(3 hours) **[Total marks : 80]**

N.B. : 1) Q(1) is compulsory and attempt any three questions out of remaining five questions.
2) All questions carry equal marks

1. **Answer any four of the following**: 20
   a) Discuss the criteria on which the equalizers are based. Also state the equalizers based on these criteria.
   b) Compare thebwide sense stationary process and the strict sense stationary process.
   c) With a suitable sketch, obtain mathematical expression for MIMO channel model
   d) Bring out the advantages and disadvantages of OFDM.
   e) Explain the terms: Coherent bandwidth and Coherence time. Explain various types of small scale fading.

2.a) For a Convolutional encoder with code rate = 1/3 and constraint length =3 and generating Vectors g1= (1 1 0) , g2= (1 1 1) , g3= (1 0 1). 10
(i) Draw the encoder and find the codeword for the input sequence 1110011.
(ii)Sketch its state diagram and Trellis diagram
(iii) Find the transfer function and free distance for this code.

b) Explain the features, encoder and decoder of Turbo codes. 10

3.a) Explain the decision feedback equalizer with its block diagram and mathematical expressions. 10

b) Explain self recovering (Blind) equalization based on maximum likelihood criterion. 10

4.a) With a neat block diagram , explain FFT-based OFDM transmitter and receiver giving the mathematical expression for the output signal. 10
Explain how high PAPR affects OFDM signal and discuss various methods of reducing PAPR.

b) For the LDPC code, described by the parity check equations 10
$c_1 + c_2 + c_5 = 0$
$c_1 + c_4 + c_6 = 0$
$c_1 + c_2 + c_3 + c_6 = 0$
(i) determine the Parity check matrix , H, using the above equations. And draw the Tanner graph for the same.
(ii) show the systematic form of H by applying the Gauss Jordan elimination method.
(iii) determine the G matrix and state whether the matrix is regular or irregular.

5.a) The transmission of a signal pulse with a raised cosine spectrum through a channel results in the following (noise-free)sampled output from the demodulator 10
$x_k = \{ -0.05, 0.2, \underset{\uparrow}{1}, -0.1, 0.08 \}$ and $x_k = 0$ elsewhere
(i) Determine the tap-coefficients of a three-tap linear equalizer based on Zero- forcing criterion.

(ii) Determine the output of the equalizer for the isolated pulse and sketch the Equalized pulse.
(iii) Determine the residual ISI and its span in time.

b) With a neat diagram explain the iterative equalization and decoding. 10

6. **Answer any two of the following**: 20

a) State the recursive relation to evaluate tap weight coefficients for LMS algorithm. Discuss the effect of step size on convergence, excess mean square error and lag error.
b) Bring out the significance of use of interleaver and recursive nature of the component encoder (RSC encoder).
c) Explain the features of transmitter and receiver of multi-carrier CDMA.
