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Question Bank

Details of the Course

Academic Year	**: 2025 – 2026**
Regulation	**: 2021**
Name of the Department	**: Electronics and Communication Engineering**
Name of the Course	**: Wireless Communication**
Course Code	**: EC 3501**
Semester	**: V**
Common To Programme(s)	**: -**

Course Outcome: (List the Course Outcomes of the Course)

On completion of this course, the students will be able to

CO1:Understand The Concept And Design Of A Cellular System.

CO2:Understand Mobile Radio Propagation And Various Digital Modulation Techniques.

CO3:Understand The Concepts Of Multiple Access Techniques And Wireless Networks

CO4:Characterize a wireless channel and evolve the system design specifications

CO5:Design a cellular system based on resource availability and traffic demands.

Bloom's Level: BL1-Remembering, BL2-Understanding, BL3-Applying, BL4-Analyzing, BL5–Evaluating, BL6-Creating.

UNIT- I – THE CELLULAR CONCEPT –SYSTEM DESIGN FUNDAMENTALS				
	PART – A (2 Marks)	**Bloom's Level**	**Course Outcome**	**Marks Allotted**
1.	Solve the Brewster Angle, θ_B for a wave impinging on poor ground having a permittivity of ξ_r =4 at the frequency of 100 MHz. Also calculate the same for typical ground with permittivity of ξ_r =5.	BTL 3	[CO1]	[2]
2.	Why is cellular concept used for mobile telephony?.	BTL 4	[CO1]	[2]
3.	What is meant by cell splitting ?	BTL 2	[CO1]	[2]
4.	What is soft handoff in mobile communication?	BTL 2	[CO1]	[2]
5.	Mention the importance of frequency reuse in cellular networks	BTL 1	[CO1]	[2]
6.	Define co-channel reuse ratio	BTL 1	[CO1]	[2]

7.	Compare co channel interference and adjacent channel interference.	BTL 2	[CO1]	[2]
8.	Why is cellular concept used for mobile telephony?.	BTL 2	[CO1]	[2]
9.	Define Grade of Service.	BTL 1	[CO1]	[2]
10.	What do you meant by mobile assisted handoff ?	BTL 2	[CO1]	[2]
11.	Solve the far field distance for an antenna with maximum dimension of 2m and operating frequency of 1GHz.	BTL 3	[CO1]	[2]
12.	Write short notes on power control for reducing interference.	BTL 1	[CO1]	[2]
13.	Mention the difference between prioritizing hand-off and practical Hand-off.	BTL 1	[CO1]	[2]
14.	Mention the drawbacks of cell splitting in cellular mobile communication.	BTL 1	[CO1]	[2]
15.	Define frequency reuse.	BTL 1	[CO1]	[2]
16.	Illustrate the importance of Cell splitting in networks	BTL 1	[CO1]	[2]
17.	Mention the importance of frequency reuse in cellular networks	BTL 1	[CO1]	[2]
18.	What is blocked call clear system (BCC)?	BTL 2	[CO1]	[2]
Descriptive Questions (13/15 Marks)				
1.	(i) Write about frequency reuse concept. (ii) Explain in detail about channel assignment strategies.	BTL 3	[CO1]	(7) (6)
2.	What is Handoff and interference and system capacity and explain with neat diagram.	BTL 3	[CO1]	[13]
3.	Explain in detail Improving coverage and capacity in cellular systems.	BTL 3	[CO1]	[13]
4.	Explain in detail trunking and grade of service and derive the formula for Erlang B and Erlang C system		[CO1]	[13]
5.	i)How would you apply frequency reuse? (ii) If signal-to-interference ratio of 15dB is required for satisfactory forward channel performance of a cellular system, what is the frequency reuse factor and cluster size that Should be used for maximum capacity if the path loss exponent is (1) n=4 (2) n=3?	BTL3	[CO1]	[13]
6.	An urban area has a population of two million residents. Three competing trunked mobile networks (systems A,B and C) provide cellular service in this area. System A has 394 cells with 19 channels each, system B has 98 cells with 57 channels each, and system C has49 cells, each with 100 channels. Find the number of users that can be supported at 2% blocking if each user averages two calls per hour at an average call duration of three minutes. Assuming that all threetrunkedsystemsareoperatedatmaximumcapacity,computethepercentagemarket penetration of each cellular provider	BTL3	[CO1]	[13]
7.	i)Discuss about Grade of service in cell system. ii)Estimate that how many users can be supported for 0.5% blocking probability for the following number of trunked channels in a blockedcalls cleared system? (a) 1, (b) 5,(c) 10,(d) 20,(e) 100. Assume each user generates 0.1 Erlangs of	BTL3	[CO1]	[15]

	traffic.			
8.	Assess the important techniques to improve coverage and capacity in Cellular systems with suitable diagrams. Also explain the capacity expansion techniques.	BTL2	[CO1]	[15]
9.	A hexagonal cell within a four cell system has a radius of 1.387km. A total of 60 channels are used within the entire system. If the load per user is 0.029 Erlangs, and λ=1 call/hour, compute the following for an Erlang C system that has a 5% probability of a delayed call and determine the following, (i) How many users per square kilometer will this system support? (ii) What is the probability that a delayed call will have to wait for more than 10sec? What is the probability that a call will be delayed for more than10sec?	BTL3	[CO1]	[15]
10.	If a total of 33MHz bandwidth is allocated to a particular FDD cellular telephone system which uses two 25KHz simplex channels to provide full duplex voice and control channels, compute the number of channels available per cell if a system uses (1) 4 cell reuse (2) 7 cell reuse and (3) 12 cell reuse. If 1 MHz of the allocated spectrums is dedicated to control channels, determine the equitable distribution of control channels and voice channels in each cell of each of the three systems	BTL3	[CO1]	[15]
11.	Explain channel assignment and Hand-off strategies in detail.	BTL 2	[CO1]	[15]
12.	How many users can be supported for 0.6% blocking probability for following the trunked channels in a blockedd call clear systems1,10,20,100.Assume each user generates 0.1 Erlangs of traffic.	BTL 3	[CO1]	[15]
13.	Describe channel assignment strategies and its classification in detail.	BTL 2	[CO1]	[15]
14.	Discuss the impact of interference in a cellular system and system capacity. Derive the equation for co-channel interference and system capacity with neat diagram.	BTL 2	[CO1]	[15]
15.	If signal-to-interference ratio of 15dB is required for satisfactory forward channel performance of a cellular system, what is the frequency reuse factor and cluster size that Should be used for maximum capacity if the path loss exponent is (1) n=4 (2) n=3?	BTL 3	[CO1]	[15]
16.	i) Illustrate the Hand-off scenario at cell boundary. ii) If a total of 33MHz bandwidth is allocated to a particular FDD cellular telephone system which uses two 25 KHz simplex channels to provide full duplex voice and control channels, compute the number of channels available per cell if a system uses (1) 4 cell reuse (2) 7 cell reuse .	BTL 3	[CO1]	[15]
UNIT- II – MOBILE RADIO PROPAGATION				
	PART – A (2 Marks)	**Bloom's Level**	**Course Outcome**	**Marks Allotted**
1.	List the various parameters in Link Budget calculation.	BTL 1	[CO2]	[2]
2.	Examine the two types of propagation model.	BTL4	[CO2]	[2]
3.	Solve the Brewster Angle for wave impinging on ground having a permittivity ϵ_r = 5.	BTL2	[CO2]	[2]
4.	How would you recall fading and Doppler spread?	BTL 2	[CO2]	[2]
5.	What is coherence time and coherence bandwidth?	BTL 2	[CO2]	[2]
6.	Compare Frequency selective fading and Flat fading.	BTL 2	[CO2]	[2]

7.	What is Doppler shift Derive the expression for it?	BTL 2	[CO2]	[2]
8.	Differentiate flat fading from frequency selective fading.	BTL 2	[CO2]	[2]
9.	Mention the factors that influence the choice of digital modulation.	BTL 1	[CO2]	[2]
10.	What is the significance of zero forcing algorithm ?	BTL 2	[CO2]	[2]
11.	Write the equation for blocked call cleared system.	BTL 2	[CO2]	[2]
12.	What is shadow fading ? Why it is called so?	BTL 2	[CO2]	[2]
13.	Differentiate small and Large scale fading.	BTL 2	[CO2]	[2]
14.	Solve the far field distance for an antenna with maximum dimension of 2m and operating frequency of 1GHz.	BTL 3	[CO2]	[2]
15.	Define Grade of Service.	BTL 1	[CO2]	[2]
Descriptive Questions (13/15 Marks)				
1.	Explain in detail Log distance model and Log normal shadowing and derive the equation for path loss.	BTL 2	[CO2]	[13]
2.	Explain in detail about the small scale fading and it types, what are the factors affecting the small scale fading.	BTL 2	[CO2]	[13]
3.	Describe the free space propagation model and derive the received power and loss equation.	BTL 2	[CO2]	[13]
4.	Compute the diffraction gain for the three cases. a) h=25 m, b) h=0, C) h = - 25 m. Assume λ= ⅓ m,d_1=1Km, d_2=1Km.For each of the cases ,identify the Freshnel zone within which the tip of the obstruction lies..	BTL 3	[CO2]	[13]
5.	Identify the various parameters involved in mobile multipath channels and explain in detail	BTL 2	[CO2]	[13]
6.	In free space propagation , Describe how the signals are affected by diffraction ,reflection and scattering.	BTL 2	[CO2]	[13]
7.	Estimate the length and effective aperture of the effective receiving antenna for a mobile is located at 5Kms away from Base station and uses a vertical $\lambda/4$ monopole antenna with a gain of 2.55 dB to receive cellular radio signals. The E-field 1Kmfromtransmitterismeasuredto10^{-3}V/m the carrier frequency is 900 MHz. Also find the received power at the mobile using the two-ray ground reflection model assuming the height of the transmitting antenna is 50m and the receiving Antenna is 1.5 m above the ground.	BTL 4	[CO2]	[15]
8.	i) Discuss in detail about fast fading and slow fading in wireless channel. (ii) Summarize the effects of fading with respect to symbol period and baseband signal bandwidth	BTL 2	[CO2]	(7) (6)
9.	Assume if a transmitter produces 50W of power, express the transmit power in units of dBM and dBW. If 50W is applied to a unity gain antenna with a 900 MHz carrier frequency, find the received power in dBM at a free space distance of 100m from the antenna. What is P_r = (10km?) Assume unity gain for the receiver antenna	BTL 3	[CO2]	[15]
10.	Explain in detail the block of MSK system and its importance in a wireless	BTL 1	[CO2]	[15]

	Communication system			
11.	Explain in detail modulation performance in fading and multipath channels.	BTL 2	[CO2]	[15]
12.	Explain in detail Zero forcing and LMS algorithm and derive the expression for it.	BTL 2	[CO2]	[15]
13.	Explain in detail DSSS and FHSS.	BTL 2	[CO2]	[15]
14.	Explain in detail Knife edge diffraction model with neat diagram.	BTL 2	[CO2]	[15]
15.	Derive the Friis free space propagation equation and explain the free space propagation model.	BTL 3	[CO2]	[15]
16.	Explain in detail about the small scale fading and it types, what are the factors affecting the small scale fading.	BTL 2	[CO2]	[15]
17.	Identify the various parameters involved in mobile multipath channels and explain in detail.	BTL 3	[CO2]	[15]
18.	I)Discuss the Flat fading channel characteristics with relevant diagrams. ii. Describe the classification of small scale fading with respect to Doppler Spread.	BTL 2	[CO2]	[15]
19.	I) What is Frequency Selective fading ? Explain. ii. Compare and contrast fast fading and slow fading. In practice fast fading occurs for very low data rate Communications .Why?	BTL 2	[CO2]	[15]
20.	Explain in detail Fresnel zone geometry diffraction with neat diagram.	BTL 2	[CO2]	[15]
21.	The transmitter height h_t=50m,knife edge obstruction height h_{obs}=100 m and receiver height h_r=25 m. Determine a)the loss due to knife edge diffraction and b) the height of obstacle required to induce 6 dB diffraction loss. Assume f = 900 MHz.	BTL 3	[CO2]	[15]
UNIT- III – MODULATION TECHNIQUES AND EQUALIZATION AND DIVERSITY				
	PART – A (2 Marks)	**Bloom's Level**	**CourseOutcome**	**MarksAllotted**
1.	Give the function of Gaussian filter in GMSK.	BTL 1	[CO3]	[2]
2.	How would you explain non coherent detection?	BTL 2	[CO3]	[2]
3.	Define the concept of windowing.	BTL 1	[CO3]	[2]
4.	Differentiate between MSK and GMSK.	BTL 2	[CO3]	[2]
5.	What is the need of equalization?	BTL 2	[CO3]	[2]
6.	How least mean square algorithm is used in equalization techniques?	BTL 2	[CO3]	[2]
7.	Mention the disadvantages of DS-SS.	BTL 1	[CO3]	[2]
8.	In digital cellular equalizer, if the carrier frequency is 900 MHz and maximum Doppler shift is 66.67 Hz, calculate the maximum mobile velocity for the given Doppler shift.	BTL 3	[CO3]	[2]

9.	Compare and contrast linear equalizers and nonlinear equalizers.	BTL 2	[CO3]	[2]
10.	Examine the MMSE decision feedback equalizer.	BTL 2	[CO3]	[2]
11.	What is the function of an equalizer in a communication system? Write the major drawback of zero forcing equalizer.	BTL 2	[CO3]	[2]
12.	Mention the disadvantages of DS-SS.	BTL 1	[CO3]	[2]
13.	Mention the advantages and disadvantages of Lattice equalizer.	BTL 1	[CO3]	[2]
Descriptive Questions (13/15 Marks)				
1.	Summarize about the working principle of linear and non-linear equalizers with neat diagram.	BTL 1	[CO3]	[13]
2.	Sketch the decision feedback equalizer block diagram and explain its working principle and derive an expression for its minimum mean square error.	BTL 1	[CO3]	[13]
3.	Describe the two modes of operating methods in adaptive equalizer and compare the performance of various algorithms for adaptive equalization.	BTL 2	[CO3]	[13]
4.	With neat diagram explain in detail modulation and demodulation of GMSK.	BTL 2	[CO3]	[13]
5.	Discuss the principle of diversity and various diversity schemes with their advantages and disadvantages.	BTL 2	[CO3]	[13]
6.	Develop Rake receiver with relevant diagrams. Also explain how time diversity is achieved in CDMA using Rake receiver.	BTL 6	[CO3]	[13]
7.	Evaluate the performance of adaptive equalizers with necessary equations and also prove that it exhibits superior performance over the conventional equalizers.	BTL 5	[CO3]	[15]
8.	Describe about the importance of equalization and diversity methods used for the mitigation of interference in multipath propagation model. Compare and contrast these two techniques.	BTL 6	[CO3]	[15]
9.	Explain in detail the factors that influence the choice of digital modulation. Also mention advantages and disadvantages of digital modulation.	BTL 2	[CO3]	[15]
10.	With neat diagram explain in detail modulation and demodulation of MSK.	BTL 2	[CO3]	[15]
UNIT- IV – MULTIPLE ACCESS TECHNIQUES				
	PART – A (2 Marks)	**Bloom's Level**	**CourseOutcome**	**MarksAllotted**
1.	Compare and contrast FDMA, CDMA and TDMA.	BTL4	[CO4]	[2]
2.	What is the need for multiple access techniques in wireless communication.	BTL2	[CO4]	[2]
3.	Write the equation for capacity of FDMA systems?	BTL1	[CO4]	[2]
4.	Mention the advantages of CDMA.	BTL1	[CO4]	[2]
5.	Mention the features of SDMA.	BTL1	[CO4]	[2]
6.	Write the equation for capacity of CDMA systems.	BTL1	[CO4]	[2]
7.	Write the equation for capacity of SDMA systems.	BTL1	[CO4]	[2]
8.	Mention the advantages and disadvantages of SDMA.	BTL1	[CO4]	[2]
9.	Mention the applications of TDMA,FDMA and CDMA.	BTL1	[CO4]	[2]

10.	Write the equation for capacity of CDMA with multiple cells.	BTL1	[CO4]	[2]
Descriptive Questions (13/15 Marks)				
1.	Explain in detail modulation performance in fading and multipath channels.	BTL2	[CO4]	[13]
2.	Derive the capacity of cellular FDMA systems.	BTL4	[CO4]	[13]
3.	Explain in detail TDMA and also derive the equations for capacity of TDMA.	BTL2	[CO4]	[13]
4.	Explain in detail FDMA and also derive the equations for capacity	BTL2	[CO4]	[13]
5.	Derive the capacity of cellular TDMA systems.	BTL4	[CO4]	[13]
6.	Explain in detail CDMA and also derive the equations for capacity	BTL2	[CO4]	[13]
7.	Explain in detail SDMA and also derive the equations for capacity	BTL2	[CO4]	[15]
8.	Explain in detail capacity of CDMA with multiple cells and also write the relevant equations.	BTL2	[CO4]	[15]
9.	Compare TDMA,FDMA and CDMA	BTL4	[CO4]	[15]
10.	Compare SDMA and CDMA	BTL4	[CO4]	[15]
UNIT- V – WIRELESS NETWORKING				
	PART – A (2 Marks)	**Bloom's Level**	**CourseOutcome**	**MarksAllotted**
1.	Mention the limitations in wireless networking.	BTL1	[CO5]	[2]
2.	Compare circuit and packet switching.	BTL2	[CO5]	[2]
3.	What is meant by traffic routing in wireless networks?	BTL2	[CO5]	[2]
4.	Write short notes on Network database.	BTL1	[CO5]	[2]
5.	Differentiate wireless and fixed telephone networks	BTL2	[CO5]	[2]
6.	What is PSTN?	BTL2	[CO5]	[2]
7.	Differentiate circuit switching and packet switching.	BTL2	[CO5]	[2]
8.	Mention the applications of 1G, 2G and 3G.	BTL1	[CO5]	[2]
9.	What is PRMA?	BTL2	[CO5]	[2]
10.	What is UMTS? Mention its advantages.	BTL2	[CO5]	[2]
Descriptive Questions (13/15 Marks)				
1.	Explain in detail the differences between Wireless and fixed Telephone networks.	BTL2	[CO5]	[13]
2.	Explain with neat diagrams Personal Communication Services/networks.	BTL2	[CO5]	[13]
3.	Write short notes on the following : i) Circuit switching ii) Packet switching	BTL1	[CO5]	[13]
4.	With neat diagram explain in detail Universal Mobile Telephone Systems and its functions.	BTL1	[CO5]	[13]

5.	What is PRMA? Explain in details its working .	BTL2	[CO5]	[13]
6.	With neat diagrams explain Cellular packet switched Architecture.	BTL2	[CO5]	[13]
7.	Write Short notes on the following: i) 1G Wireless networks ii) 2G Wireless Networks iii) 3G Wireless Networks	BTL1	[CO5]	[15]
8.	Explain with neat diagram distributed database for mobility management.	BTL2	[CO5]	[15]
9.	Compare 1G Wireless networks,2G Wireless Networks,3G Wireless Networks	BTL2	[CO5]	[15]
10.	With neat diagram explain cellular packet switched architecture.	BTL2	[CO5]	[15]