B.E. ELECTRONICS AND TELE-COMMUNICATION ENGINEERING
FOURTH YEAR
SECOND SEMESTER EXAM 2022
WIRELESS COMMUNICATION SYSTEMS (HONS.)

Time: 3 Hours   **Full Marks: 70**

Answer all 5 questions (you must mention OR for attempting questions with OR)

Q.1 A
  i.   In 1921 mobile radios began operating at _____ in United States in the police dept. and emergency uses.
  ii.   In 1945 _____ introduced the first commercial mobile telephone system launched at_____ . Three channels at _____ with _____ channel spacing were allocated by FCC- Federal Communication Commission.
  iii. Cellular wireless mobile services are first available in _____ in the year _____ followed by a tremendous growth.
  iv.   The automatic channel selection and direct dialing system at 450 MHz band was introduces by _____ in 1969, known as the IMTS.   **05**

B) i) Write about 5 basic Wireless Communication Challenges those differentiated wired digital communication.

ii) Define terminal mobility and personal mobility in terms of wireless cellular communication.
                                                                                                          05

Q.2 a) What is the basic principle for cellular communication? Prior to cellular communication what was the technique to provide wireless services? What are the disadvantages associated with that system.

b) Define a radio cell and adjacent co-channel cell in a cellular wireless communication network. Dow is the adjacent co-channel distance measured?

c) Draw a 7 cell cluster and show adjacent co-channel cells. What are the frequency channels within a cluster?

d) If the square cells would be used other than hexagonal cells what would happen?
                                                                                                    5+5+3+2

OR

Q.2 a) Explain how is capacity of the cellular networks enhanced using i. Cell Splitting and ii. using cell sectoring with antenna.

b) In a cellular network with hexagonal cells, the minimum S/I ratio need to be kept at 18 dB for quality communication. Consider that mobile receiver resides at the cell edge, determine the minimum cluster size for omnidirections antenna and 120 degree antenna sectoring if the propagation loss exponent k=4.

c) With pictorial representation explain the handoff operation when an active mobile moves from cell A to B. If the minimum acceptable signal quality P_{min} is -100 dBm then what should be the handoff threshold? If P_{min} is changed to -90 dBm keeping handoff threshold same as you consider earlier, then what would happen for handoff?   **5+5+5**

Q.3 a) In a multipath environment two pulses are transmitted with a time separation. Pictorially show the received pulses and explain your drawing.

b) What is called time variant impulse response? How is it represented? What would be the received signal r(t) in a time varying channel if s(t) is the transmitted signal.

c) With respect of LTV channel, define the frequency domain representation of the impulse, Doppler Spread function and Delay Doppler spread function.   **5+5+5**

OR

Q.3 a) What is called Fading? Prove that a fast fading channel follows the Rayleigh distribution.
b) Explain when is a channel become frequency selective or time selective. How are time coherence and bandwidth coherence defined?
c) The discrete power delay profile for a wireless channel is given as follows,

τ= 0, 1,2,3,4,5 micro secs the power is S(i)= -10 dB, -5 dB, -12 dB, -15 dB, -14 dB and -18 dB respectively. Find the mean delay and rms delay for the channel.   **5+5+5**

Q.4 a) Explain how does GSM multiple access method employ for users for data transmission.

b) TDMA and CDMA are the two access methods for 2G and 3G wireless Networks respectively. In a tabular form highlight 5 pros and cons for each methods.
c) A CDMA system is defined with the following specification, frequency reuse ratio η_f = 0.9, E_b/N_0 = 12 dB, the information transmission rate = 18.2 kbps, system bandwidth 25.0 MHz. Neglecting all other sources of interferences, determine the system capacity and spectral efficiency of the CDMA system.   **5+5+5**

Q.5 a) Draw the 2G GSM network system and designate the 3 components RSS, NSS and OSS (Radio, Network and Switching and operation subsystem).
Now by placing two very important nodes on the 2G GSM architecture, show how is 2.5G GPRS system has evolved for data packet communication.
b) Differentiate the PHY layers for 1G, 2G and 3G cellular networks. What are the specifications of the channels for three cases. To communicate over the network, what type (s) of mobile handset will be required?
c) Consider a mobile handset (MS), BTS-BSC that constitutes BSS and MSC for 2G GSM network. Draw the message layer signaling protocols for this.   **5+5+5**

OR
Q5. Write Short Notes on
    (a) GPRS PDP context and Session Management
    (b) Evolution of GSM-GPRS-UMTS network
    (c) 4G LTE Network and it's Goal   **5+5+5**