off between BER performance and bandwidth and also between data rate and bandwidth. [4]
12. a) The polynomial  $p(X) = 1 + X + X^4$  is a primitive polynomial over Galois Field,  $GF(2)$ . Show 4-tuple representation for the elements of  $GF(2^4)$ . [6]  
b) Let the transmission code be the double error correcting RS code of length 7. Obtain syndrome polynomials for the following received vector  $r = (0 \ 0 \ \alpha^5 \ 1 \ \alpha^2 \ 0 \ \alpha^2)$  [4]
13. a) A convolutional code is generated by an encoder having the impulse responses  $g_1 = (101)$ ;  $g_2 = (111)$ . Draw the corresponding encoder. [4]  
b) Construct the state diagram for the above encoder. [6]
14. a) Sketch Turbo encoder using recursive convolutional code and explain it in detail. [6]  
b) Explain the effect of number of iterations and puncturing on the performance of turbo codes. [4]
15. a) Describe Alamouti scheme in relation to  $2 \times 2$  MIMO scheme. [6]  
b) List key features of space-time codes. [4]
16. a) If BER of  $10^{-4}$  is achieved at  $\frac{E_b}{N_0} = 8.4$  dB in detecting BPSK modulation in an AWGN channel, determine the coding gain required to maintain the same BER when the modulation format is changed from BPSK to noncoherent BFSK. [5]  
b) Derive generator matrix G for LDPC codes from H matrix. [5]
17. Answer any two of the following:
  - a) What are the advantages of concatenated codes over a single block code? [5]
  - b) Why is Log Likelihood Ratio preferred for Turbo decoder? [5]
  - c) Derive MIMO fading channel capacity expression. [5]