Indra Ganesan
COLLEGE OF ENGINEERING

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai
Accredited by NAAC with 'B+' Grade, 2(f) & 12B Status Institution by UGC
IG Valley, Madurai Main Road, Manikandam, Tiruchirappalli - 620012

NAAC DOCUMENTS

QUALITY INDICATOR FRAME WORK

CRITERION – 1

CURRICULAR ASPECTS

SUBMITTED BY

IQAC

INTERNAL QUALITY ASSURANCE CELL

INDRA GANESAN COLLEGE OF ENGINEERING

Criteria 1	Curricular Aspects	100

Curricular Planning and Implementation (20)

The Institution ensures effective curriculum planning and delivery through a well-planned and documented process including Academic calendar and conduct of continuous internal Assessment

Table of Content

INDRA GANESAN COLLEGE OF ENGINEERING

IG Valley, Manikandam, Tiruchirappalli, Tamil Nadu – 620 012, India
(Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai-25)

DEPARTMENT OF ELCTRONICS AND COMMUNICATION ENGINEERING

PREFACE OF THE COURSE FILE

Batch : **2018-2022**

Academic Year : **2020-2021 / EVEN**

Program : B.E. ECE

Year & Semester : **3rd Year / VI Semester / 'A' Section**

Course Code : EC8652 NBA Course Code: **C312**

Name of the Course : Wireless Communication

Faculty in-charge :Mrs.RAHAMATHUNISHA, Assistant Professor / ECE

Signature of the Faculty in-charge

HoD / ECE

Dr. G. Balakrishnan, M.E., Ph.D.,
Principal
Indra Ganesan College of Engineering
IG Valley, Main Road
Manikandam, Trichy-620 012.

INDRA GANESAN COLLEGE OF ENGINEERING

IG Valley, Manikandam, Tiruchirappalli, Tamil Nadu – 620 012, India
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Faculty Time Table

Mrs.N.RAHAMATHUNISHA

Day Order	1	2	3	4	5	6	7	8
I					EC8652			
II				EC8652				
III	EC8652							
IV							EC8652	EC8652
V								

S.Code	Title	Year / Branch	Hours
EC8652	Wireless Communication	III / B.E. ECE	5
TOTAL - 5 hours			

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DEPARTMENT OF ELCTRONICS AND COMMUNICATION ENGINEERING

SYLLABUS

EC8652 WIRELESS COMMUNICATION

L T P C
3 0 0 3

OBJECTIVES:

- To study the characteristic of wireless channel
- To understand the design of a cellular system
- To study the various digital signaling techniques and multipath mitigation techniques
- To understand the concepts of multiple antenna techniques

UNIT I WIRELESS CHANNELS 9

Large scale path loss – Path loss models: Free Space and Two-Ray models -Link Budget design – Small scale fading- Parameters of mobile multipath channels – Time dispersion parameters-Coherence bandwidth – Doppler spread & Coherence time, fading due to Multipath time delay spread – flat fading – frequency selective fading – Fading due to Doppler spread – fast fading – slow fading.

UNIT II CELLULAR ARCHITECTURE 9

Multiple Access techniques - FDMA, TDMA, CDMA – Capacity calculations–Cellular concept- Frequency reuse - channel assignment- hand off- interference & system capacitytrunking & grade of service – Coverage and capacity improvement.

UNIT III DIGITAL SIGNALING FOR FADING CHANNELS 9

Structure of a wireless communication link, Principles of Offset-QPSK, p/4-DQPSK, Minimum Shift Keying, Gaussian Minimum Shift Keying, Error performance in fading channels, OFDM principle – Cyclic prefix, Windowing, PAPR.

UNIT IV MULTIPATH MITIGATION TECHNIQUES 9

Equalisation – Adaptive equalization, Linear and Non-Linear equalization, Zero forcing and LMS Algorithms. Diversity – Micro and Macro diversity, Diversity combining techniques, Error probability in fading channels with diversity reception, Rake receiver.

UNIT V MULTIPLE ANTENNA TECHNIQUES 9

MIMO systems – spatial multiplexing -System model -Pre-coding - Beam forming - transmitter diversity, receiver diversity- Channel state information-capacity in fading and non-fading channels.

TOTAL: 45 PERIODS

OUTCOMES:

The student should be able to:

- Characterize a wireless channel and evolve the system design specifications
- Design a cellular system based on resource availability and traffic demands
- Identify suitable signaling and multipath mitigation techniques for the wireless channel and system under consideration.

TEXT BOOKS:

1. Rappaport,T.S., —Wireless communication, Pearson Education, Second Edition, 2010.(UNIT I, II, IV)
2. Andreas.F. Molisch, —Wireless Communications, John Wiley – India, 2006. (UNIT III,V)

REFERENCES:

1. Wireless Communication –Andrea Goldsmith, Cambridge University Press, 2011
2. Van Nee, R. and Ramji Prasad, —OFDM for wireless multimedia communications, Artech House, 2000
3. David Tse and Pramod Viswanath, —Fundamentals of Wireless Communication, Cambridge University Press, 2005.
4. Upena Dalal, —Wireless Communication, Oxford University Press, 2009

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Lecture Schedule

Degree/Program: B.E / ECE
Duration:Feb 2021 – May 2021

Course code &Name: EC8652 -Wireless Communication
Semester: VI Section: A Faculty : RAHAMATHUNISHA

AIM:

To expose the students to design of Cellular Systems

OBJECTIVES:

The students should be made to:

- To study the characteristic of wireless channel
- To understand the design of a cellular system
- To study the various digital signaling techniques and multipath mitigation techniques
- To understand the concepts of multiple antenna techniques

PREREQUISITES: Communication theory, Digital communication, Antennas

COURSE OUTCOMES:

After the course, the student should be able to:

CO	Course Outcomes	POs	PSOs
C312.1	Characterize a wireless channel and evolve the system design specifications	1,2,3,4,5,6,8,10,12	1,3
C312.2	Design a cellular system based on resource availability and traffic demands	1,2,3,4,5,6,8,10,12	1,3
C312.3	Identify suitable signaling and multipath mitigation techniques for the wirelesschannel and system under consideration.	1,2,3,4,5,6,8,10,12	1,3
C312.4	Analyze the various mitigation techniques to address fading and interference in multipath propagation	1,2,3,4,5,6,8,10,12	1,3
C312.5	Compare the performance of channel using various propagation models	1,2,3,4,5,6,8,10,12	1,3
C312.6	Use various signalling schemes for wireless communication channels	1,2,3,4,5,6,8,10,12	1,3

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S.No	Date	Period	Topics to be Covered	Book & Page. No.
UNIT I - WIRELESS CHANNELS				**Target periods :9**
1	18.02.2021	7	Large scale path loss	T1
2	18.02.2021	8	Path loss models: Free Space model	T1
3	22.02.2021	5	Two-Ray model	T1
4	23.02.2021	4	Link Budget design	T1
5	24.02.2021	1	Small scale fading	T1
6	25.02.2021	7	Parameters of mobile multipath channels	T1
7	25.02.2021	8	Time dispersion parameters-Coherence bandwidth – Doppler spread & Coherence time	T1
8	01.03.2021	5	fading due to Multipath time delay spread – flat fading – frequency selective fading	T1
9	02.03.2021	4	Fading due to Doppler spread – fast fading – slow fading.	T1
UNIT II - CELLULAR ARCHITECTURE				**Target periods :9**
10	06.03.2021	1	Multiple Access techniques - FDMA	T1
11	08.03.2021	5	TDMA	T1
12	09.03.2021	4	CDMA	T1
13	10.03.2021	1	Capacity calculations–Cellular concept	T1
14	11.03.2021	7	Frequency reuse ,channel assignment	T1
15	11.03.2021	8	Hand off	T1
16	13.03.2021	4	Interference & system capacity	T1
17	15.03.2021	5	Trunking & grade of service	T1
18	15.03.2021	7	Coverage and capacity improvement	T1
UNIT III - DIGITAL SIGNALING FOR FADING CHANNELS				**Target Periods :9**
19	16.03.2021	4	Structure of a wireless communication link,	T1
20	22.03.2021	5	Principles of Offset-QPSK	T1
21	23.03.2021	4	p/4-DQPSK	T1
22	24.03.2021	1	Minimum Shift Keying	T1
23	25.03.2021	7	Gaussian Minimum Shift Keying	T1
24	25.03.2021	8	Error performance in fading channels	T1
25	27.03.2021	7	OFDM principle	R2
26	27.03.2021	8	Cyclic prefix	R2
27	29.03.2021	5	Windowing, PAPR	R2
UNIT IV - MULTIPATH MITIGATION TECHNIQUES				**Target Periods :9**
28	30.03.2021	4	Equalisation	T2
29	30.03.2021	1	Linear and Non-Linear equalization	T2
30	10.04.2021	4	Zero forcing and LMS Algorithm	T2
31	12.04.2021	5	Diversity – Micro diversity,	T1
33	13.04.2021	4	Macro diversity	T1
34	14.04.2021	1	Diversity combining techniques	T1
35	15.04.2021	7	Error probability in fading channels with diversity reception	T1

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36	15.04.2021	8	Rake receiver	
UNIT V - MULTIPLE ANTENNA TECHNIQUES				T1
37	16.04.2021	5	MIMO systems	**Target Periods:9**
38	19.04.2021	5	spatial multiplexing	R2
39	20.04.2021	8	System model	R2
40	24.04.2023	5	Pre-coding	R2
41	26.04.2021	4	Beam forming	R2
42	27.04.2021	5	Transmitter diversity	R2
43	28.04.2021	4	Receiver diversity	R1
44	29.04.2021	1	Channel state information	R1
45	01.05.2021	7	Capacity in fading and non-fading channels.	R1
			Content Beyond the Syllabus	R1
46	01.05.2021	8	GSM for wireless communication	

Book Reference – Text Books

Sl.No	Title of the Book	Author	Publisher	Year
1.	Wireless communication	Rappaport,T.S	Pearson Education, Second Edition	2010
2.	Wireless Communication	Andreas.F. Molisch	John Wiley – Indi	2006

Book Reference- References

Sl.No	Title of the Book	Author	Publisher	Year
1.	Wireless Communication	Andrea Goldsmith	Cambridge University Press	2011
2	OFDM for wireless multimedia communications	Van Nee, R. and Ramji Prasad	Artech House	2000
3	Fundamentals of Wireless Communication	David Tse and Pramod Viswanath	Cambridge University Press	2005
4	Wireless Communication	Upena Dalal	Oxford University Press	2009

Website Reference:

https://www.nptelvideos.com/communications/wireless_communications.php
https://www.tutorialspoint.com/orthogonal-frequency-division-multiplexing-ofdm

Signature of the Faculty in-charge

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Identification of Curricular Gap & Content Beyond Syllabus(CBS)

Name of the Faculty :Mrs. Rahamathunisha N
Course Code & Name: EC 8652 Wireless communication
Degree & Program:B.E. /ECE Semester & Section: VI / A Academic Year: 2020 -2021 /EVEN

I.Mapping of Course Outcomes with POs & PSOs.(before CBS)

Table.1 Mapping of COs, C, PSOs with POs - before CBS.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C312.1	3	3	-	2	1	1	-	-	-	1	-	1	3	1
C312.2	3	3	2	2	-	1	-	1	-	1	-	2	3	1
C312.3	3	3	-	2	2	1	-	-		1	-	2	3	1
C312.4	3	3	-	2	2	1	-	-	-	1	-	2	3	1
C312.5	3	3	-	2	2	1	-	-	-	1	-	2	3	1
C312.6	3	3	-	2	2	1	-	-	--	1	-	2	3	1
C312	3	3	2	2	2	1	-	1	-	1	-	2	3	1

2

II. Identification of content beyond syllabus.

Table.2 Identification of content beyond syllabus

Details of Content Beyond Syllabus(CBS) added	POs strengthened/ vacant filled	CO/Unit
GSM for Mobile Communication	PO5(2) Vacant filled	C312.2 / II

III. Mapping of Course Outcomes with POs & PSOs. (After CBS)

Table.3 Mapping of COs, C, PSOs with POs- after CBS.

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
C312. 1	3	3	-	2	1	1	-	-	-	1	-	1	3	1
C312. 2	3	3	2	2	2*	1	-	1	-	1	-	2	3	1
C312. 3	3	3	_	2	2	1	-	-		1	-	2	3	1
C312. 4	3	3	-	2	2	1	-	-	-	1	-	2	3	1
C312. 5	3	3	-	2	2	1	-	-	-	1	-	2	3	1
C312. 6	3	3	-	2	2	1	-	-	--	1	-	2	3	1
C312	3	3	2	2	2	1	-	1	-	1	-	2	3	1

Signature of the Faculty

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Identification of Curricular Gap &Content Beyond Syllabus(CBS)MATERIAL

Name of the Faculty : Mrs.RAHAMATHUNISHA N
Course Code & Name : EC8652 & WIRELESS COMMUNICATION
Degree &Program:B.E./ECE **Semester&Section:VI/A** **AcademicYear:2020-2021/EVEN**

TOPIC:GSM FOR MOBILE COMMUNICATION

Definition

Global system for mobile communication(GSM) is a globally accepted standard for digitalcellular communication. GSM is the name of a standardization group established in 1982 to create a common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at 900 MHz.

Introduction:The Evolution of Mobile Telephone Systems

Cellular is one of the fastest growing and most demanding telecommunications applications. Today, it represents a continuously increasing percentage of all new telephone subscriptions around the world. Currently there are more than 45 million cellular subscribers worldwide, and nearly 50 percent of those subscribers are located in the United States. It is forecasted that cellular systems using a digital technology will become the universal method of telecommunications. By the year 2005, forecasters predict that there will be more than 100 million cellular subscribers worldwide. It has even been estimated that some countries may have more mobile phones than fixed phones by the year 2000 (see *Figure 1*).

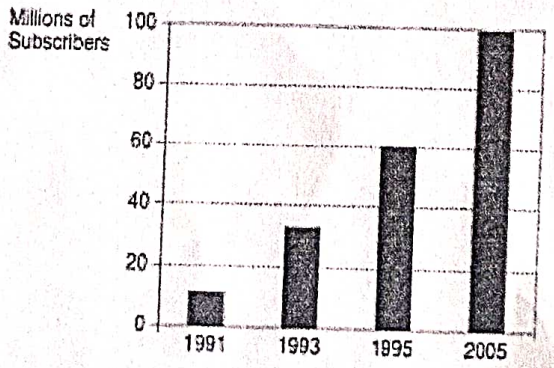

Figure1.CellularSubscriberGrowthWorldwide

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- **modulation**—Modulation is the process of sending a signal by changing the characteristics of a carrier frequency. This is done in GSM via Gaussian minimum shift keying (GMSK).
- **transmission rate**—GSM is a digital system with an over-the-air bitrate of 270 kbps.
- **access method**—GSM utilizes the time division multiple access (TDMA) concept. TDMA is a technique in which several different calls may share the same carrier. Each call is assigned a particular time slot.
- **speech coder**—GSM uses linear predictive coding (LPC). The purpose of LPC is to reduce the bit rate. The LPC provides parameters for a filter that mimics the vocal tract. The signal passes through this filter, leaving behind a residual signal. Speech is encoded at 13 kbps.

GSM Subscriber Services

There are two basic types of services offered through GSM: telephony (also referred to as teleservices) and data (also referred to as bearer services).
Telephony services are mainly voice services that provide subscribers with the complete capability (including necessary terminal equipment) to communicate with other subscribers. Data services provide the capacity necessary to transmitappropriate data signals between two access points creating an interface to the network. In addition to normal telephony and emergency calling, the following subscriber services are supported by GSM:

Dual-tone multifrequency (DTMF)—DTMF is a tone signaling scheme often used for various control purposes via the telephone network, such as remote control of an answering machine. GSM supports full-originating DTMF.

Facsimile group III—GSM supports CCITT Group 3 facsimile. As standard fax machines are designed to be connected to a telephone using analog signals, a special fax converter connected to the exchangeis used in the GSM system. This enables a GSM–connected fax to communicate with any analog fax in the network.

Short message services—A convenient facility of the GSM networkis the short message service. A message consisting of a maximum of 160 alphanumeric characters can be sent to or from a mobile station. This service can be viewed as an advanced form of alphanumeric paging with a number of advantages. If the subscriber's mobile unit is powered off or has left the coverage area, the message is stored and offered back to the subscriber when the mobile is powered on or has reentered the coverage area of the network. This function ensures thatthe message will be received.

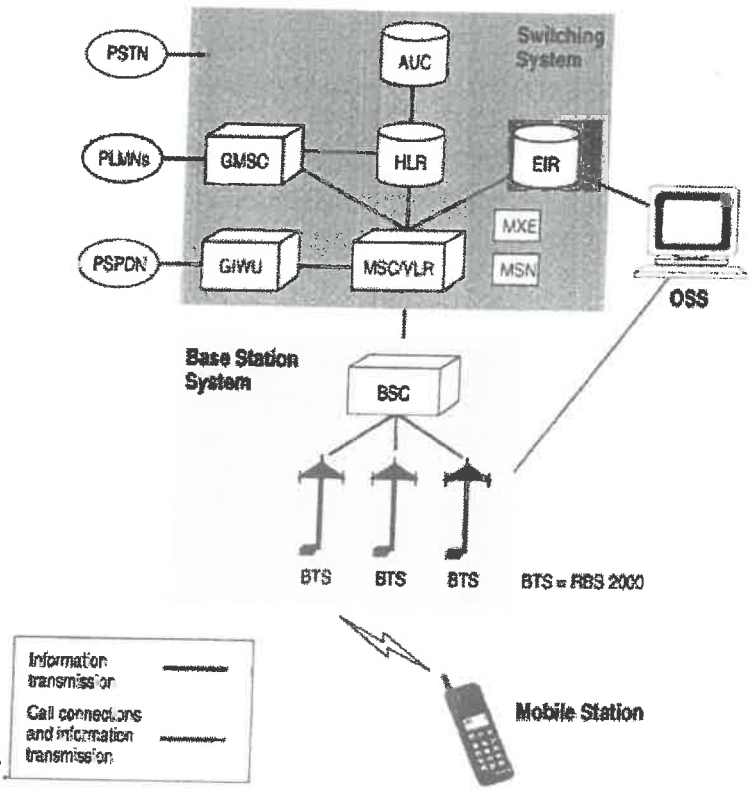
cell broadcast—A variation of the short message service is the cell broadcast facility. A message of a maximum of 93 characters can be broadcast to all mobile subscribers in a certain geographic area. Typicalapplications include traffic congestion warnings and reports on accidents.

Voice mail—This service is actually an answering machine within the network, which is controlled by the subscriber. Calls can be forwardedto the subscriber's voice-mail box and the subscriber checks for messages via a personal security code.

The concept of cellular service is the use of low-power transmitters where frequencies can be reused within a geographic area. The idea of cell-based mobileradio service was formulated in the United States at Bell Labs in the early 1970s

The GSM Network

GSM provides recommendations, not requirements. The GSM specifications define the functions and interface requirements in detail but do not address the hardware. The reason for this is to limit the designers as little as possible but stillto make it possible for the operators to buy equipment from different suppliers. The GSM network is divided into three major systems: the switching system (SS),the base station system (BSS), and the operation and support system (OSS). The basic GSM network elements are shown in *Figure 2*.



The Switching System

The switching system (SS) is responsible for performing call processing andsubscriber-related functions. The switching system includes the following functional units:

Home Location register (HLR)—The HLR is a database used for storage and management of subscriptions. The HLR is considered the most important database, as it stores permanent data about subscribers, including a subscriber's service profile, location information, and activity status. When an individual buys a subscription from one of the PCS operators, he or she is registered in the HLR of that operator.

Mobile services Switching Center (MSC)—The MSC performs the telephony switching functions of the system. It controls calls to and from other telephone and data systems. It also performs such functionsas toll ticketing, network interfacing, common channel signaling, and others.

Visitor Location register (VLR)—The VLR is a database that contains temporary information about subscribers that is needed by the MSC in order to service visiting subscribers. The VLR is always integrated with the MSC. When a mobile station roams into a new MSC area, the VLR connected to that MSC will request data about the mobile station from the HLR. Later, if the mobile station makes a call, the VLR will have the information needed for call setup without having to interrogate the HLR each time.

Authentication Center (AUC)—A unit called the AUC provides authentication and encryption parameters that verify the user's identityand ensure the confidentiality of each call. The AUC protects network operators from different types of fraud found in today's cellular world.

Equipment Identity register (EIR)—The EIR is a database that contains information about the identity of mobile equipment that prevents calls from stolen, unauthorized, or defective mobile stations. The AUC and EIR are implemented as stand-alone nodes or as a combined AUC/EIR node.

The Base Station System (BSS)

All radio-related functions are performed in the BSS, which consists of base station controllers (BSCs) and the base transceiver stations (BTSs).

BSC—The BSC provides all the control functions and physical links between the MSC and BTS. It is a high-capacity switch that provides functions such as handover, cell configuration data, and control of radio frequency (RF) power levels in base transceiver stations. A number of BSCs are served by an MSC.

BTS—The BTS handles the radio interface to the mobile station. The BTS is the radio equipment (transceivers and antennas) needed to service each

GSM SPECIFICATIONS:

- **bandwidth**—the range of a channel's limits; the broader the bandwidth, the faster data can be sent
- **bits per second (bps)**—a single on-off pulse of data; eight bits are equivalent to one byte
- **frequency**—the number of cycles per unit of time; frequency is measured in hertz (Hz)
- **kilo (k)**—kilo is the designation for 1,000; the abbreviation kbps represents 1,000 bits per second

- **megahertz (MHz)**—1,000,000 hertz (cycles per second)**milliseconds (ms)**—one-thousandth of a second
- **frequency band**—The frequency range specified for GSM is 1,850 to 1,990 MHz (mobile station to base station).
- **duplex distance**—The duplex distance is 80 MHz. Duplex distance is the distance between the uplink and downlink frequencies. A channel has two frequencies, 80 MHz apart.
- **channel separation**—The separation between adjacent carrier frequencies. In GSM, this is 200 kHz.

Fax mail—With this service, the subscriber can receive fax messages at any fax machine. The messages are stored in a service center from which they can be retrieved by the subscriber via a personal security code to the desired fax number.

Supplementary Services

call forwarding—This service gives the subscriber the ability to forward incoming calls to another number if the called mobile unit isnot reachable, if it is busy, if there is no reply, or if call forwarding is allowed unconditionally.

barring of outgoing calls—This service makes it possible for a mobile subscriber to prevent all outgoing calls.

barring of incoming calls—This function allows the subscriber to prevent incoming calls. The following two conditions for incoming call barring exist: baring of all incoming calls and barring of incoming calls when roaming outside the home PLMN.

advice of charge (AoC)—The AoC service provides the mobile subscriber with an estimate of the call charges. There are two types of AoC information: one that provides the subscriber with an estimate of the bill and one that can be used for immediate charging purposes. AoC for data calls is provided on the basis of time measurements.

call hold—This service enables the subscriber to interrupt an ongoing call and then subsequently reestablish the call. The call hold service is only applicable to normal telephony.

call waiting—This service enables the mobile subscriber to be notified of an incoming call during a conversation. The subscriber can answer, reject, or ignore the incoming call. Call waiting is applicable to all GSM telecommunications services using a circuit-switched connection.

multiparty service—The multiparty service enables a mobile subscriber to establish a multiparty conversation—that is, a simultaneous conversation between three and six subscribers. This service is only applicable to normal telephony.

calling line identification presentation/restriction—These services supply the called party with the integrated services digital network (ISDN) number of the calling party. The restriction service enables the calling party to restrict the presentation. The restriction overrides the presentation.

closed user groups (CUGs)—CUGs are generally comparable to a PBX. They are a group of subscribers who are capable of only calling themselves and certain numbers.

Signature of the Faculty

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Assignment Question Paper

Assignment – 01			Date of Issue:	15.03.2021	Marks	10
Course code	EC 8652	Course Title	Wireless Communication			
Year	III	Semester/Section	VI /A	Date of Submission:	29.03.2021	

Q.No	Questions	CO
1	Describe free space propagation mode and derive the loss in received signal strength	C312.1
2	Compare and contrast of fast and slow fading. In practice fast fading occurs only in very low data rate communications. Why?	C312.1
3	Explain Cell Splitting, Cell Sectoring techniques	C312.2
4	Explain about co-channel interference and adjacent channel interference. Describe the techniques to avoid interference	C312.2

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Name and Signature of the Faculty Incharge

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Assignment Answer Sheet

Name of the Student : A.RAGAVI

AU Register Number: 811221419016

Assignment – 01						
Course code	EC 8652	Course Title	WIRELESS COMMUNICATION	Date of Issue:	15.03.2021	Marks	10
Year	III	Semester/Section	III / A	Date of Submission:	29.03.2021		

Q.No	Questions	CO
1	Describe free space propagation mode and derive the loss in received signal strength	C312.1
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Mark Allocation

Rubrics	Marks Allocated	Marks obtained
Content Quality	6	5
Presentation Quality	2	2
Timely submission	2	2
Total marks	10	9

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Name and Signature of the Faculty Incharge

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Register Number:

INDRA GANESAN COLLEGE OF ENGINEERING

IG Valley, Manikandam, Tiruchirappalli, Tamil Nadu – 620 012, India

(Approved by AICTE, New Delhi and affiliated to Anna University, Chennai)

Internal Assessment Exam - I

Course code	EC 8652	Course Title	WIRELESS COMMUNICATION		Date/Session	04/03/21 AN	Marks 50
Regulation	2017	Duration	90 minutes		Academic Year	2020-21	
Year	3RD	Semester	VI		Department	ECE	

COURSE OUTCOMES

C312.1	Characterize a wireless channel and evolve the system design specifications
C312.2	Design a cellular system based on resource availability and traffic demands
C312.3	Identify suitable signaling and multipath mitigation techniques for the wireless channel and system under consideration.
C312.4	Analyze the various mitigation techniques to address fading and interference in multipath propagation
C312.5	Compare the performance of channel using various propagation models
C312.6	Use various signalling schemes for wireless communication channels

Q.No.	Question	CO	BTS
	PART A (Answer all the Questions 10 x 2 = 20 Marks)		
1	What is meant by large scale path loss models?	CO1	K2
2	Define Reflection	CO1	K1
3	Write the conditions for frequency selective fading.	CO1	K2
4	Define maximum excess delay.	CO1	K1
5	State the difference between large scale and small scale fading	CO1	K2
6	What is Doppler spread?	CO1	K2
7	Define Coherence Bandwidth	CO1	K2
8	Give the expression for system capacity using frequency reuse	CO2	K3
9	Why the hexagon is used as a cell shape?	CO2	K4
10	Define FDMA	CO2	K1
	PART B (Answer all the Questions 2 x 10 = 20 Marks)		
11a	Explain briefly two ray ground reflection model and mention advantages and disadvantages of its model	CO1	K2
	OR		
11b	Explain small scale fading parameters of mobile multipath channels	CO1	K2
12a	Explain the features of various multiple access techniques used in wireless communication. State the advantages and disadvantages of each technique.	CO2	K3
	OR		
12b	Exaplin the concept of Cellular system and frequency reuse.	CO2	K3
	PART C (Answer all the Questions 1 x 10 = 10 Marks)		
13a	Give a detailed note about the link budget design using path loss models.	CO1	K2
	OR		
13b	Explain Handoff strategies in detail	CO2	K2

S. RAHAMATHUNNISHA

Course Faculty

(Name /Sign / Date)

Dr. G. Balakrishnan, M.E., Ph.D.,
Principal
Indra Ganesan College of Engineering
IG Valley, Madurai Main Road
Manikandam, Trichy-620 012.

M. Ramesh

HoD

(Name /Sign / Date)

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Internal Assessment Test Answer Book

Name	812181060012			**Year/ Semester/Section**	III/VI/A
Batch No.	2018-2022	**Date/Session**		**Department**	ECE
Course code	EC8652	**Course Title**	Wireless Communication		
Internal Assessment Test	**IAT 1** ☑	**IAT 2** ☐	**IAT 3** ☐	**Model** ☐	
Name and Signature of the Invigilator with date	17/3/2021 P. SANTHANA SELVI				

Instruction to the Student: Put tick mark to the question attended in the column against question.

Part A			Part B / Part C					Total Marks
Q. No.	✓	Marks	Q. NO.	✓	a Marks	✓	b Marks	
1		2	11		8			08
2		2	12				9	09
3		2	13		8			08
4		2	14					
5		2	15					
6		2	16					
7		2					Total	25
8		–						
9		2						
10		–						
Total		16	Grand Total		41		Name and Signature of the Examiner with date	(S. RATHAMANIKANDAN)

To be filled by the examiner

Course Outcomes	1	2	3	4	5	6	Total
Marks allotted	34	26					
Marks Obtained	30	11					

IQAC Audit - Remarks

Try to get above 90 marks

Name and Signature of the IQAC member

Dr. G. Balakrishnan, M.E., Ph.D.
Principal
Indra Ganesan College of Engineering
IG Valley, Madurai Main Road
Manikandam, Trichy-620 012.

INDRA GANESAN COLLEGE OF ENGINEERING

IG VALLEY, MANIDANDAM, TIRUCHIRAPPALLI – 620012

RTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ACADEMIC YEAR 2020 – 2021(EVEN SEMESTER)

STUDENTS MARK STATEMENT- CO BASED

INTERNAL ASSESSMENT TEST-I

SUBJECT CODE &TITLE: EC 8652 WIRELESS COMMUNICATION

YEAR/SEM: III/VI **MONTH & YEAR:MARCH 2021**

S.NO	REG NO	STUDENT NAME	CO1 (34)	CO2 (26)	TOTAL (50)	TOTAL (100)
1.	811218106001	Abinaya R	30	14	44	88
2.	811218106002	Akila K	25	18	43	86
3.	811218106004	Arthi M	18	19	37	74
4.	811218106005	AzhaguMeena M	10	13	23	46
5.	811218106006	Devi K	20	15	35	70
6.	811218106007	Dhanalakshmi S	28	16	44	88
7.	811218106008	Hari Krishnan S	16	16	32	64
8.	811218106009	Janani V	24	20	44	88
9.	811218106010	Jenifer C	23	23	46	92
10.	811218106011	Jenifer S	20	17	37	74
11.	811218106012	Kesavamurthi M	30	11	41	82
12.	811218106013	Kiruthika S	29	13	42	84
13.	811218106015	Maria Francis D	24	20	44	88
14.	811218106016	Ragavi A	30	16	46	92
15.	811218106017	Ruthramoorthy M	22	18	40	80
16.	811218106018	Sabarinathan K	21	12	33	66
17.	811218106019	Sarmila M	27	15	42	84
18.	811218106020	Sumathi	12	08	20	40
19.	811218106021	ThivyaPriya R	22	23	45	90

Dr. G. Balakrishnan, M.E., Ph.D.,
Principal
Indra Ganesan [illegible] Engineering
IG Valley, [illegible]
Manikandam, Trichy-620 012.

MARKS RANGE:

<20	20-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
0	0	1	1	0	3	3	9	2

Total No.of Candidates Present	**19**
Total No.of Candidates Absent	**0**
Total No.of Students Pass	**17**
Total No. of Students Fail	**02**
Percentage of Pass	**89.4 %**

STAFF INCHARGE **HoD/ECE** **PRINCIPAL**

Dr. G. Balakrishnan, M.E., Ph.D.,
Principal
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IG Valley, Madurai Main Road

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ROOT CAUSE ANALYSIS

Name of the Faculty : N. RAHAMATHUNISHA
Degree & Program : B.E. ECE
IA Test : I /II/III/Model
Target : 100 %

Course Code & Name : EC8652 & WC
Semester & Section : 6th sem & A
University Exam/Month & Year: April/May 2021
Achieved : 89 %

S.NO	BATCH NO	NAME OF THE STUDENT	CAUSES FOR FAILURE	SIGNATURE OF THE STUDENT WITH DATE	CORRECTIVE ACTION TAKEN	PREVENTIVE ACTION TAKEN	FOLLOWUP STATUS	REMARKS OF THE HOD
1.	811218106005	Azhagu Meena M	Not attended PART C Questions	Azhagu	Advised to attend PART C	Given important PART C Questions	Progress monitored	Advised to concentrate PART C
2.	811218106020	Sumathi	PART A Questions are not attended properly	S. Sumathi	Advised to prepare PART A Questions	Two marks given	Progress monitored	Advised to concentrate PART A

Signature of the Faculty Member

Signature of the HoD/ECE

Dr. G. Balakrishnan, M.E., Ph.D.,
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IQAC Academic Audit Form

ACADEMIC YEAR: 2020-2021 SEMESTER EVEN

Name of Department : ECE | Year / Sem / Sec : IV / VII / A | No. of Students Registered : 19

Details of Examination : ~~IA Test -1~~ / IA Test -2 / IA Test -3 / Model Test

S.No.	Course Code	List of Reg.No Verified	Course Log Book Verified (Y / N)	Course File Verified (Y / N)	No of students Attended	No of Absentees	No of Failures	Pass %	Remarks
1	MG 8591	811218106001	Y	Y	19	00	02	89%	Retest Conducted
2	EC 8095	811218106005	Y	Y	19	0	05	74%	Retest
3	EC8652	811218106007	Y	Y	19	0	02	89%	Retest
4	EC8004	811218106012	Y	Y	19	0	0	100%	—
5	EC8691	811218106016	Y	Y	19	0	0	100%	—
6	EC8651	811218106021	Y	Y	19	0	5	74%	Retest

Verified by

External Member Name and Signature:	Mr. Praveen Sangeeth Kumar.
Internal Member Name and Signature:	P. Santhanaselvi

Overall Remarks:

Conduct Retest for failures

M. Bhuvaneswari
HoD/ ECE

IQAC Co-Ordinator

Principal

Dr. G. Balakrishnan, M.E., Ph.D.,
Principal
Indra Ganesan College of Engineering
Manikandam, Tiruchirappalli-620 012.