Ref. No.: Ex/ET/PC/H/T/421/2025

B.E. ELECTRONICS AND TELE-COMMUNICATION ENGINEERING
FOURTH YEAR SECOND SEMESTER EXAM, 2025

Subject: Wireless Communication Systems (Hons)

Time: 3 hours **Full Marks: 100**

Answer all six questions (mention question No. with OR if you attempt any question with OR)

Answer must be written at one place for each attempted question

Module 1: CO1 Marks: 20

Q1. A. Write at least five (5) advantages of wireless communication over wired communication. 2

B. Write five (5) basic challenges of wireless communication. 2

C. Wireless communication is century old and started with USA Police Department at low bandwidth near _____ for _____ services. 1

D. AT & T and Bell introduced the first commercial mobile telephone system in the year _____launched at Missouri in US with _____ MHz Bandwidth and three channels with _____ kHz channel spacing. 2

E. In 1974 FCC approved the underlying concepts of _____service and allocated for this purpose 666 duplex (two-way) channels in the _____frequency range. Authorization granted to Illinois Bell in 1978. 2

F. Cellular wireless mobile services were first made available in _____ in the Year _____. 1

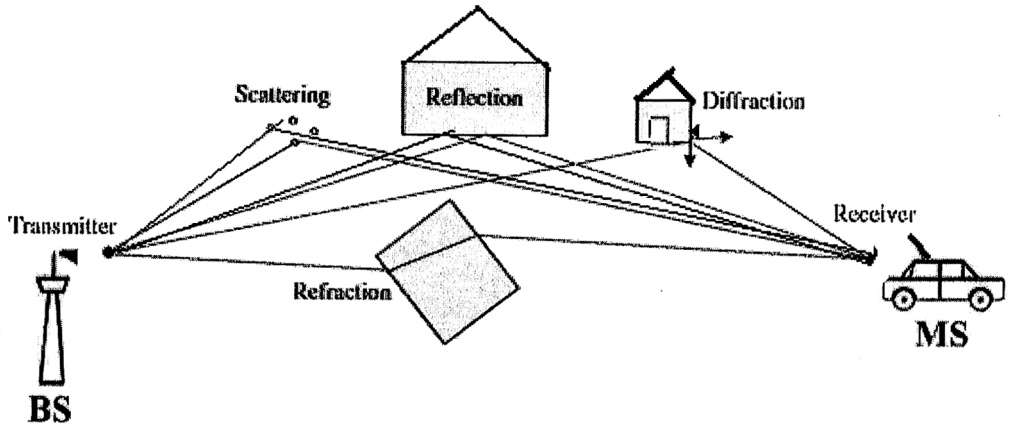
G. Prior to cellular communication, single base transmitter was used over large areas– What were the difficulties faced for that system? 2

H. Cellular array is linked with frequency reuse technique –what are the scientific bases of frequency reuse within a geographical area? 4

I. If Signal to Noise ratio of 15 dB is required for satisfactory forward channel performance in a cellular system with 6 neighbour cells, what is the frequency reuse factor and cluster size to provide maximum capacity if path loss exponent is 3. 4

Model II: CO2 and CO3 **Marks: 40**

Q2. A. The following figure describes the phenomena in wireless mobile communication path between Base Station (BS) and Mobile Station (MS). What will be the possible effects may occur at the receiving end. What will be the probable distribution of received signal? Describe the model. 10



B) In part (A), now imagine there is always a significant direct LOS component - how the received signal distribution will change? Discuss the effect of increasing signal strength of LOS components from 0 dB to 20 dB. Show the pictorial representation. 10

Q2. **OR**

A. Discuss when the following path loss models will be used.

i. Free space path loss, ii. Log-distance model, iii. Log-normal shadowing: Give expressions for each model. What is the minimum and maximum standard deviation occurs in shadowing. 08

B. By drawing the two ray ground reflection model, prove that in the two-ray path loss model the path difference $\Delta = d_1 - d_2$, is approximated to $2h_th_r/d$, where symbols have their usual meaning. What will be the expression for received signal power Pr. Discuss the effect of don received signal power. 08

C. If ht = 35 m, hr = 3m, d= 250 m, find whether the two-ray model could be applied. Give reason for your answer. 04

Q3. A. Define the different terms of fading flat fading, frequency selective fading, slow fading and fast fading and their causes. What is meant by time coherency and bandwidth coherency? What is the relation between the two. 10

B) 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. What will be maximum data rate possible for the channel? 10

Q3. OR

A. 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. 6

B. With respect of LTV channel, define the frequency domain representation of the impulse, Doppler Spread function and Delay Doppler spread function. 6

C. The local average power delay profile in a particular environment is found to be

$P(\tau) = \sum^{2}_{n=0} [10^{-6} /(n^2 +1)] \delta (\tau - n10^{-6})$

(i) Sketch the power Delay Profile of the channel in dBm
(ii) Find whether the channel follows fast or slow fading. 8

Module III : CO4 Marks : 15

Q4. A. Explain the process of determining spectrum efficiency calculation for TDMA and DS-CDMA spread spectrum techniques. In which generations these two access methods are associated. 10

B. If GSM frame consists of 8 time slots of 156.25 bits and if there is 6 trailing bits, 8.25 guard bits, 26 training bits and two traffic burst of 58 bits of data, find the GSM frame efficiency? 5

Q4. OR

A. Explain FDMA access methods with its pros and cons. Find the spectrum efficiency for FDMA in channels/MH/Km^2. 10

B. The number of available channel for AMPS cellular system is 416 out of this there are 21 control channels, the total bandwidth is 12.5 MHz. Find FDMA spectral efficiency. If the cellular system uses 4 cells cluster with 8 km^2 cell area, find the overall spectral efficiency and specify the unit. 05

Model IV: CO5 Marks: 15

Q.5 A. Draw the very basic network architecture for 2G GSM cellular network and then show the evolutionary development of GSM to GPRS networks for data communication. Explain the role of two new nodes. 7

B. International Mobile Telecommunications (IMT)-2000 and IMT –advanced have set up agenda for 3G and beyond 3G networks – what is the target for 3GPP LTE network in terms of peak data rate, mobility and latency requirements. What are the access methodologies for LTE in uplink and downlink? 4

C. Draw the LTE Network architecture with different nodes in E-UTRAN and EPC. 4

Q5. OR

A. Categorize which of the following systems are meant for voice, data and multimedia communication.

AMPS, DECT, IS-95, GSM, GPRS, EDGE, UMTS, CDMA-2000, LTE 3

B. Write Key features of LTE network. 5

C. Write the basic reasons for 5G network evolution that 4G networks could not deliver. What are the differentiating technologies used to cater the required services by 5G. 7

Module V: CO6 Marks: 10

Q.6 Justify the following statements: 4+3+3=10

A. Cell sectoring is one of the important ways for capacity enhancement in cellular system

B. Location management is crucial in cellular networks

C. When power threshold is too small for handoff initiation, drop call is the result

END