Dayananda Sagar College of Engineering
Department of Electronics & Communication Engineering
Continuous Internal Evaluation – II

Course Name :	Wireless and Mobile Communication	Date :	09/12/2021
Course Code :	17EC7DCWMC	Day :	Thursday
Semester&Section :	7 A,B,C,D	Timings :	11.15-12.45pm
Max Marks :	50 M	Duration :	1½ Hrs.

No.		Question Description	Mks	CO & Levels
Q1	(a)	The propagation path loss _____ i. Increases with frequency of transmission but decreases with distance. ii. Decreases with frequency of transmission and distance. iii. Increases with frequency of transmission and distance. iv. Independent of frequency of transmission and distance.	1	
	(b)	Long distance propagation occurring due to the phenomenon of superrefraction is called i. Duct propagation ii. Refraction iii. Diffraction iv. LOS transmission	1	
	(c)	In a digital communication system the delay spread along with fading causes _____ there by limiting the maximum symbol data rate. i. Intersymbol interference ii. Multipath fading. iii. Doppler Effect iv High bit-error rates	1	
	(d)	Flat fading channel is characterized by _____ i.Rayleigh distribution ii. Multipath fading iii. Ricean Distribution iv. Frequency selective channel.	1	
	(e)	Bluetooth devices communicate using small radio transceiver called _____ that are built onto microprocessor chip i. Transponder ii. Radio modules iii. Receivers iv. None of the above	1	
	(f)	A cluster in a cellular system is a _____ i. Group of frequencies ii. Group of cells iii. Group of subscribers iv. Group of mobile systems	1	
	(g)	Multipath fading can be reduced by using. i. error control codingii. Interleaving iii. Diversityiv. All of the above	1	
	(h)	A regular _____shaped cell is the closest approximation to a circle which has been used for cellular system design. i. Circle ii. Triangle iii. Square iv. Hexagon	1	
	(i)	Cells using the same set of frequencies are called _____ i Clusters ii adjacent cells iii Co channel cells iv Neighboring cells	1	
	(j)	Determine the number of cells in the cluster for i=2, j=4. i. 28 ii. 27 iii.25 iv. 19	1	
Q2	(a)	Explain the basic radio propagation mechanism in a mobile communication	10	CO2&L2
Q3	(a)	Explain the different cell shapes used in cellular architecture. Discuss on the shape that is most preferred over others to represent the cellular architecture. Describe the principle of frequency reuse concept with a neat diagram.	10	CO3&L2
Q4	(a)	What is meant by (i) Doppler shift (ii) Coherence Bandwidth? Explain with the help of expression.	5	CO2&L4
	(b)	A mobile receiver is tuned to a transmission at 800MHz and receives signals with Doppler frequencies ranging from 5 Hz to 15 Hz when moving at a uniform speed of 80km/h. what is the beam width of the mobile antenna?	5	CO2&L4
		OR		
Q5	(a)	Derive the equations of pathloss and received power of two ray point - to- point propagation model in a mobile communication.	10	CO2&L4
Q6	(a)	A mobile communication system is allocated RF spectrum of 25MHz and uses RF channel band width of 25KHz so that a total number of 1000 voice channels can be supported in the system. a) If the service area is divided into 20cells with a frequency reuse factor of 4, compute the system capacity. b) The cell size is reduced to the extent that the service area is now covered with 100 cells. Compute the system capacity while keeping the reuse factor as 4 c) Consider the cell size further reduced so that the same service area is now covered with 700 cells with the frequency reuse factor of 7. Compute the system capacity	10	CO2&L4
		OR		
Q7	(a)	Illustrate with required diagram, the concept of Coverage hole fillers and leaky feeders.	10	CO3&L2

A – Dr. KPS, B-RSK, C- SAS, D- TT

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Date of test : 9/12/2024	Title of the subject	Max Marks : 50 M.
Day : day Thursday		Sub Mentor : PT .
Branch : ECE	Sub initials WMC	Sub Mentor Sign : .
Semester : 7th	Sub Code 17EC7DCWMC	Staff i/c of sec : .
Section : A B C D	Internal Test	Staffs i/c sign : .
Timings : 09.30 AM–11.00 AM.	I / II / IMPT	HOD Name : Dr. TCM
Test Duration : 1½ Hrs.	Test Solutions	HOD's sign : .

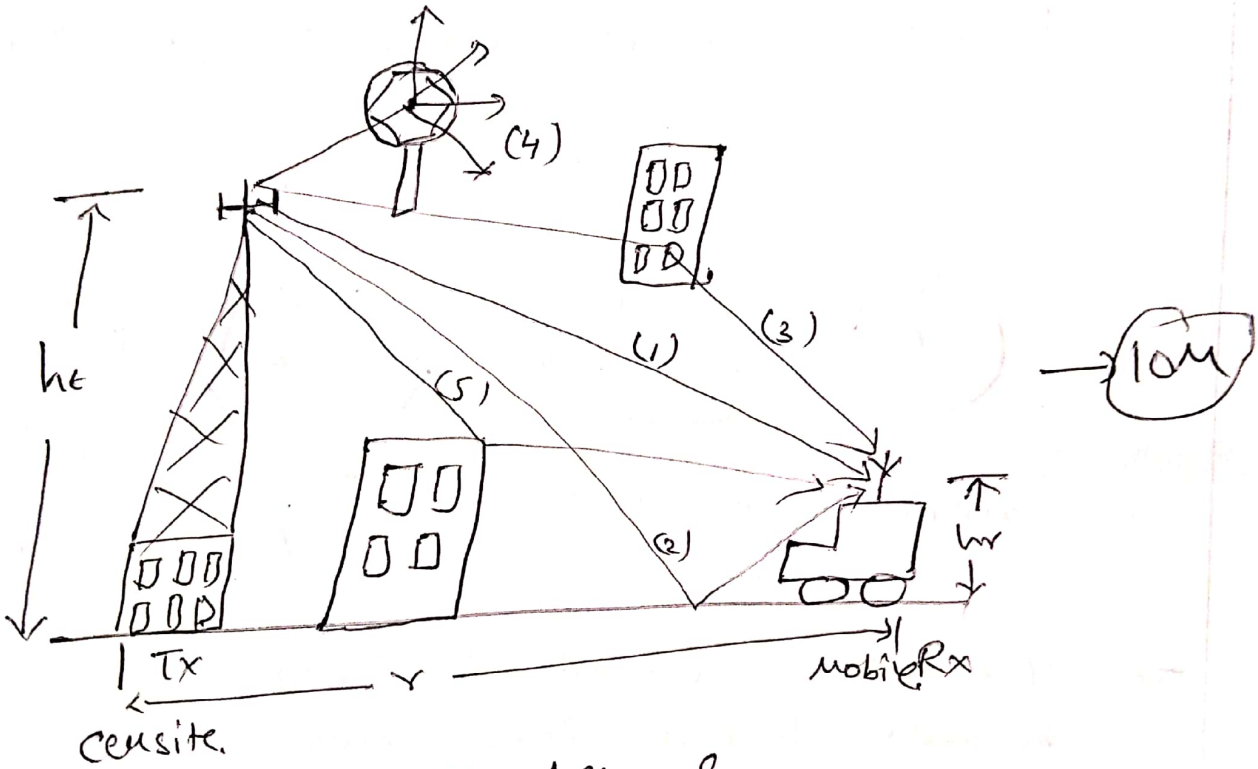
Q. No.	Test question paper solutions with steps	Marks Allocation
1		10M
a)	iii) Increases with freqeuncy of transmission & distance.	
b)	i) Duct Propagation.	
c)	i) Intersymbol Interference.	
d)	(i) Rayleigh distribution.	
e)	ii) Radio Modules	
f)	ii) Group of cells	
g)	i) All of the above	
h)	iv) Hexagon	
i)	iii) Co-Channel cells	
j)	i) 28	

Q. No.	question ... h steps

2(a) Basic Propagation Mechanism.

1. Reflection
2. Scattering
3. Diffraction

} + Explanation of Each



(1) Direct Signal
(2) Ground reflected Signal
(3) Reflected Signal
(4) Scattered Signal
(5) Diffracted Signal

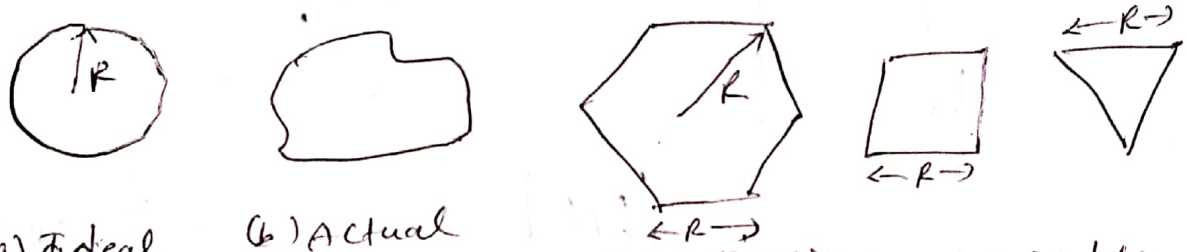
3 (a)

→

* In Cellular System the most important factor is the Size & Shape of a cell.

* Because of constraints imposed by natural irregular terrian, man-made structures, & non uniform Population densities

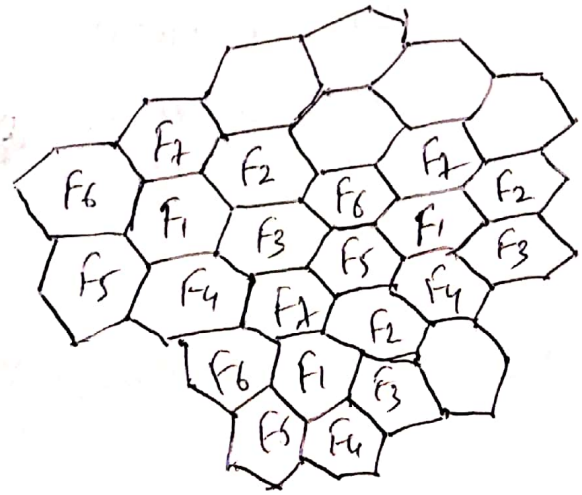
* The below fig depicts Ideal cell, actual cell & Possible cell models such as triangle, Square & hexagon



(a) Ideal (b) Actual (c) Fictitious Cell Models

⇒ The most Preferred is Hexagon as Cell Shape because has a large Coverage area.

→ Frequency reuse Concept → (10M)



+ Explanation

Q. No.	for question ... tion ... h steps

4(a) (i) Doppler Shift

$$f_d = \frac{1}{\lambda_c} V_m \cos\theta$$

$$f_{dm} = V_m / \lambda_c = V_m f_c / c \quad \longrightarrow 2\frac{1}{2}$$

$f_c \rightarrow$ frequency of transmission.

$V_m \rightarrow$ Speed of the mobile

$c \rightarrow$ speed of the light

+ Explanation.

(ii) Coherence B.W :

$\longrightarrow 2\frac{1}{2}$

(b)

Carrier frequency $f_c = 800\,MHz$.

doppler frequency 1, $f_{d1} = 5\,Hz$.

$f_{d2} = 15\,Hz$.

$V_m = 80\,km/h$

$= (80 \times 10^3)/3600 = 22.222\,m/s$

$$f_d = \left(\frac{1}{\lambda_c}\right) V_m \cos\theta$$

(or)

$$\cos\theta = (\lambda_c \times f_d)/V_m.$$

Step1:- To calculate the wavelength of the transmission signal λ_c

$$\lambda_c = c/f_c = \frac{3\times10^8}{800\times10^6} = 0.375 \text{ m/s}$$

Step2:- To calculate θ_1 at doppler freq

$$\cos\theta_1 = \frac{(\lambda_c/f_{d1})}{\text{Vm}} \left(\frac{\lambda_c \times f_{d1}}{V_m}\right)$$

$$= \left(\frac{0.375\times5}{22.222}\right) = 0.08437$$

$$\theta_1 = \underline{85.15^\circ}$$

(10M)

Step3:- To calculate θ_2 at doppler frequency

$$\cos\theta_2 = \left(\frac{\lambda_c \times f_{d2}}{V_m}\right) = \left(\frac{0.375\times15}{22.22}\right) = 0.2531$$

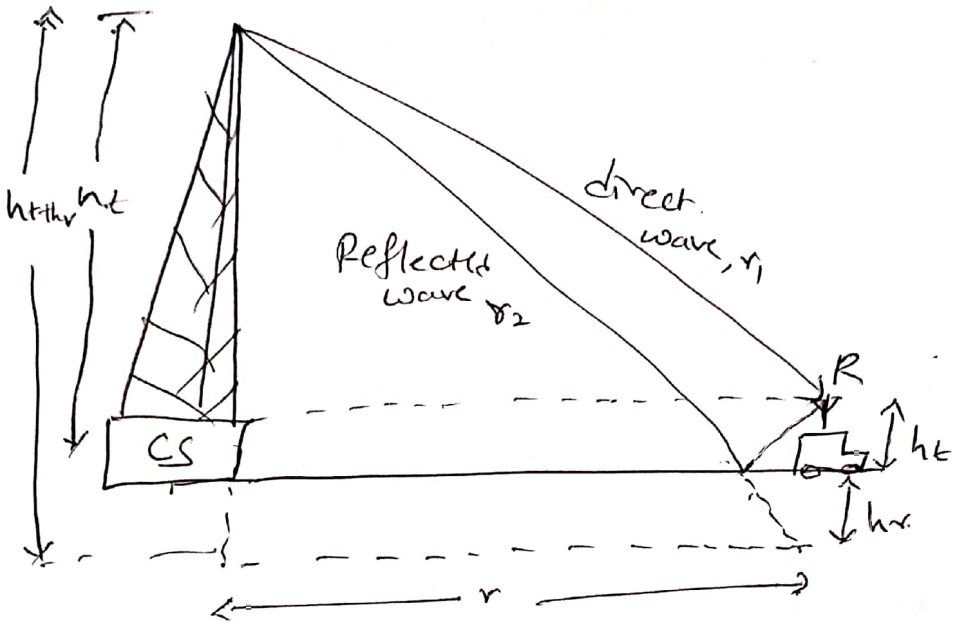
$$= \underline{75.33^\circ}$$

Step4:- To Calculate beam width of mobile antenna

$$= \theta_1 - \theta_2$$

$$= \underline{9.82^\circ}$$

(5)



10 M

$$r_1 = \sqrt{r^2 + (h_t - h_r)^2}$$

$$r_2 = \sqrt{r^2 + (h_t + h_r)^2}$$

need to derive equations

$$P_r = \frac{P_t G_t G_r h_t^2 h_r^2}{r^4}$$ → final expression.

(6) Sol:- Number of available voice channels

$N = 1000$

Step1:- Capacity of Cluster = 1000

no of cells covering area = 20

frequency reuse = 4

Step2:- Determine number of Clusters

no of Cluster = no of cells / cluster size

$= 20/4 = 5$

Step3:- (i) To determine the System Capacity

The Capacity of a Cluster = 1000

no of Clusters = 5

= 1000 × 5 = 5000 users

(ii) To compute new System Capacity for increased no of cells

no of cells covering area = 100

freaquacy reuse factor = 4

Step4:- no of Clusters = 100/4 = 25

Step5:- no of Channels in all 25 Clusters

1000 × 25 = 25000 users

(10M)

(iii) To Compute new System Capacity for increased no of cells & Cluster size.

no of cells Covering the area = 700

Cluster size = 7.

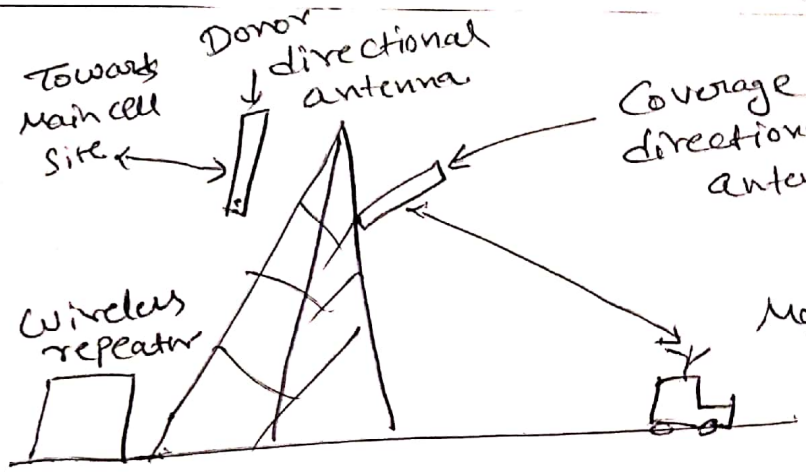
Step6:- no of Cluster = 700/7 = 100

Step7:- no of Channels in 100 Clusters = 1000 × 100

= 100,000 users

Q. No.	Test question paper solution with steps

(7)



→ 10M

Coverage hole fillers

Leaky feeder + Explanation