KANDULA SRINIVASA REDDY MEMORIAL COLLEGE OF ENGINEERING
(AUTONOMOUS)

KADAPA-516003. AP

(Approved by AICTE, Affiliated to JNTUA, Ananthapuramu, Accredited by NAAC)

(An ISO 9001-2008 Certified Institution)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VALUE ADDED COURSE

ON

"ADVANCED WIRELESS COMMUNICATION"

Resource Person : Dr. S.L Prathapa Reddy

Course Coordinator: Mr. G A Sanjeeva Reddy, **Assistant Professor, Dept. of ECE, KSRMCE**

Duration: 02/04/2024 to 29/04/2024

K.S.R.M. COLLEGE OF ENGINEERING

(UGC-AUTONOMOUS)

Kadapa,Andhra Pradesh, India– 516 003

Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu.

An ISO 14001:2004 & 9001: 2015 Certified Institution

Lr./KSRMCE/SDC/2023-24/

Date: 26-03-2024

To
The Principal,
KSRMCE,
Kadapa.

Respected Sir,

Sub: Permission to Organize a Value Added Course on "ADVANCED WIRELESS COMMUNICATION" from **02/04/2024 to 29/04/2024**–Req- Reg.

The Department of ECE is planning to organize a Value Added Course on "ADVANCED WIRELESS COMMUNICATION" for III Year B. Tech.students. The course will be conducted from **02/04/2024 to 29/04/2024**. In this regard, I kindly request you to grant permission to conduct Course.

Thanking you sir,

Yours faithfully

(G A Sanjeeva Reddy, Coordinator)

forwarded to the
Principal sir

Permitted
U.S.S. Murty
26/03/2024

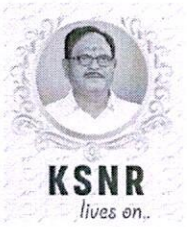
K.S.R.M. COLLEGE OF ENGINEERING

(UGC-AUTONOMOUS)

Kadapa, Andhra Pradesh, India– 516 003

Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu.

An ISO 14001:2004 & 9001: 2015 Certified Institution



Cr./KSRMCE/SDC/2023-24/ Date: 27/03/2024

Circular

The Department of ECE is organizing a Value Added Course on "ADVANCED WIRELESS COMMUNICATION" from **02/04/2024 to 29/04/2024** to III Year B. Tech students. In this regard, interested students are requested to register their names for the Value Added Course with the Coordinator.

For further information contact the Value Added Course Coordinator.

Value Added Course Coordinator: Sri. G A Sanjeeva Reddy, Asst. Professor, Dept. of ECE, KSRMC. Contact No: 8074449062

HOD

Professor & H.O.D.
Department of E.C.E.
K.S.R.M. College of Engineering
KADAPA - 516 003

Dept. of ECE

Cc to:

IQAC-KSRMCE

Date: 30-03-2024

Name of the Event: Value Added Course on "ADVANCED WIRELESS COMMUNICATION"

Venue : SJ 207

List of Participants

Sl. No.	Name of the student	Department	Roll No.	Contac No./Email ID
1	O Ravanamma	ECE	219Y1A04B8	219Y1A04B8@ksrmce.ac.in
2	P Sandeep Muni	ECE	219Y1A04C1	219Y1A04C1@ksrmce.ac.in
3	P Vijayasimha Prasad	ECE	219Y1A04C2	219Y1A04C2@ksrmce.ac.in
4	P Haneefa	ECE	219Y1A04C3	219Y1A04C3@ksrmce.ac.in
5	P Karthik	ECE	219Y1A04C4	219Y1A04C4@ksrmce.ac.in
6	P Satya Narayana	ECE	219Y1A04C5	219Y1A04C5@ksrmce.ac.in
7	P Chandana	ECE	219Y1A04C6	219Y1A04C6@ksrmce.ac.in
8	P Manideep Reddy	ECE	219Y1A04C7	219Y1A04C7@ksrmce.ac.in
9	P Manju	ECE	219Y1A04D1	219Y1A04D1@ksrmce.ac.in
10	P Rama Devi	ECE	219Y1A04D3	219Y1A04D3@ksrmce.ac.in
11	P Gangothri	ECE	219Y1A04D4	219Y1A04D4@ksrmce.ac.in
12	P Meghana	ECE	219Y1A04D6	219Y1A04D6@ksrmce.ac.in
13	R Sainath	ECE	219Y1A04D7	219Y1A04D7@ksrmce.ac.in
14	R Siva Tejasweri	ECE	219Y1A04D8	219Y1A04D8@ksrmce.ac.in
15	S Mounika	ECE	219Y1A04D9	219Y1A04D9@ksrmce.ac.in
16	S Swathi	ECE	219Y1A04E0	219Y1A04E0@ksrmce.ac.in
17	S Rahiman	ECE	219Y1A04E3	219Y1A04E3@ksrmce.ac.in
18	S K Arshad	ECE	219Y1A04E4	219Y1A04E4@ksrmce.ac.in
19	S K Gouse Lazam	ECE	219Y1A04E5	219Y1A04E5@ksrmce.ac.in
20	S Md Akhil	ECE	219Y1A04E6	219Y1A04E6@ksrmce.ac.in
21	S Md Ashfaq	ECE	219Y1A04E7	219Y1A04E7@ksrmce.ac.in
22	S Mohasina	ECE	219Y1A04F0	219Y1A04F0@ksrmce.ac.in
23	S Wajeed Ahamed	ECE	219Y1A04F1	219Y1A04F1@ksrmce.ac.in
24	S Zakeer Basha	ECE	219Y1A04F2	219Y1A04F2@ksrmce.ac.in
25	S Srinath	ECE	219Y1A04F3	219Y1A04F3@ksrmce.ac.in
26	S Manasa	ECE	219Y1A04F4	219Y1A04F4@ksrmce.ac.in
27	S Bargavi	ECE	219Y1A04F6	219Y1A04F6@ksrmce.ac.in
28	S Sumalatha	ECE	219Y1A04F8	219Y1A04F8@ksrmce.ac.in
29	T Bhargavi	ECE	219Y1A04F9	219Y1A04F9@ksrmce.ac.in

30	T Mahendra	ECE	219Y1A04G0	219Y1A04G0@ksrmce.ac.in
31	V Prashanth	ECE	219Y1A04G2	219Y1A04G2@ksrmce.ac.in
32	V Reddy Prasad Reddy	ECE	219Y1A04G3	219Y1A04G3@ksrmce.ac.in
33	V Kiran	ECE	219Y1A04G5	219Y1A04G5@ksrmce.ac.in
34	V Guru Sai Yadav	ECE	219Y1A04G6	219Y1A04G6@ksrmce.ac.in

Coordinator

HOD

Professor & H.O.D.
Department of E.C.E.
K.S.R.M. College of Engineering
KADAPA - 516 003

Dept. of ECE

Syllabus of Value Added Course

Course Name: ADVANCED WIRELESS COMMUNICATION 40Hrs

Course Objectives:

1. Understand the basics of wireless communication used for mobile telephony
2. Apply the basic methodologies of cellular system designing.
3. Describe the 3G network architecture and cellular network
4. Understand GSM and TDMA technologies and GSM Call establishment, Cal handoff and Roaming
5. Distinguish between CDMA technology, wireless LAN and PAN technologies.

Course Outcomes:

1. Understand and Identify the telecommunication system and networks system, Different generations of wireless cellular networks 1G, 2G,2.5G ,3G and 4G Cellular system and beyond, Wireless standard organizations.
2. Analyze Common Cellular System components, Common cellular network components, Hardware and software views of cellular networks.
3. Understand Wireless network architecture and operation, power management and network security and Capacity expansion techniques,.
4. Understand GSM and TDMA Technologies. GSM frame concept , GSM system operation registration, call setup, location updating, and call hand off procedure,
5. Analyze the design issues in CDMA, Wireless LAN and PAN Networks 3G cellular system components; list the components of wireless cellular network and different frequency band used in GSM and CDMA

UNIT-I

Introduction to wireless telecommunication systems and Networks, History and Evolution of wireless radio system, Development of modern telecommunication infrastructure, overview of existing Network infrastructure, Wireless Network applications, Future Wireless Network. Different generations of wireless cellular networks 1G, 2G,2.5G ,3G and 4G Cellular system and beyond, Wireless standard organizations.

UNIT-II

Common Cellular System components, Common cellular network components, Hardware and software, views of cellular networks, 3G cellular systems components. Cellular component identification, Call establishment

UNIT-III

Wireless network architecture and operation: The cellular concept Cell fundamentals, Capacity expansion techniques, Cellular backhaul networks, Mobility management, Radio resources and power management, Wireless network security.

UNIT-IV

GSM and TDMA Technology: GSM system overview-introduction to GSM and TDMA,GSM Network and System Architecture, GSM channel concept,
GSM system operations-GSM identities, GSM system operations (Traffic cases).

UNIT-V

CDMA Technology: CDMA system overview, introduction to CDMA,CDMA network and system architecture
CDMA basics: CDMA Channel concept, CDMA operations(Layer 3) 3g CDMA,IS95B,CDMA 2000 and WCDMA
Wireless LANs/IEEE 802.11X: Introduction and Evolution of Wireless LANs, Design issues.

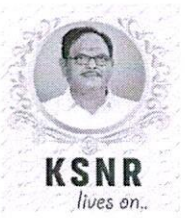
Text Books

1. Garry J Mullet, "Introduction to Telecommunication Systems and Networks: . India Edition, Delmar Cengage Learning,2007

Reference Books:

1. TL Singal, "Wireless Communications", Tata McGraw-Hill, Education, 2010
2. Vijay K Garg, "IS-95 CDMA and cdma2000: Cellular/PCS Systems Implementation", Pearson Education, reprint 2006.

Professor & H.O.D.
Department of E.C.E.
K.S.R.M. College of Engineering
KADAPA - 516 003



SCHEDULE

Department of Electronics and Communication Engineering

Value Added Course

On

"ADVANCED WIRELESS COMMUNICATION"From 02/04/2024 to 29/04/2024

Date	Timing	Resource Person	Topic to be covered
02/04/24	2 PM to 5 PM	Dr. S L Prathapa Reddy	Introduction to wireless telecommunication systems and Networks History and Evolution of wireless radio system,
03/04/24	3 PM to 5 PM	Dr. S L Prathapa Reddy	Development of modern telecommunication infrastructure, overview of existing Network infrastructure
04/04/24	3 PM to 5 PM	Dr. S L Prathapa Reddy	Wireless Network applications, Future Wireless Network
05/04/24	3 PM to 5 PM	Dr. S L Prathapa Reddy	Different generations of wireless cellular networks 1G, 2G,2.5G ,3G and 4G Cellular system and beyond,
06/04/24	3 PM to 5 PM	Dr. S L Prathapa Reddy	Wireless standard organizations.
08/04/24	3 PM to 5 PM	Dr. S L Prathapa Reddy	Common Cellular System components
12/04/24	3 PM to 5 PM	Dr. S L Prathapa Reddy	Common cellular network components, Hardware and software,
13/04/24	3 PM to 5 PM	Dr. S L Prathapa Reddy	views of cellular networks, 3G cellular systems components
15/04/24	3 PM to 5 PM	Dr. S L Prathapa Reddy	Cellular component identification, Call establishment
16/04/24	3 PM to 5 PM	Dr. S L Prathapa Reddy	Wireless network architecture and operation The cellular concept Cell fundamentals
18/04/24	3 PM to 5 PM	Dr. S L Prathapa Reddy	Capacity expansion techniques,
19/04/24	3 PM to 5 PM	Dr. S L Prathapa Reddy	Cellular backhaul networks Mobility management, Radio resources
20/04/24	3 PM to 5 PM	Dr. S L Prathapa Reddy	power management, Wireless network security
22/04/24	3 PM to 5 PM	Dr. S L Prathapa Reddy	GSM system overview-introduction to GSM

23/04/24	3 PM to 5 PM	Dr. S L Prathapa Reddy	TDMA,GSM Network and System Architecture
24/04/24	3 PM to 5 PM	Dr. S L Prathapa Reddy	GSM channel concept
25/04/24	3 PM to 5 PM	Dr. S L Prathapa Reddy	GSM system operations-GSM identities, GSM system operations (Traffic cases).
26/04/24	3 PM to 5 PM	Dr. S L Prathapa Reddy	CDMA system overview, introduction to CDMA CDMA network and system architecture
27/04/24	3 PM to 5 PM	Dr. S L Prathapa Reddy	CDMA Channel concept, CDMA operations(Layer 3) 3g CDMA IS95B,CDMA 2000 and WCDMA
29/04/24	3 PM to 5 PM	Dr. S L Prathapa Reddy	Introduction and Evolution of Wireless LANs, Design issues

Resource Person(s)

HoD

Professor & H.O.D.
Department of E.C.E.
K.S.R.M. College of Engineering
KADAPA - 516 003

K.S.R.M. COLLEGE OF ENGINEERING

(UGC-AUTONOMOUS)

Kadapa, Andhra Pradesh, India– 516 003

Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu.

An ISO 14001:2004 & 9001: 2015 Certified Institution

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Attendance sheet of Certification Courseon"ADVANCED WIRELESS COMMUNICATION"

From 02/04/2024 to 29/04/2024

Sl. No.	Roll No.	Name	2/4/2024	3/4/2024	4/4/2024	5/4/2024	6/4/2024	8/4/2024	12/4/2024	13/4/2024	15/4/2024	16/4/2024	18/4/2024	19/4/2024	20/4/2024	22/4/2024	23/4/2024	24/4/2024	25/4/2024	26/4/2024	27/4/2024	29/4/2024
1	219Y1A04B8	O Ravanamma													A							
2	219Y1A04C1	P Sandeep Muni										A						A				
3	219Y1A04C2	P Vijayasimha Prasad						A										A				
4	219Y1A04C3	P Haneefa										A									A	
5	219Y1A04C4	P Karthik						A							A							
6	219Y1A04C5	P Satya Narayana							A							A						
7	219Y1A04C6	P Chandana			A												A					
8	219Y1A04C7	P Manideep Reddy														A			A			
9	219Y1A04D1	P Manju				A														A		
10	219Y1A04D3	P Rama Devi								A												A

11	219Y1A04D4	P Gangothri																						
12	219Y1A04D6	P Meghana																						
13	219Y1A04D7	R Sainath																						
14	219Y1A04D8	R Siva Tejasweri																						
15	219Y1A04D9	S Mounika																						
16	219Y1A04E0	S Swathi																						
17	219Y1A04E3	S Rahiman																						
18	219Y1A04E4	S K Arshad																						
19	219Y1A04E5	S K Gouse Lazam																						
20	219Y1A04E6	S Md Akhil																						
21	219Y1A04E7	S Md Ashfaq																						
22	219Y1A04F0	S Mohasina																						
23	219Y1A04F1	S Wajeed Ahamed																						
24	219Y1A04F2	S Zakeer Basha																						
25	219Y1A04F3	S Srinath																						
26	219Y1A04F4	S Manasa																						
27	219Y1A04F6	S Bargavi																						
28	219Y1A04F8	S Sumalatha																						
29	219Y1A04F9	T Bhargavi																						
30	219Y1A04G0	T Mahendra																						

31	219Y1A04G2	V Prashanth				A										A								
32	219Y1A04G3	V Reddy Prasad Reddy								A												A		
33	219Y1A04G5	V Kiran											A						A					
34	219Y1A04G6	V Guru Sai Yadav													A					A				

Coordinator(s)

HoD

Professor & H.O.D.
Department of E.C.E.
K.S.R.M. College of Engineering
KADAPA - 516 003

VALUE ADDED COURSE ON

ADVANCED WIRELESS COMMUNICATION

RESOURCE PERSON

Dr S. L. PRATHAPAREDDY
PROFESSOR,
DEPARTMENT OF ECE

Report of
Value Added Course on "ADVANCED WIRELESS COMMUNICATION"
From 02/04/2024 to 29/04/2024

Target Group	**: III B. Tech Students**
Details of Participants	**: 34 Students**
Organizer	**: G A Sanjeeva Reddy**
Resource Person	**: Dr. S L Prathapa Reddy**
Organizing Department	**: ECE**
Venue	**: SJ-207**

Description:

The Department of ECE has organized a Value Added Course on "ADVANCED WIRELESS COMMUNICATION" from 02th April 2024 to 29th April 2024. The course Resource Person is **Dr. S L Prathapa Reddy**

The main objective of advanced wireless communication is to enhance the efficiency, speed, reliability, and security of wireless networks. This includes improving data transmission rates, expanding coverage areas, reducing interference, enabling seamless connectivity, and supporting a wide range of applications and devices. Advanced wireless communication technologies aim to meet the increasing demands for faster and more robust wireless connectivity in our ever-connected world.

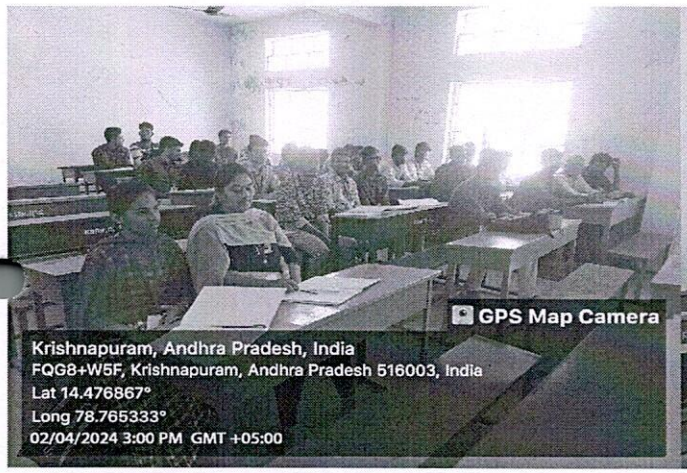
Advanced wireless communication also focuses on developing innovative techniques such as multiple input multiple output (MIMO) systems, beam forming, cognitive radio, network slicing, and other technologies to optimize spectrum utilization, mitigate signal degradation, and provide better quality of service. Additionally, advancements in areas like 5G and beyond, Internet of Things (IoT), edge computing, and artificial intelligence (AI) are shaping the future of wireless communication, offering new opportunities for improved efficiency, lower latency, and enhanced user experiences.

Furthermore, advanced wireless communication research seeks to address challenges related to network security, energy efficiency, mobility management, and integration with emerging technologies like virtual reality, augmented reality, and autonomous systems. By pushing the boundaries of wireless communication

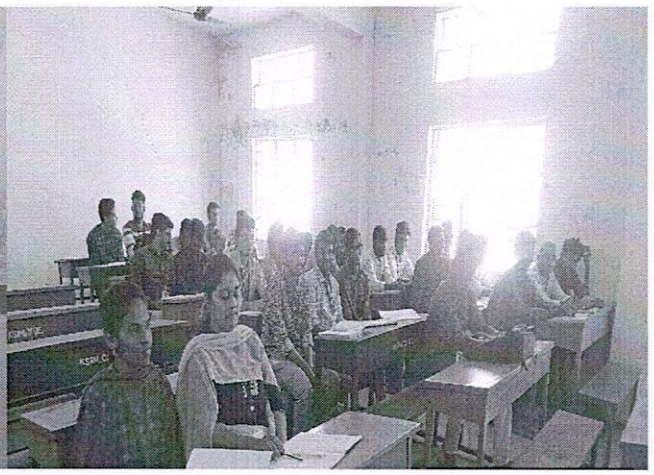
capabilities, researchers and industry professionals aim to create a connected ecosystem that enables seamless communication across various devices, platforms, and environments, ultimately enhancing productivity, connectivity, and user satisfaction.

PHOTOS

The pictures taken during the course are given below:



Resource Person giving introduction



Students listing the class

Coordinator

HoD

Professor & H.O.D.
Department of E.C.E.
K.S.R.M. College of Engineering
KADAPA - 516 003

K.S.R.M. COLLEGE OF ENGINEERING (AUTONOMOUS), KADAPA-516003
DEPARTMENT OF ELECTRONICS AND COMUNICATION ENGINEERING
VALUE ADDED CERTIFICATE COURSE ON
"ADVANCED WIRELESS COMMUNICATION"FROM 02/04/2024 to 29/04/2024

ASSESSMENT TEST

Roll Number: _____ **Name of the Student:** _____

Time: 20 Min **(Objective Questions)** **Max.Marks: 20**

Note: Answer the following Questions and each question carries **one** mark.

1. Which of the following is a type of wireless communication? ( )

a) LAN b) WAN c) PAN d) All of the mentioned

2. Space diversity is also known as _____ ( )

a) Frequency diversity b) Antenna diversity c) Polarization diversity d) Time diversity

3. Which of the following is not an example of wireless communication? ( )

a) Wi-Fi b) Mobiles c) Landline d) Wireless Computer Parts

4. ------ Is a transmission method used in MIMO wireless communications to transmit encoded data signals independently. ( )

a) MU-MIMO b) STTD c) SM d) Collaborative Uplink MIMO

5. Which two channels are responsible for initiating mobile calls? ( )

a) FCC and RVC b) FVC and FCC c) FVC and RVC d) FCC and RCC

6. Which of the following is a CDMA standard of second generation network? ( )

a) ETACS b) EDGE c) IS-95 d) IS-136

7. Which of the following is not a TDMA standard of 2.5G network? ( )

a) GPRS b) GSM c) HSCSD d) EDGE

8. Which modulation scheme is used by Bluetooth? ( )

a) GFSK b) DQPSK c) BPSK d) MSK

9. Which of the following do not undergo free space propagation? ( )

a) Wired telephone systems b) Wireless line of sight radio links

c) Microwave line of sight radio links d) Satellite communication system

10. Small scale fades are characterized by _____ amplitude fluctuations. ( )

a) Large b) Small c) Rapid d) Slow

11. What is a cell in cellular system? ( )

a) a group of cells b) A group of subscribers

c) A small geographical area d) A large group of mobile systems

12. What is frequency reuse? ( )

a) Process of selecting and allocating channels

b) Process of selection of mobile users

c) Process of selecting frequency of mobile equipment

d) Process of selection of number of cells

13. Actual radio coverage of a cell is called _ ( )

a) Fingerprint b) Imprint c) Footprint d) Matrix

14. Which of the following is a universally adopted shape of cell? ( )

a) Hexagon b) Circle c) Triangle d) Square

15. Why the shape of cell is not circle? ( )

a) Omni directionality b) Small area

c) Overlapping regions or gaps are left d) Complex design

16. Which type of antenna is used for center excited cells? ( )

a) Omnidirectional antenna b) Grid antenna

c) Sectored antenna d) Dipole antenna

17. For a cellular system, if there are N cells and each cell is allocated k channel. What is the total number of available radio channels, S? ( )

a) S=N/k b) S=k/N c) S=k*N d) S=kN

18. What is a cluster in a cellular system? ( )

a) Group of cells b) Group of frequencies

c) Group of subscribers d) Group of mobile systems

19. The multiple satellite access technique suitable only for digital transmission is the ( )

a) CDMA b) CDMA c) TDMA d) Both TDMA and FDMA

20. Capacity of a cellular system is directly proportional to ( )

a) Number of times a cluster is replicated b) Number of cells

c) Number of Base stations d) Number of users

K.S.R.M. COLLEGE OF ENGINEERING (AUTONOMOUS), KADAPA-516003
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
VALUE ADDED/CERTIFICATE COURSE ON
"ADVANCED WIRELESS COMMUNICATION"FROM 02/04/2024 to 29/04/2024

AWARD LIST

S.NO	Roll Number	Name of the Student	Marks Obtained
1	219Y1A04B8	O Ravanamma	16
2	219Y1A04C1	P Sandeep Muni	17
3	219Y1A04C2	P Vijayasimha Prasad	18
4	219Y1A04C3	P Haneefa	16
5	219Y1A04C4	P Karthik	17
6	219Y1A04C5	P Satya Narayana	18
7	219Y1A04C6	P Chandana	16
8	219Y1A04C7	P Manideep Reddy	14
9	219Y1A04D1	P Manju	18
10	219Y1A04D3	P Rama Devi	17
11	219Y1A04D4	P Gangothri	12
12	219Y1A04D6	P Meghana	18
13	219Y1A04D7	R Sainath	15
14	219Y1A04D8	R Siva Tejasweri	15
15	219Y1A04D9	S Mounika	18
16	219Y1A04E0	S Swathi	16
17	219Y1A04E3	S Rahiman	17
18	219Y1A04E4	S K Arshad	15
19	219Y1A04E5	S K Gouse Lazam	15
20	219Y1A04E6	S Md Akhil	15
21	219Y1A04E7	S Md Ashfaq	15
22	219Y1A04F0	S Mohasina	18
23	219Y1A04F1	S Wajeed Ahamed	17
24	219Y1A04F2	S Zakeer Basha	16
25	219Y1A04F3	S Srinath	15
26	219Y1A04F4	S Manasa	15
27	219Y1A04F6	S Bargavi	18
28	219Y1A04F8	S Sumalatha	18
29	219Y1A04F9	T Bhargavi	12
30	219Y1A04G0	T Mahendra	13
31	219Y1A04G2	V Prashanth	14
32	219Y1A04G3	V Reddy Prasad Reddy	12
33	219Y1A04G5	V Kiran	13
34	219Y1A04G6	V Guru Sai Yadav	15

Coordinator

HoD

Professor & H.O.D.
Department of E.C.E.
K.S.R.M. College of Engineering
KADAPA - 516 003

K.S.R.M. COLLEGE OF ENGINEERING

(UGC - Autonomous)
Kadapa, Andhra Pradesh, India– 516 003
Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu.

KSNR
lives on..

CERTIFICATION OF PARTICIPATION

This is to certify that Mr/Ms T. Bhargavi bearing Roll No. 21941A04E9 Has participated in Valve Added course on"Advanced wireless communication" and Organized by Department of ECE, K.S.R.M College of Engineering (Autonomous), Kadapa. from 02/04/2024 to 29/04/2024.

Coordinator

HOD

V. S. S. Murty
Principal

PRINCIPAL
K.S.R.M. COLLEGE OF ENGINEERING
KADAPA-516005 (A.P.)

K.S.R.M. COLLEGE OF ENGINEERING

(UGC - Autonomous)

Kadapa, Andhra Pradesh, India– 516 003

Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu.

KSNR
lives on..

CERTIFICATION OF PARTICIPATION

This is to certify that Mr/Ms V. Guru Sai Yadav bearing Roll No. 21911A04G6. Has participated in Valve Added course on"Advanced wireless communication" and Organized by Department of ECE, K.S.R.M College of Engineering (Autonomous), Kadapa. from 02/04/2024 to 29/04/2024.

Coordinator

HOD

Principal

PRINCIPAL
K.S.R.M. COLLEGE OF ENGINEERING
KADAPA-516005 (A.P.)

K.S.R.M. COLLEGE OF ENGINEERING

(UGC - Autonomous)

Kadapa, Andhra Pradesh, India– 516 003

Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu.

KSNR

lives on..

CERTIFICATION OF PARTICIPATION

This is to certify that Mr/Ms P. Gangothri bearing Roll No. 21911A04D4 Has participated in Valve Added course on"Advanced wireless communication" and Organized by Department of ECE, K.S.R.M College of Engineering (Autonomous), Kadapa. from 02/04/2024 to 29/04/2024.

Coordinator

HOD

V. S. S. Murty

Principal

PRINCIPAL
K.S.R.M. COLLEGE OF ENGINEERING
KADAPA-516003 (A.P.)

Feedback form on Value Added Course "ADVANCE WIRELESS COMMUNICATION" from 02/04/2024 to 29/04/2024

sanjeevareddy@ksrmce.ac.in (not shared) Switch account

* Required

Roll Number *

Your answer

Name of the Student *

Your answer

The objectives of the Value Added Course were met (Objective) *

- ◯ Excellent
- ◯ Good
- ◯ Satisfactory
- ◯ Poor

The content of the course was organized and easy to follow (Delivery) *

- ◯ Excellent
- ◯ Good
- ◯ Satisfactory
- ◯ Poor

The Resource Persons were well prepared and able to answer any question (Interaction) *

- ◯ Excellent
- ◯ Good
- ◯ Satisfactory
- ◯ Poor

The exercises/role play were helpful and relevant (Syllabus Coverage) *

- ◯ Excellent
- ◯ Good
- ◯ Satisfactory
- ◯ Poor

The Value Added Course satisfy my expectation as a value added Programme (Course Satisfaction) *

- ◯ Excellent
- ◯ Satisfactory
- ◯ Good
- ◯ Poor

Any Issues

Your answer

Submit Clear form

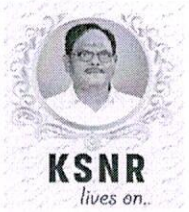
K.S.R.M. COLLEGE OF ENGINEERING

(UGC-AUTONOMOUS)

Kadapa,Andhra Pradesh, India– 516 003

Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu.

An ISO 14001:2004 & 9001: 2015 Certified Institution



Value Added Course on "Advanced Wireless Communication"

02-April-2024 To 29-April-2024

Feedback responses

S.No.	Roll No	Year & Semester	Branch	Is the course content met your expectation	Is the lecture sequence well planned	The contents of the course is explained with examples	Is the level of course high	Is the course exposed you to the new knowledge and practices	Is the lecturer clear and easy to understand	Rate the value of course in increasing your skills	Any issues
1	219Y1A04B8	B.Tech II sem	ECE	Yes	Yes	Strongly agree	Agree	Strongly agree	3	5	Nothing
2	219Y1A04C1	B.Tech II sem	ECE	Yes	Yes	agree	Agree	Strongly agree	3	4	very good
3	219Y1A04C2	B.Tech II sem	ECE	Yes	Yes	Strongly agree	Agree	Strongly agree	5	5	Good
4	219Y1A04C3	B.Tech II sem	ECE	Yes	Yes	Strongly agree	Agree	Strongly agree	5	4	very good
5	219Y1A04C4	B.Tech II sem	ECE	Yes	Yes	Strongly agree	Agree	Strongly agree	4	5	nothing
6	219Y1A04C5	B.Tech II sem	ECE	Yes	Yes	agree	Agree	Strongly agree	4	3	Good
7	219Y1A04C6	B.Tech II sem	ECE	Yes	Yes	agree	Agree	Strongly agree	5	4	Good
8	219Y1A04C7	B.Tech II sem	ECE	Yes	Yes	agree	Agree	Strongly agree	5	4	nothing
9	219Y1A04D1	B.Tech II sem	ECE	Yes	Yes	Strongly agree	Agree	Strongly agree	5	5	nothing
10	219Y1A04D3	B.Tech II sem	ECE	Yes	Yes	agree	Agree	Strongly agree	4	3	Very Good
11	219Y1A04D4	B.Tech II sem	ECE	Yes	Yes	agree	Agree	Strongly agree	4	5	Good
12	219Y1A04D6	B.Tech II sem	ECE	Yes	Yes	agree	Agree	Strongly agree	5	4	Good
13	219Y1A04D7	B.Tech II sem	ECE	Yes	Yes	agree	Agree	Strongly agree	3	5	Nothing

14	219Y1A04D8	B.Tech II sem	ECE	Yes	Yes	Strongly agree	Agree	Strongly agree	5	5	very good
15	219Y1A04D9	B.Tech II sem	ECE	Yes	Yes	Strongly agree	Agree	Strongly agree	5	4	nothing
16	219Y1A04E0	B.Tech II sem	ECE	Yes	Yes	agree	Agree	Strongly agree	4	5	very good
17	219Y1A04E3	B.Tech II sem	ECE	Yes	Yes	agree	Agree	Strongly agree	5	3	no
18	219Y1A04E4	B.Tech II sem	ECE	Yes	Yes	agree	Agree	Strongly agree	3	4	Nothing
19	219Y1A04E5	B.Tech II sem	ECE	Yes	Yes	Strongly agree	Agree	Strongly agree	5	5	Good
20	219Y1A04E6	B.Tech II sem	ECE	Yes	Yes	Strongly agree	Agree	Strongly agree	3	3	Good
21	219Y1A04E7	B.Tech II sem	ECE	Yes	Yes	Strongly agree	Agree	Strongly agree	5	5	Good
22	219Y1A04F0	B.Tech II sem	ECE	Yes	Yes	agree	Agree	Strongly agree	5	5	Nothing
23	219Y1A04F1	B.Tech II sem	ECE	Yes	Yes	agree	Agree	Strongly agree	4	4	Good
24	219Y1A04F2	B.Tech II sem	ECE	Yes	Yes	Strongly agree	Agree	Strongly agree	4	4	Good
25	219Y1A04F3	B.Tech II sem	ECE	Yes	Yes	agree	Agree	Strongly agree	4	4	Good
26	219Y1A04F4	B.Tech II sem	ECE	Yes	Yes	agree	Agree	Strongly agree	5	5	Nothing
27	219Y1A04F6	B.Tech II sem	ECE	Yes	Yes	agree	Agree	Strongly agree	5	3	no
28	219Y1A04F8	B.Tech II sem	ECE	Yes	Yes	agree	Agree	Strongly agree	4	4	no
29	219Y1A04F9	B.Tech II sem	ECE	Yes	Yes	Strongly agree	Agree	Strongly agree	4	3	no
30	219Y1A04G0	B.Tech II sem	ECE	Yes	Yes	Strongly agree	Agree	Strongly agree	5	4	no
31	219Y1A04G2	B.Tech II sem	ECE	Yes	Yes	Strongly agree	Agree	Strongly agree	5	4	nothing
32	219Y1A04G3	B.Tech II sem	ECE	Yes	Yes	agree	Agree	Strongly agree	5	3	Nothing
33	219Y1A04G5	B.Tech II sem	ECE	Yes	Yes	agree	Agree	Strongly agree	4	5	Nothing
34	219Y1A04G6	B.Tech II sem	ECE	Yes	Yes	Strongly agree	Agree	Strongly agree	5	5	Good

Coordinator

HOD
Dept. of ECE

Professor & HOD
Department of E.C.E.
K.S.R.M. College of Engineering
KADAPA - 516 003

KSRM COLLEGE OF ENGINEERING

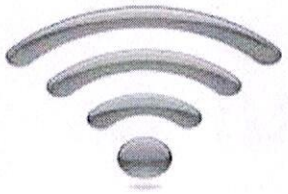
(AN AUTONOMOUS INSTITUTION)
Affiliated to JNTUA,ANANTHAPURAMU
Accredited by NAAC, New Delhi

Dr. S L PRATHAPA REDDY

Ph.D

ECE DEPARTMENT

ADVANCED WIRELESS COMMUNICATION



CONTENTS

S.No	Wired Network	Wireless Network
1.	A wired network employs wires to link devices to the Internet or another network, such as laptops or desktop PCs.	"Wireless" means without wire, media that is made up of electromagnetic waves (EM Waves) or infrared waves. Antennas or sensors will be present on all wireless devices
2.	Faster transmission speed	Slow transmission speed
3.	Propagation delay is Low	Propagation delay is high
4.	More Secure & hence Reliable	Less Secure & hence less Reliable
5.	Devices must be hard-wired	Installation is Quick
6.	Less Expensive	More Expensive
7.	High installation & maintenance cost	Low installation & maintenance cost
8.	Hub, Switch, etc. devices are used	Wireless routers, access points, etc. are used.

Specifications	Wired network	Wireless network
Speed of operation	Higher	lower compare to wired networks, But advanced wireless technologies such as LTE, LTE-A and WLAN-11ad will make it possible to achieve speed par equivalent to wired network
System Bandwidth	High	Low, as Frequency Spectrum is very scarse resource
Cost	Less as cables are not expensive	More as wireless subscriber stations, wireless routers, wireless access points and adapters are expensive
Installation	Wired network installation is cumbersome and it requires more time	Wireless network installation is easy and it requires less time
Mobility	Limited, as it operates in the area covered by connected systems with the wired network	Not limited, as it operates in the entire wireless network coverage
Transmission medium	copper wires, optical fiber cables, Ethernet	EM waves or radio waves or infrared
Network coverage extension	requires hubs and switches for network coverage limit extension	More area is covered by wireless base stations which are connected to one another.
Applications	LAN (Ethernet), MAN	WLAN, WPAN(Zigbee, Bluetooth), Infrared, Cellular(GSM,CDMA, LTE)
Channel Interference and signal power loss	Interference is less as one wired network will not affect the other	Interference is higher due to obstacles between wireless transmitter and receiver e.g. weather conditions, reflection from walls, etc
QoS (Quality of Service)	Better	Poor due to high value of jitter and delay in connection setup
Reliability	High compare to wireless counterpart, as manufactured cables have higher performance due to existence of wired technology since years.	Reasonably high, This is due to failure of router will affect the entire network.

INTRODUCTION

WHAT IS WIRELESS ?

The word wireless in dictionary is defined"having no wires " **.**

In networking terminology , wireless is the term used to describe any computer network where there is no physical wired connection between sender and receiver, but rather the network is connected by radio waves and or microwaves to maintain communications.

Wireless networking utilizes specific equipment such as NICs **and** Routers **in place of wires (copper or optical fibre).**

Advantages, Disadvantages and Applications of Wireless Communication

Interconnection of systems, people or things with the help of a communication media can be referred as **network**. The type of communication in which use electromagnetic waves as communication media for transmitting and receiving data or voice is called wireless communication. The electromagnetic spectrum is divided into well-defined channel for data transmission.

Advantages:

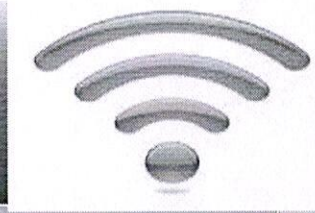
1. **Freedom from wires:**
   Can be configured with the use of any physical connection.
2. **Easy to setup :**
   Wireless network is easy to expand and setup
3. **Better or global coverage:**
   It provides global reach by providing networking in places such as rural areas, battlefield, etc… where wiring is not feasible.
4. **Flexibility:**
   Wireless network is more flexible and adaptable compared to wired network.
5. **Cost-effectiveness:**
   Since it is easy to install and doesn't require cables, wireless network is relatively cheaper.
6. **Mobile and portable:**
   Wireless network is easy to carry and re-install in another place.

Disadvantages:

1. As communication is done through open space, it is less secure.
2. Unreliability
3. More open to interference.
4. Increased chance of jamming.
5. Transmission speed is comparably less.

Applications of Wireless Communication:

1. Satellite system
2. Television remote control
3. Wi-Fi
4. Paging system
5. Wi-Max
6. Security systems
7. Cellphones
8. Computer interface devices
9. Bluetooth
10. GPS
11. GSM



COMPARISON OF 1G TO 5G TECHNOLOGIES

Technology	1G	2G/2.5G	3G	4G	5G
Deployment	1970/1984	1980/1999	1990/2002	2000/2010	2014/2015
Bandwidth	2.4kbps	14-64kbps	144kbps2mbps	100mbps-	>1gbps
Technology	Analog cellular	Digital cellular	Broadbandwidth/ cdma/ip technology	Unified ip &seamless combo of LAN/WAN/WLAN/PAN	4G+WWWW
Service	Mobile telephony	Digital voice,short messaging	Integrated high quality audio, video & data	Dynamic information access, variable devices	Dynamic information access, variable devices with AI capabilities
Multiplexing	FDMA	TDMA/CDMA	CDMA	CDMA	CDMA
Switching	Circuit	Circuit/circuit for access network&air interface	Packet except for air interface	All packet	All packet
Core network	PSTN	PSTN	Packet network	Internet	Internet
Handoff	Horizontal	Horizontal	Horizontal	Horizontal&Vertical	Horizontal&Vertical

1G

- Frequency: 150MHz / 900MHz
- Bandwidth: Analog telecommunication (30KHz)
- Characteristic: First wireless communication
- Technology: Analog cellular
- Capacity (data rate): 2.4kbps

- From 1980 to 1990
- Bad voice quality
- Poor battery, cellphones
- Big cellphones

- Better than nothing, at least its wireless and mobile

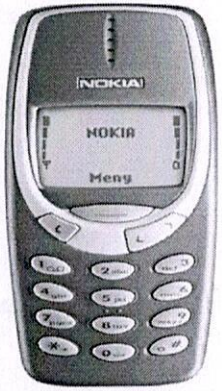
2G

- Frequency: 1.8GHz (900MHz), digital telecommunication
- Bandwidth: 900MHz (25MHz)
- Characteristic: Digital
- Technology: Digital cellular, GSM
- Capacity (data rate): 64kbps

- Why better than 1G?

- From 1991 to 2000
- Allows txt msg service
- Signal must be strong or else weak digital signal

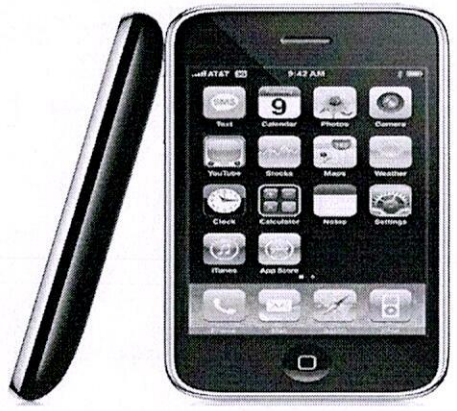
- 2.5G
  - 2G cellular technc GPRS
  - E-Mails
  - Web browsing
  - Camera phones



3G

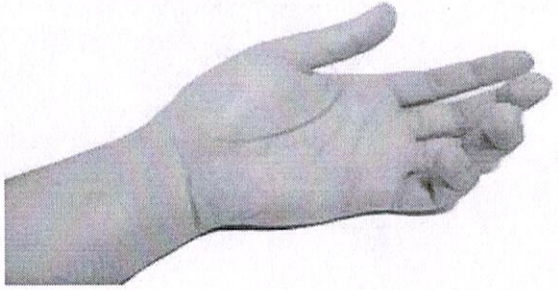
- Frequency: 1.6 – 2.0 GHz
- Bandwidth: 100MHz
- Characteristic: Digital broadband, increased speed
- Technology: CDMA, UMTS, EDGE
- Capacity (data rate): 144kbps – 2Mbps

- From 2000 to 2010
- Called smartphones
- Video calls
- Fast communication
- Mobil TV
- 3G phones ra expensive



- Why better than 2G?

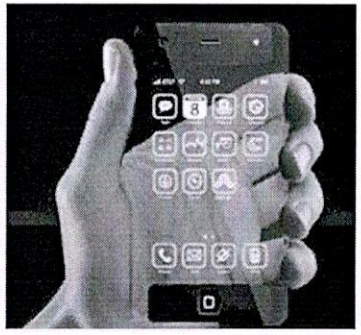
4G

- Frequency: 2 – 8 GHz
- Bandwidth: 100MHz
- Characteristic: High speed, all IP
- Technology: LTE, WiFi
- Capacity (data rate): 100Mbps – 1Gbps
-  G?

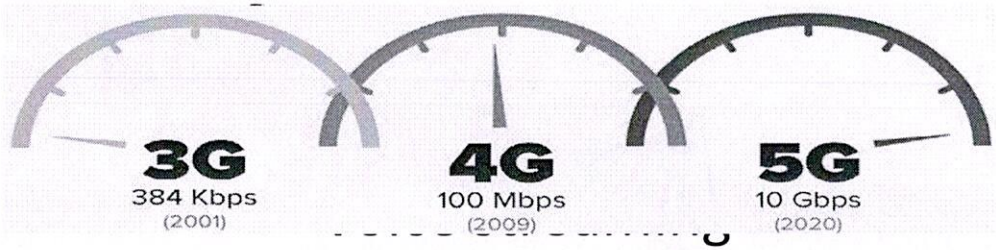
- From 2010 to today (2020?)
- MAGIC
  - Mobile multimedia
  - Anytime, anywhere
  - Global mobile support
  - Integrated wireless solutions
  - Customized personal service
- Good QoS + high security
- Bigger battery usage

5G

- https://5g.co.uk/guides/5g-frequencies-in-the-uk-what-you-need-to-know/
- Capacity (data rate): 1Gbps – ULIMITED?

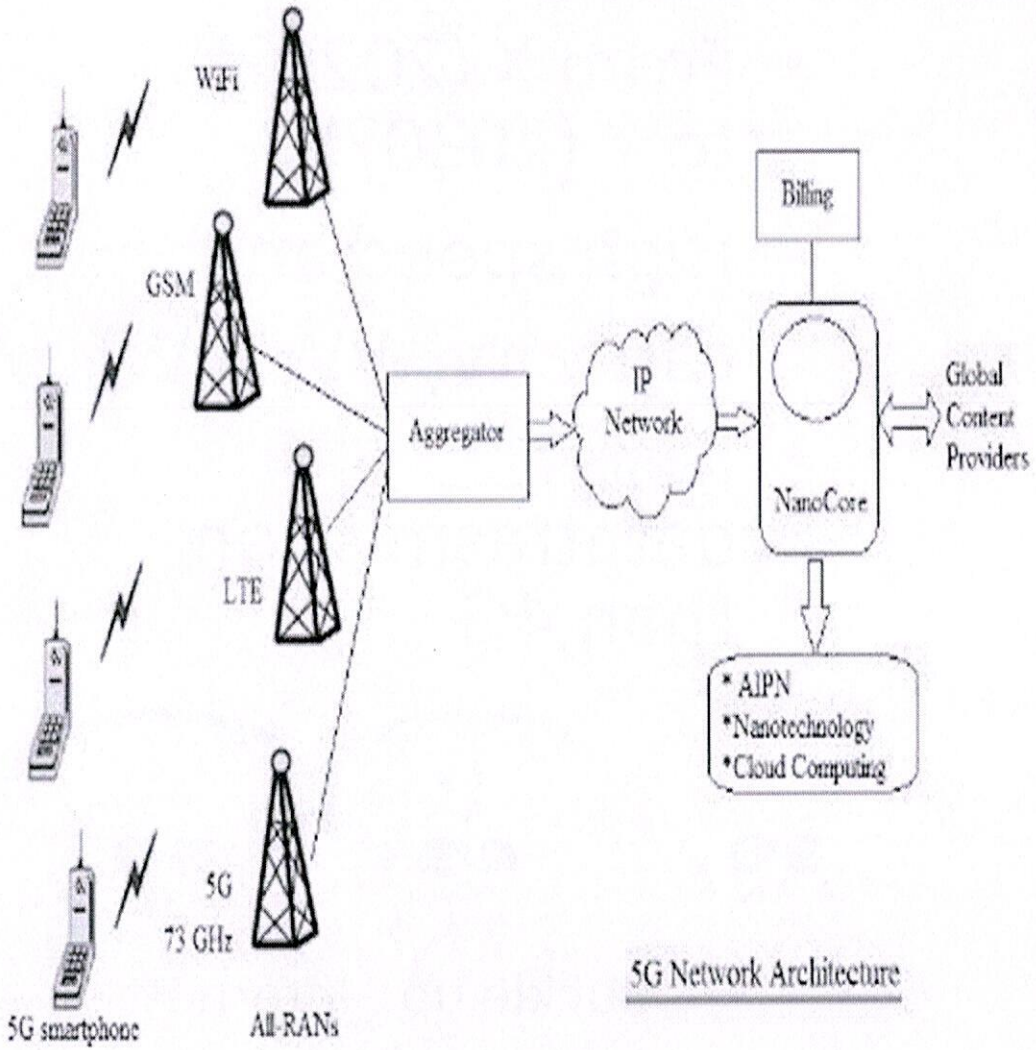


- From X (2020?) to Y (2030?)
- High speed and capacity(WWWW)
- Faster datatrasmission than 4G



  - Buckle up.. Internett
- More efficient

Future: 5G? 6G?



5G Network Architecture

6G:

- Integrate 5G with satellite network for global coverage
- Ultra fast Internet access
- Smart home/cities

7G:

- Space roaming
- World completely wireless

COMPARISON BETWEEN 3G Vs 4G

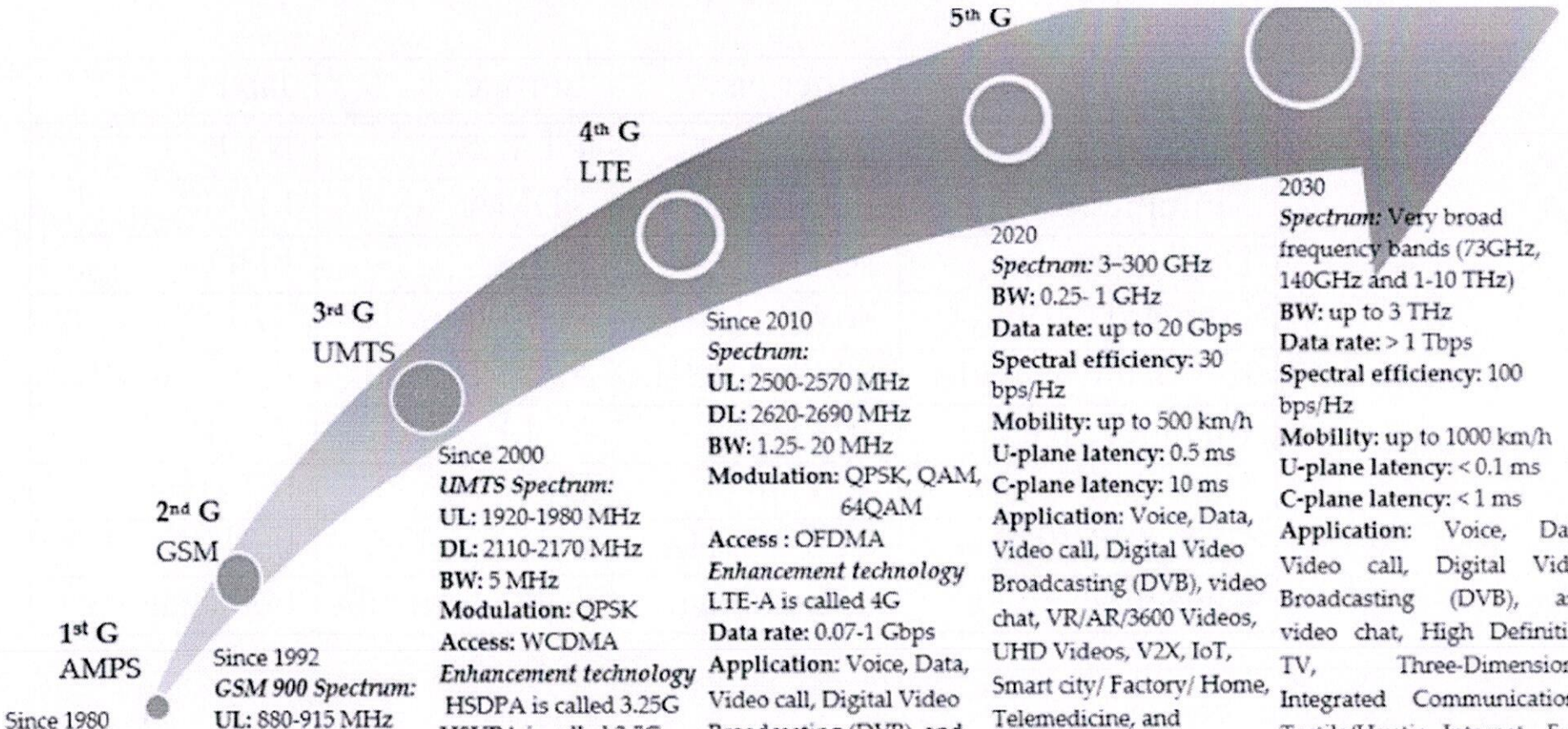
The basic difference between 3G and 4G is in data transfer and signal quality.

Technology	3G	4G
Data Transfer Rate	3.1 mbps	100mbps
Internet Services	Broadband	Ultra Broadband
Mobile - TV Resolution	Low	High
Bandwidth	5-20 MHz	100MHz
Frequency	1.6-2 GHz	2-8 GHz
Download and upload	5.8 Mbps	14 Mbps

COMPARISON BETWEEN 4G Vs 5G

The following basic differences between 4G and 5G are:

Technology	4G(2000-10)	5G(2010-20)
Switching	Circuit/Packet	Circuit/Packet
Data Rate	Upto 20Mbps	Upto 1 Gbps
Technology	Combination of broadband LAN/WAN/PAN	Combination of broadband LAN/WAN/PAN


1st G
AMPS
Since 1980
AMPS Spectrum:
UL: 824-845 MHz
DL: 869-894 MHz
BW: 30 kHz
Modulation: FM
Access: FDMA
Data rate: 2.4 kbps
Application: Voice
2nd G
GSM
Since 1992
GSM 900 Spectrum:
UL: 880-915 MHz
DL: 925-960 MHz
GSM 1800 Spectrum:
UL:1710-1785 MHz
DL: 1805-1880 MHz
BW: 200 kHz
Modulation: GMSK
Access: TDMA\FDMA
Enhancement technology
GPRS is called 2.5G
EDGE is called 2.75G
Data rate: 9.6-200 kbps
3rd G
UMTS
Since 2000
UMTS Spectrum:
UL: 1920-1980 MHz
DL: 2110-2170 MHz
BW: 5 MHz
Modulation: QPSK
Access: WCDMA
Enhancement technology
HSDPA is called 3.25G
HSUPA is called 3.5G
HSPA is called 3.75G
Data rate: 0.3-30 Mbps
Application: Voice, Data, Video call
4th G
LTE
Since 2010
Spectrum:
UL: 2500-2570 MHz
DL: 2620-2690 MHz
BW: 1.25- 20 MHz
Modulation: QPSK, QAM, 64QAM
Access : OFDMA
Enhancement technology
LTE-A is called 4G
Data rate: 0.07-1 Gbps
Application: Voice, Data, Video call, Digital Video Broadcasting (DVB), and video chat, High Definition TV content and mobile TV
5th G
2020
Spectrum: 3–300 GHz
BW: 0.25- 1 GHz
Data rate: up to 20 Gbps
Spectral efficiency: 30 bps/Hz
Mobility: up to 500 km/h
U-plane latency: 0.5 ms
C-plane latency: 10 ms
Application: Voice, Data, Video call, Digital Video Broadcasting (DVB), video chat, VR/AR/3600 Videos, UHD Videos, V2X, IoT, Smart city/ Factory/ Home, Telemedicine, and Wearable devices
2030
Spectrum: Very broad frequency bands (73GHz, 140GHz and 1-10 THz)
BW: up to 3 THz
Data rate: > 1 Tbps
Spectral efficiency: 100 bps/Hz
Mobility: up to 1000 km/h
U-plane latency: < 0.1 ms
C-plane latency: < 1 ms
Application: Voice, Data, Video call, Digital Video Broadcasting (DVB), and video chat, High Definition TV, Three-Dimensional Integrated Communications, Tactile/Haptic Internet, Full-sensory digital sensing and realty, Fully automated driving, Industrial Internet, and Internet of bio-nano-things

First Generation Analog Cellular Systems:

Region	America	Europe	Japan
Parameter	AMPS	ETACS	NTT
Multiple Access	FDMA	FDMA	FDMA
Duplexing	FDD	FDD	FDD
Forward Channel	869-894 MHz	935-960 MHz	870-885 MHz
Reverse Channel	824-849 MHz	890-915 MHz	925-940 MHz
Channel Spacing	30 kHz	25 kHz	25 kHz
Data Rate	10 kbps	8 kbps	0.3 kbps
Spectral Efficiency	0.33 bps/Hz	0.33 bps/Hz	0.012 bps/Hz
Capacity	832 channels	1000 channels	600 channels

AMPS: Advanced Mobile Phone System (America and Australia)

ETACS: European Total Access Communications System

NTT: Nippon Telephone and Telegraph System

Second Generation Digital Cellular Systems:

Region	U.S.	Europe	Japan	U.S.
Parameter	IS-54	GSM	PDC	IS-95
Multiple Access	TDMA/FDD	TDMA/FDD	TDMA/FDD	CDMA/FDD
Modulation	$\pi/4$ DQPSK	GMSK	$\pi/4$ DQPSK	QPSK/OQPSK
Forward Channel	869-894 MHz	935-960 MHz	810-826 MHz	869-894 MHz
Reverse Channel	824-849 MHz	890-915 MHz	940-956 MHz	824-849 MHz
Channel Spacing	30 kHz	200 kHz	25 kHz	1,250 kHz
Data/Chip Rate	48.6 kbps	270.833 kbps	42 kbps	1.2288 Mcps
Speech Codec Rate	7.95 kbps	13.4 kbps	6.7 kbps	1.2/2.4/ 4.8/9.6 kbps

IS (Interim Standard)-54: North-America TDMA Digital Cellular System

GSM: Groupe Special Mobile $\longrightarrow$ Global System for Mobile

PDC: Personal Digital Cellular

IS-95: CDMA Cellular System

High-speed wireless data technologies as of early 2004:

Technologies	Gener-ation	Multiple Access	Carrier Bandwidth	Peak Data Rate	Modulation	Data/Voice Support
GPRS	2.5G	TDMA	0.2MHz	115kbps	GMSK	data
	Designed as overlay on GSM / TDMA Networks					
EDGE	2.5G	TDMA	2.4Mbps	384kbps	8PSK/GMSK	data
	Designed as overlay on GSM / TDMA Networks					
cdma2000 1x Rel. 0	3G	CDMA	1.25Mbps	628kbps	BPSK/QPSK	data+voice
IS-856 (1xEV-DO, HDR)	3G+	CDMA/ TDMA	1.25Mbps	2.4576Mbps	QPSK/8PSK/ 16QAM	data
	Designed as high data rate extension to cdma2000					
cdma2000 1x Rel. D (1xEV-DV)	3G+	CDMA	1.25Mbps	3.0912Mbps	QPSK/8PSK 16QAM	data+voice
	Designed as high data rate extension to cdma2000 1x with voice support					
UMTS Rel. 5 (HSDPA)	3G	CDMA	3.84MHz	1.96Mbps	QPSK/16QAM	data+voice
	Designed as high throughput, high peak data rate extension to UMTS Release 99					

First Generation (1G):

In 1979, Nippon Telegraph and Telephone Company (NTTC) launched the first generation mobile network in Tokyo, Japan. It expanded the whole of Japan within five years. Then worldwide, it was known as the 1G Cellular Network. Though it was analog, it gained popularity worldwide in Sweden, Norway, Denmark, the UK, the USA, Finland, Austria, Canada, South Korea, Europe, etc. There were some features, and due to technical limitations, there were many disadvantages.

Features:

Analog technology.
Maximum speed 2.4kbps.
Nordic Mobile Telephone System (NMTS).
Advanced Mobile Phone System (AMPS).
Total Access Communication System (TACS).
Only voice service.
800 & 900 MHz frequency.
10 MHz bandwidth.
Frequency modulation.
Frequency Division Multiple Access (FDMA) technique

Limitations:

Ordinary battery life.
Due to interference, voice quality is poor.
The number of cell coverage and limited users.
Between similar systems, roaming was not possible.
Less security system.
Not convenient to carry as it was significant in size.

Second Generation (2G):

In 1991, a second-generation mobile network was launched by Radiolinja based on the GSM. It's a digital network, and providing a reliable & secure communication channel was the 2G network's primary motive. Because of transmitting wireless transmission of 2G mobile network was known as the Global System of Mobile Communication. 2G network also has some features and limitations.

Features:

Digital technology.
Small data services like SMS and MMS (Multimedia Message System).
Roaming was possible.
First internet system with poor data rate.
Better voice call.
Conference calls are allowed.
Comparatively enhanced security.
Data speed up to 64 Kbps.
30 to 200 kHz bandwidth.

Limitations:

Restricted mobility.
Data rate low.
Less features.
Less hardware capability.
User numbers are limited.

Third Generation (3G):

To standardize any generation of mobile networks takes approximately ten years. From this perspective, 3G was commercially introduced in 2001 and first used in Europe, Japan, and China. It is the best popular wireless technology developed by UMTS, which means Universal Mobile Telecommunications System. To facilitate better voice calls and data systems were the main target of the 3G network. Some unique features and limitations are listed below-

Features:

High data rates with low cost.
Email.
Web browsing.
Video downloading.
Picture sharing.
Better voice call.
15 to 20 MHz bandwidth.
Speed 2 Mbps.
Much better security system than 1G & 2G.
Support fire alarms.
Support mobile app.
TV streaming.
3D quality was high.
Support multimedia messages.
Location tracking.
Map location.

Limitations:

Mobile devices were costly.
Spectrum licenses are expensive.
To support a higher data rate requires higher bandwidth.

Fourth Generation (4G):

According to the ITU (International Telecommunication Union) in December 2010, 4G refers to LTE (Long Term Evolution), HSPA+ (Evolved High-Speed Packet Access), and WiMAX (Worldwide Interoperability for Microwave Access). It is a broadband cellular network different from 1G, 2G, and 3G mobile networks. 4G network was developed by IEEE and here used LTE and LTE advanced technology. It focuses on providing high-speed and quality data rates. This improved data service comes from the most used LTE system. WiMAX increases the network performance of 4G mobile. Key features and demerits are given below-

Features:

High data speed.
The maximum speed is 100 Mbps, which is 1 Gbps.
Improved security.
Voice calls service at low cost.
Multimedia message service.
Worldwide web access.
IP telephony.
Gaming service.
High-definition mobile TV.
Video conferencing.
3D TV connection without buffering.
Frequency 1800 MHz.
Global and scalable mobile networks.
Ad hoc and multi-hop networks.
High capacity and low bit per bit.

limitations:

Expensive infrastructure.
Expensive hardware.
Expensive spectrum.
A comprehensive upgrade is time-consuming.

Fifth Generation (5G):

5G network is currently under development that began in 2019 by cellular phone companies worldwide. According to the GSM, up to 2025, more than 1.7 billion subscribers would have a 5G mobile network. This network is connected with massive MIMO to improve connection, data speed, and other services. It also provides higher downloading speed and higher bandwidth with the association of different devices. There are several features and due to technical problems also has some limitations. They are-

Features:

Deliver ultra-fast data.
Low latency in milliseconds.
Reliability of the network.
Better quality of almost all services.
Higher security.
Try to fulfil customer demands.
Higher connection density.
Better battery consumption.
Improved wireless coverage.
Higher download speed up to 10 Gbps.
24 to 47 GHz frequency.
GPS tracking.
Multimedia message experience for customers.
Supercharged system.
Support massive data rate for the internet of things.
Cost deduction for data.
Small cell technologies use.

Disadvantages OF 5G Technology

Limited Coverage: While 5G technology is touted to have the fastest speed, its presence in only select cities globally that have 5G towers is one of the limitations of this technology. Despite global companies and governments working for maximum cities to have the coverage of 5G, it would take years for the introduction and implementation, as the testing, trial, and set-up of 5G towers is an expensive process.

Weak Upload Speeds: Experts believe that despite its ability to have faster download speeds, 5G technology will have less upload speed compared to 4G and 4G LTE. This is another drawback of 5G technology.

Battery Damages: Another limitation of 5G technology is it weakens the cellular device, by draining the battery and reducing the lifespan. So far only a few manufacturers have introduced mobile phones that are 5G friendly. While research and development are underway to manufacture 5G devices, the technology is proving to be a bane to 4G devices as it often leads to battery damage according to experts.

Interference With Airport And Flight Operations: In January this year, several airlines including Air India canceled their flights to the US as the telecom operators in the country were trying to roll out 5G operations in the country. One of the major reasons behind the cancellation of flights was the interference of technology with flight operations, according to the US aviation authority. Though this issue has not been encountered by other nations where 5G services have been rolled out, this makes it another limitation of 5G technology.

Cyber security Risk: Another drawback of 5G technology is it increases the risk of hacking thus impinging on cyber security. Moreover, lack of encryption during the connection process also makes the devices using 5G technology an easier target for cyber attacks and data theft.

5G Technology In India

In India, 5G spectrum auction began on July 26 and concluded on August 1, with the government fetching a whopping Rs 1,50,173 crore through the bids. The government had put 72 GHz of radiowaves for sale across 10 bands, of which 71 per cent have been sold. The spectrum bands that were put on sale include— low (600 MHz, 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz, 2500 MHz), mid (3300 MHz), and high (26 GHz).

Mukesh Ambani-led Reliance Jio emerged as the winner of the bid across several spectrum bands including the covered 700 MHz band worth Rs 88,078 crore. Sunil Mittal-led Bharti Airtel fetched the second spot after buying 19,867 MHZ airwaves worth Rs 43,084 crore. While beleaguered telecom company Vodafone-Idea Limited (VIL) bought spectrum worth Rs 18,784 crore, Adani Group bought spectrum bands worth Rs 212 crore.

Difference between 1g and 2g

Features	1G	2G
Introduced	1979	1991
Technology	AMPS, TACS	GSM
Frequency	800-900 MHz	1.8 GHz
Internet Service	Normal	Narrow band
Net Speed	2.4 Kbps	64 Kbps
Application	Voice call	Voice call, short message

Difference between 2G and 3G

Features	2G	3G
Introduced	1991	2001
Technology	GSM	WCDMA
Frequency	1.8 GHz	2 GHz
Internet Service	Narrow band	Broad band
Net Speed	64 Kbps	2 Mbps
Application	Voice call, short message	Video call, GPS, MMS

Difference between 3G and 4G

Features	3G	4G
Introduced	2001	2010
Technology	WCDMA	WiMAX, LTE
Frequency	2 GHz	1800 MHz
Internet Service	Broad band	Ultra Broadband
Net Speed	2 Mbps	1 Gbps
Application	Video call, GPS, MMS	Video call, GPS, mobile TV

Difference between 3G and 5G

Features	3G	5G
Introduced	2001	2019
Technology	WCDMA	MIMO
Frequency	2 GHz	24-47 GHz
Internet Service	Broad band	Wireless World Wide Web
Net Speed	2 Mbps	10 Gbps
Application	Video call, GPS, MMS	HD video, robots.