



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

ELECTRONICS AND COMMUNICATION ENGINEERING

TUTORIAL QUESTION BANK

Course Name	:	CELLULAR AND MOBILE COMMUNICATIONS
Course Code	:	A70434-R15
Class	:	IV B. Tech I Semester
Branch	:	ECE
Year	:	2018 – 2019
Course Coordinator	:	Dr. P.G. Krishna Mohan, Professor, Dept of ECE
Course Faculty	:	Mr. U Somanaidu, Assistant Professor, Dept of ECE, Mr. Shashikanth Reddy, Assistant Professor, Dept of ECE

OBJECTIVES

This course introduces the fundamentals of mobile communications that are important to wireless communication system. It introduces cellular mobile radio systems, various generations of cellular systems and fading channel. It also covers various types of interferences that are co-channel and non co-channel interferences in mobile radio environment. Subsequently the course describes cell coverage for signal and traffic, signal reflections in various terrains, various cell sites antennas & mobile antennas and their analysis. Next different frequency management and channel assignment techniques are described. Finally the concepts of handoffs, dropped calls and cell splitting are analyzed.

UNIT-I			
INTRODUCTION TO CELLULAR MOBILE			
PART-A (SHORT ANSWER QUESTIONS)			
S.No	Question	Blooms Taxonomy Level	Course Outcome
1.	Give two advantages of cellular mobile systems over telephone systems.	Understand	1
2.	Write the equation to calculate offered load in mobile transmission.	Remember	2
3.	Define FCC?	Understand	1
4.	Define Trunking efficiency.	Remember	2
5.	Mention the elements of basic cellular systems.	Understand	3
6.	What are the functions of MTSO?	Remember	1
7.	Write short notes on voice quality can be tested.	Understand	2
8.	What is known as circuit merit?	Remember	2
9.	What are the items required for service quality.	Understand	2
10.	Give the relation between received carrier power and distance measured from transmitter to the receiver end.	Understand	2
11.	Define fading effect.	Remember	1
12.	What is known as Rayleigh fading?	Understand	2
13.	What are the main parts of mobile radio environment?	Remember	3

14.	Define delay spread.	Remember	1
15.	Define coherence bandwidth.	Remember	5
16.	What is meant by direct wave path?	Understand	1
17.	Define line of sight path and obstructive path.	Remember	1
18.	Write briefly about noise figure?	Understand	2
19	What is the significance of hexagonal shaped cells?	Remember	2
20	Define ignition noise.	Remember	3
21	Explain performance criteria.	Understand	1
22	List out the elements of cellular mobile systems?	Remember	3
23	What is interference and co-channel interference?	Understand	4
24	Differentiate between co-channel interference and adjacent channel interference?	Understand	3
25	What do you mean by Erlang?	Remember	3
26	If a maximum call per hour is 3500 and average calling time is 1.76 minutes, find the offered load.	Remember	3
27	Define co-channel interference.	Remember	2
28	Define co-channel interference reduction factor.	Remember	1
29	What is meant by frequency reuse distance?	Understand	2
30	Define cell splitting.	Remember	1
31	Define micro cells.	Remember	1
32	What is mean by macro cell?	Understand	1
33	What is the value of co-channel interference reduction factor in a 7-cell reuse pattern?	Understand	3
34	What is the demerit of cell splitting?	Remember	1
35	Write short notes on any two components of cellular system.	Understand	3

PART-B (LONG ANSWER QUESTIONS)

S.No	Question	Blooms Taxonomy Level	Course Outcome
1.	Discuss in detail about the operation of cellular mobile system with block diagram.	Understand	1
2.	Explain the call initialization, call progress and call termination process.	Understand	2
3.	Define and Explain amplifier noise and ignition noise in detail.	Understand	2
4.	What is multi path effect; explain its effects in mobile propagation.	Remember	1
5.	What is the uniqueness of mobile radio environment, Explain why hexagonal shaped cells are used for mobile communication?	Remember	3
6.	Explain the significance of fading of fading in mobile environment.	Understand	3
7.	Compare analog and digital cellular systems with at least 15 points each.	Remember	3
8.	Discuss in detail about the 1G-AMPs and any one 2G cellular standard in detail.	Understand	1
9.	Define and explain the following terms used in wireless communications, i. Base Station ii. Control Channel. iii. Forward Control Channel iv. Full Duplex Channel System v. Half Duplex Channel System vi. Hand off vii. Mobile Station	Remember	2

10.	Write the significance of Omni-directional antenna system.	Understand	1
11.	What is co-channel interference with first tier and second tier with an example.	Understand	1
12	Discuss the limitations of conventional mobile telephone system	Understand	2
13	Explain in detail a) Concept of frequency channels and b) Co-channel interference.	Understand	1
14	Explain the concept of co-channel interference in detail.	Understand	2
15	Define and Discuss in detail about the cell splitting technique.	Understand	2
16	What is meant by co-channel interference reduction factor? Explain with all.	Remember	2
17	Write the normal case of carrier to interference ratio with Omni-directional.	Understand	2
18	List out and Explain in detail about the components of basic cellular system.	Understand	1
19	What is cell-splitting? Explain its types in detail about cell splitting.	Remember	1
PART-C (ANALYTICAL QUESTIONS)			
1.	Calculate the transmit and receive carrier frequencies for, i) AMPS channel 4 and ii) AMPS channel 991.	Remember	2
2.	Consider maximum number of calls in one hour in one cell is 3500 and an Average calling time t'' is 1.76 minutes. Calculate the offered load in the cell.	Understand	2
3	Consider a metropolitan area of 1100 square km is to be covered by cells with cell radius of 2 km. Calculate the number of cells that would be needed	Remember	3
4	A mobile transmitter produces a power of 25W as measured at antenna and its supply power is 47W. Calculate its efficiency.	Understand	3
5	Assume a cellular system operates with traffic of 2500 Erlangs. If each user in the system uses phone for 3 minutes of busiest hour on an average case, then find the number of users which can be accommodated under even distribution	Remember	3
6	A receiver equivalent noise figure value is 3 db. Find its equivalent noise temperature.	Understand	2
7	Consider a cellular system which consists of 34 cells with the cell radius as 1.4 km. a total frequency bandwidth is capable of supporting 343 traffic channels. Find what geographical area in km can be covered and the number of channels available per call.[Assume $N=7$ reuse cellular pattern].	Remember	3
8	For a seven cell reuse pattern find the reuse factor if the minimum distance between centers of co-channel-cells is 18 km. Radius of cell is 3 km and the distance between adjacent cells in the seven cell pattern is 6 km.	Understand	3
9	Calculate the maximum data rate required for transmission if the signal to noise of the communication link is 20 dB and the RF bandwidth is 40 KHz.	Remember	2

10	Assume a cellular phone transmitter has deviation of 11 kHz frequency. If the transmitter operates at a maximum deviation with voice frequencies 500 Hz and 3500 Hz, calculate their modulation index value.	Understand	3
----	--	------------	---

UNIT-II CO-CHANNEL INTERFERENCE

PART-A (SHORT ANSWER QUESTIONS)

S.No	Question	Blooms Taxonomy Level	Course Outcome
1.	Define co-channel interference.	Remember	1
2.	If the actual signal is e_1 and interference is e_2 what will be the received signal.	Remember	2
3.	Mention two advantages of Omni-directional antenna.	Understand	1
4.	Given the co-channel interference reduction factor q is 6 what will be the cluster size?	Remember	2
5.	If co-channel interference reduction factor q is 5.2 and the cluster size is q what will be the carrier to interference ratio.	Understand	2
6.	Comment on the lowering antenna height method in a valley.	Remember	3
7.	If antenna height is lowered in foliage area what are the effects that would take place.	Understand	3
8.	What are the advantages of having a notch in the antenna radiation pattern?	Remember	1
9.	Write a short note on umbrella-pattern effect.	Understand	2
10.	List any two benefits of an umbrella cellular pattern.	Remember	1
11.	Give two uses of parasitic elements.	Understand	1
12.	Discuss adjacent channel interference?	Understand	1
13.	What is known as near end-far-end interference?	Understand	1
14.	Define cross talk and ring combiner.	Remember	3
15.	What are the effects of cell site antenna height analysis?	Understand	3
16.	Explain the methods to reduce adjacent channel interferences?	Remember	3

PART-B(LONG ANSWER QUESTIONS)

1.	Explain subjective versus objective test measurements and SINAD in detail.	Understand	3
2.	Define and explain real time co-channel interference of cellular mobile communications.	Understand	2
3.	What is co-channel interference of cellular mobile communications? Explain its measurements.	Remember	3
4.	Compare and explain co-channel and non-co-channel interferences in detail.	Understand	2
5.	Discuss in detail about antenna system design methods of cellular mobile communications.	Remember	2
6.	List out all Parasitic elements and Discuss in detail about the Parasitic elements.	Understand	1
7.	Define diversity receiver in detail?	Remember	1
8.	What are the types of non-co-channel interferences in cellular system?	Understand	5
9.	Explain antenna system design and different test methods in detail.	Understand	1
10.	Explain the types of non-co-channel interferences in cellular system.	Understand	3

11	What is meant by diversity receiver and SINAD measurements?	Understand	2
12	Explain non-co-channel interference effects on coverage and interferences.	Understand	3
13	Distinguish Co-channel interference and Non Co-channel interference?	Understand	3
14	Explain the effects of coverage and interference by power decrease.	Understand	5
15	What is meant by UHF TV interference?	Understand	1
16	Write briefly about cell site components.	Understand	1

PART-C (ANALYTICAL QUESTIONS)

1	Assume a cellular system wherein a car travels at 200 km per hour speed. Calculate how often (approximately) handoffs would occur if the radius of the cell is 8 km?	Remember	3
2	Calculate the far field distance for an antenna with largest dimension 1.5m and the corresponding frequency of 1200 MHz	Understand	2
3	Calculate the time period between handoffs if the cell radius is 10 kms where the vehicle travels at a speed of 130 kmph.	Understand	3
4	a. Explain the Co- channel interference reduction factor and derive the general formula for C/I. b. Determine the frequency reuse distance for $K = 4, 7, 12, 19$.	Remember	2
5	a. Draw the block diagram of a cellular system and explain how a cellular telephone call is made between the landline and the mobile user and when the call is initiated by the landline customer. Draw suitable timing diagrams. b. Explain briefly about 3G CDMA techniques.	Understand	1

UNIT-III CELL COVERAGE FOR SIGNAL AND TRAFFIC

PART-A (SHORT ANSWER QUESTIONS)

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	What are human made structures?	Remember	2
2	What are natural terrains?	Remember	1
3	Give two examples for natural terrain and human made structures	Understand	1
4	Write a short note on point-to-point model.	Remember	3
5	Write a short note on signal reflections in a flat terrain.	Understand	1
6	Give any two effects of human made structures.	Understand	1
7	What are the three main types of point-to-point model?	Remember	3
8	Write the equation of effective antenna height gain.	Understand	2
9	Draw the diagram of human made structures to find propagation path loss curve.	Remember	3
10	Write a short note on constant standard deviation along a path loss curve.	Understand	2
11	Draw the graph of an 8db local mean spread.	Remember	2
12	Draw the simple model for propagation over water.	Understand	3
13	Give the general formula for mobile radio propagation.	Remember	2
14	Write a short note on foliage loss.	Understand	1
15	Write a short note on characteristics of foliage environment.	Remember	1

16	What is the significance of a 1m intercept under propagation in near-in distance case?	Understand	2
CIE-II			
17	What are near and long distance propagation.	Remember	1
18	List the merits of point to point model.	Understand	1
19	Write short note on about signal reflections in a hilly terrain.	Remember	1
20	Compare a hilly and flat terrain with two important points.	Understand	3
21	Write a short note on sum-and-difference pattern.	Remember	1
22	Give the general formula for sum-and-difference pattern.	Understand	2
23	What is known as Dolph-Chebyshev synthesis?	Remember	2
24	Write a short note on Taylor synthesis and bayle's synthesis	Understand	1
25	What is known as symmetrical pattern?	Remember	3
26	What is known as abnormal antenna configuration?	Remember	2
27	List out the directional antennas?	Understand	1
28	Define space diversity technique.	Remember	1
29	What are the advantages of space diversity technique?	Remember	3
30	What is the use of two-branch space diversity antenna?	Understand	1
31	Draw a simple diagram of diversity antenna spacing concept in cell site.	Remember	3
32	Write short note on high-gain broadband umbrella pattern antenna.	Remember	3
PART-B(LONG ANSWER QUESTIONS)			
1	Define human made structures and natural terrain structures and their	Understand	1
2	What is signal reflections in flat and hilly terrain contours and their influences	Understand	1
3	Discuss the phase difference between direct and reflected paths in detail.	Remember	3
4	Write constant standard deviation along a path loss curve in detail.	Understand	1
5	Explain point to point model with its equations.	Remember	1
6	What is meant by propagation of mobile signal over water and a flat open area.	Understand	3
7	Derive the general formula used for signal propagation over water and flat.	Remember	2
8	Explain foliage losses and propagation in near-in distance.	Understand	3
CIE-II			
9	Write short notes long distance propagation.	Remember	2
10	Explain the sum-and-difference patterns and their synthesis in detail.	Understand	1
11	Design aspects and merits of an omni-directional antenna in cell	Remember	2
12	What is known as directional antennas? Explain directional antennas	Understand	2
13	Discuss space diversity antennas in detail.	Understand	1
14	Write short notes on a) Umbrella pattern antenna. b) Space diversity antennas.	Understand	1
15	Define umbrella pattern antenna and omni-directional antennas in detail.	Understand	1

16	Explain about minimum separation of cell-site receiving antennas.	Understand	1
PART-C (ANALYTICAL QUESTIONS)			
1	Explain in detail about, a) Human made structures and b) Point-to-point model in detail.	Remember	1
2	i. What is the need for frequency reuse? Explain the frequency reuse concept and show that $N=i^2 + j^2$ Where N is the number of cells per cluster. ii. Derive an expression for signal to interference ratio (S/I) for 7 cell cluster system.	Remember	2
CIE-II			
2	Explain in detail about a) Broadband umbrella pattern antenna structures. b) Radiation pattern of normal umbrella-pattern antenna.	Understand	1
3	Discuss in detail about a) Glass-mounted antennas. b) Horizontally and vertically oriented space-diversity antennas.	Remember	3
UNIT-IV FREQUENCY MANAGEMENT AND CHANNEL			
PART-A (SHORT ANSWER QUESTIONS)			
S.No	Question	Blooms Taxonomy Level	Course Outcome
1	What is meant by frequency management?	Understand	2
2	What is meant by channel assignment?	Remember	2
3	Differentiate the terms frequency management and channel assignment.	Remember	3
4	Write short note on set-up channels.	Understand	1
5	List few points on frequency spectrum utilization.	Remember	1
6	What is known as access channels?	Understand	1
7	What is known as FOCC?	Remember	2
8	Define paging channel.	Understand	1
9	Give the equation for number of calls in the cell site.	Remember	2
10	Define location management and handoff management.	Remember	3
11	Explain how to avoid interference between two systems while assigning setup channels.	Remember	1
12	Give two points related to non-uniform compact channel allocation algorithm.	Understand	1
13	Draw an underlay and overlay structures.	Understand	3
14	What is the use of tilted antennas?	Remember	1
15	Write short note on channel sharing.	Remember	1
16	Differentiate channel sharing and borrowing.	Understand	3
17	Define adjacent channel assignment.	Remember	1
18	What is meant by fixed channel assignment?	Understand	1
19	Define sectorization.	Remember	3
20	Write short note on non-fixed channel assignment.	Understand	1
PART-B(LONG ANSWER QUESTIONS)			
1	Explain in detail about i. Set-up channels ii. Paging channel iii. Access channels.	Understand	1
2	Explain numbering and grouping concept in detail.	Understand	2

3	Explain in detail about a) Frequency channel utilization b) Significance of frequency management chart.	Understand	2
4	What is known as channel assignment? Explain fixed channel assignment.	Remember	3
5	Explain in detail about i. Supervisory audio tone. ii. Channel borrowing and iii. Channel assignments to travelling mobile units.	Understand	3
6	Explain underlay and overlay cellular structures in detail with examples.	Understand	1
7	Explain channel sharing and channel borrowing concepts in detail.	Understand	2
8	Explain cell sectorization technique.	Understand	1
9	Explain non-fixed channel assignment in detail.	Understand	1
10	What is known as dynamic channel assignment average blocking and handoff	Remember	2

PART-C (ANALYTICAL QUESTIONS)

1	Calculate the total available channels for a cellular system having a total 50km simplex channels to provide full duplex voice and control channels. Assume that the system uses nine cell reuse pattern and 1MHZ of the total bandwidth is allocated for control channels also calculate the number of control channels and voice channels per cell.	Remember	1
2	What do you understand by non-fixed channels assignment? Describe the corresponding algorithms.	Understand	2
3	Compare the average blocking in spatially uniform and non-uniform traffic distribution for FCA,BCA and FBCA.	Remember	1
4	If a transmitter produces 50W of power express the transmitter power in units of (i) dBm (ii) dBW, if 50W is applied to a unity gain antenna with a 900MHz carrier frequency find the received power in dBm at a free space distance of 100m from the antenna. What is Pr (10Km)? Assume unity for the receiver antenna?	Remember	1

UNIT-V HANDOFFS AND DROPPED

PART-A (SHORT ANSWER QUESTIONS)

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Define handoff.	Remember	1
2	What are the types of handoff?	Understand	1
3	Define dropped call.	Remember	1
4	What will be the number of handoffs 8 per call if cell size is smaller as 3.2 to 8 km?	Understand	2
5	If the cell of 16 to 24 km what will be the number of handoffs per call?	Remember	2
6	Write short note on initiation of handoff.	Understand	3
7	What is known as delaying handoff?	Remember	1
8	Comment on two-hand off level algorithm.	Understand	5
9	Draw a simple two-level handoff scheme diagram.	Remember	3
10	What are the advantages of delayed handoffs?	Understand	1
11	What is meant by forced handoffs?	Remember	1
12	What is known as handoff queuing.	Understand	1
13	Define MAHO?	Remember	3

14	Define soft handoff.	Understand	1
15	What is the advantage of soft handoff over hard handoff?	Remember	3
16	Write short note on inter system handoff.	Understand	1
17	What is known as dropped call rate?	Remember	3
18	What is meant by controlling a handoff?	Understand	3
19	What is known as a hole in handoff analysis?	Remember	3
20	What is the significance of handoff?	Understand	1
PART-B(LONG ANSWER QUESTIONS)			
1	Explain “Initiation of handoff”.	Understand	1
2	Explain delaying a handoff with an algorithm in detail.	Understand	1
3	What are the advantages of delayed handoff? Also explain the parameters	Remember	2
4	Explain forced handoff and creating a handoff.	Understand	1
5	Write in detail about following handoff techniques. a) Controlling a handoff. b) Forced handoff in detail.	Understand	2
6	Explain MAHO and soft handoff techniques.	Understand	3
7	Define handoff; explain it’s important in detail with its types.	Remember	1
8	Explain “Dropped call rate” in detail.	Understand	1
9	Define handoff? Explain in detail about inter system handoff.	Remember	3
10	Draw the GSM architecture and discuss various interfaces used in GSM.	Understand	1
11	What is meant by handoff? Describe the classification of handoff processes?	Remember	2
12	What is meant by handoff initiation? Explain the different methods of handoff initiation with suitable diagrams?	Understand	1
PART-C (ANALYTICAL QUESTIONS)			
1	Explain the following terms. i) Forced Handoff ii) Hard Handoff iii) Delaying Handoff	Remember	1
2	What type of handoff is used when a call initiated in one cellular system enters another system before terminating? Explain how it works?	Understand	1
3	i. What are the various methods of delaying the handoff? Explain briefly. ii. What is meant by a dropped call? Explain the factors that influence the dropped call rate.	Remember	1

Prepared By: Dr.P.G.Krishna Mohan, Professor, Dept of ECE,
Mr. U Somanaidu, Assistant Professor, Dept of ECE
Mr. Shashikanth Reddy, Assistant Professor, Dept of ECE

ECE, HOD.