

AMIETE – ET (Current Scheme)

Time: 3 Hours

JUNE 2015

Max. Marks: 100

NOTE: There are 9 Questions in all.

- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- The answer sheet for the Q.1 will be collected by the invigilator after 45 Minutes of the commencement of the examination.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

Q.1 Choose the correct or the best alternative in the following: (2×10)

- a. If a power of 100 W is supplied to an isotropic radiator, then the power density at a point 10 km away from it is_____.
- (A) 79.6 nW/m² (B) 67.9 nW/m²
(C) 97.6 nW/m² (D) None of these
- b. A taxi company uses a central dispatcher, with an antenna on the top of a 15m tower to communicate with taxicabs. The taxis have antennas on their roofs at 1.5 m from the ground. What is the maximum communication distance between the taxis?
- (A) 10.1 km (B) 11.1 km
(C) 110.1 km (D) None of these
- c. A car travels at 60 km/hr. What is the time between fades if the car uses a cell phone at 800 MHz.
- (A) 11.2 ms (B) 21.1 ms
(C) 12.1 ms (D) None of these
- d. A metropolitan area of 1000 sq km is to be covered by cells with a radius of 2km. The number of cells required assuming hexagonal cells would be _____.
- (A) 37 (B) 73
(C) 100 (D) None of these
- e. A vehicle travels through a cellular system at 100 km/hr. Approximately how often will handoffs occur if the radius is 10km? Assume the diameter of the cell is 20km.
- (A) 12 min (B) 12 sec
(C) 21 min (D) None of these
- f. The velocity of a satellite in a circular orbit, which is 500 km above the earth's surface is _____.
- (A) 7.6 km/s (B) 6.7 km/s
(C) 3.8 km/s (D) None of these

- g. The maximum and minimum hopping rates for the Bluetooth system respectively are
 (A) 800 Hz & 160 Hz (B) 1600 Hz & 320 Hz
 (C) 1000 Hz & 100 Hz (D) None of these
- h. In the AMPS system, the system bandwidth is 12.5 MHz, the channel spacing is 30 kHz and edge guard spacing is 10 kHz. Then the spectral efficiency of the FDMA is _____.
 (A) 0.849 (B) 0.948
 (C) 0.489 (D) None of these
- i. The Hamming distance between the two code words $v = 1100001011$ and $w = 1001101001$ is _____.
 (A) 1 (B) 5
 (C) 3 (D) 4
- j. If $g(x) = 1 + x + x^2$ for a cyclic code, then the code vector for the message $u = 1010$ is _____.
 (A) 1110010 (B) 10101010
 (C) 01010101 (D) None of these

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

- Q.2** a. Define the following with respect to cellular communication:
 (i) frequency reuse
 (ii) spectrum efficiency
 (iii) path loss
 (iv) multipath propagation (8)
- b. Calculate the number of times the cluster of size 4 has to be replicated in order to approximately cover the entire service area of 1569 km^2 with the adequate number of uniform sized cells of 7 km^2 each. (4)
- c. Compare discrete random variables and continuous random variables. (4)
- Q.3** a. Briefly discuss the following terms with reference to cellular system:-
 (i) Co channel interference & its reduction factor
 (ii) Cell splitting
 (iii) Cell sectoring (9)
- b. In a certain cellular system, the base station radiates 15W. Suppose that the cells are split and the new cells have one fourth the radius of the original cells. Find the power that the base stations in the new layouts must transmit to maintain the SNR at the cell boundaries. The path loss exponent $\gamma = 4$. (7)

- Q.4** a. Briefly discuss the following:
(i) ACI
(ii) Near far effect
(iii) Power control (9)
- b. If a 100 W power is applied to a unit gain antenna with a 600 MHz carrier frequency, find the received power in dBm at a distance of 200m from the antenna. What is P_r (10km)? (7)
- Q.5** a. Write a detailed note on indoor & outdoor mobile radio propagation models. (8)
- b. Assuming the speed of a vehicle to be equal to 60mph, carrier frequency of 860MHz and rms delay bandwidth. At a coded symbol rate of 19.2 kbps, what kind of symbol distortion will be experienced? What type of fading will be experienced by the channel? (8)
- Q.6** a. A full duplex cellular system is allocated a total spectrum of 20 MHz and each simplex channels has 25kHz spectral width, Determine the
(i) total number of full duplex channels available
(ii) number of channels per cell site if $K = 4$ cell reuse pattern is employed. (4)
- b. Bring out the distinguishing features of the following error control coded:
(i) block (ii) convolution (iii) and cyclic (iv) turbo codes (8)
- c. In a GSM cellular communication system, a data block of 180 bits is encoded into 220 bits of code word on the control channel before sending it to a convolution encoder. Determine the number of parity check bits added and the code rate of the block encoder used. (4)
- Q.7** a. Briefly discuss the packet radio access protocols. Compare their performances. (10)
- b. A normal GSM has 3 start bits and 3 stop bits, 26 training bits for allowing adaptive equalization, 8.25 guard bits and 2 burst of 58 bits of encrypted data which is transmitted at 270.833 kbps in the channel. Find (i) number of overhead bits per frame (ii) total number of bits per frame (iii) frame rate (iv) time duration of a slot (v) frame efficiency (6)
- Q.8** a. Explain the different types of interfaces used to connect the units of BSS in GSM. (6)
- b. Compare the characteristics of LEO, MEO and GEO satellites. (6)
- c. A satellite is moving in a near earth circular orbit at a distance of 640 km. Determine its orbital period. Assume ($R = 6360$ km). (4)
- Q.9** a. Discuss the evaluation of the mobile standards: 2G, GPRS, EDGE and LTE. (8)
- b. Explain how adhoc networks differ from infrastructure based wireless networks. (8)