COURSE HANDOUT

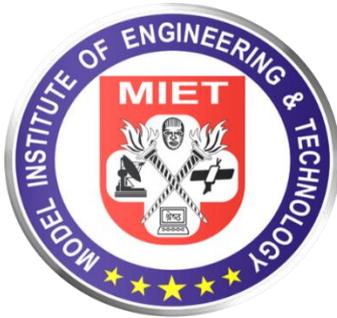ADVANCED MOBILE TECHNOLOGIES (ECE-701(B))

ECE-7TH SEMESTER

ACADEMIC YEAR (2024-25)

Ms. Shiveta Bhat

Assistant Professor

Department of Electronics and Communication Engineering

Department of Electronics and Communication Engineering

Model Institute of Engineering & Technology (Autonomous)

Kot Bhalwal, Jammu - 181122

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Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Sessional	Final Exam	Total
ECE-701(B)	Advanced Mobile Technologies	PCC	3	2	1	0	50	100	150

COURSE OUTCOMES

At the end of the course the student will be able to:	
CO1	Describe major cellular communication standards and wireless communications networks.
CO2	Explain 5G technologies for communication systems.
CO3	Differentiate 5G Networks for various frequency bands.
CO4	Analyze the current state-of-art and challenges for 5G technologies.
CO5	Explore the need and potential applications of 6G and Terahertz technology.

Unit-I

Evolution from 1G to 5G: Analog voice systems in 1G, digital radio systems in 2G, voice and messaging services, 2.5G (GPRS), 2.75G (EDGE), 3G UMTS (IMT 2000), 3G services and data rates, 4G (IMT Advanced), LTE, VoLTE, OFDM, LTE Advanced Pro (3GPP Release 13+), 5G (IMT 2020) 5G potential and applications, comparison of various generations.

(11 Hours)

Unit-II

Basics of 5G: Introduction to enhanced mobile broadband (eMBB), ultra-reliable low latency communications (URLLC), massive machine type communications (MMTC), D2D communications, V2X communications, Spectrum for 5G, spectrum access/sharing, millimeter Wave communication.

(11 Hours)

Unit-III

5G Network: New Radio (NR), Standalone and non-standalone mode, non-orthogonal multiple access (NOMA), massive MIMO, beam formation, flexible frame structure, Service Data Adaptation Protocol (SDAP), centralized RAN, open RAN, multi-access edge computing (MEC), network function virtualization (NFV).

(12 Hours)

Unit-IV

Current state and Challenges ahead: 5G penetration in developed countries, stronger backhaul requirements, dynamic spectrum access and usage of unlicensed spectrum, large cell usage, LMLC, possible solutions for connectivity in rural areas (BharatNet, TVWS, Long-range Wi-Fi, FSO).

(8 Hours)

Unit-V

Introduction to Terahertz and 6G Technology: Terahertz communication, need for THz Communication, applications, requirements, Challenges, Introduction to 6G Technology, features, Requirements, emerging applications, challenges.

(6 Hours)

Textbooks

S.No.	Name of the Books	Name of the Author	Publisher Name	Edition (Pub.Yr.)
1	Wireless Communications	T.L Singal	MC Graw Hill	1st (2013)
2	An Introduction to LTE: LTE, LTE-Advanced, SAE, VoLTE and 4G Mobile Communications	Christopher Cox	Wiley	2nd (2014)
3	5G Mobile and Wireless Communications Technology	Afif Osseiran, José F. Monserrat, and Patrick Marsch.	Cambridge University Press	1st (2016)

Reference Books

S.No	Name of the Books	Name of the Author	Publisher Name	Edition (Pub.Yr.)
1	6G Wireless Network	Yuleiwu	Springer	1st (2022)
2	THz Communication Paving the way towards wireless Tbps	Thomas Kurner	Springer	1st (2022)

COURSE PLAN		
Unit-I Evolution from 1G to 5G		
S.No	**Topics**	**Recommended Books**
1	Analog voice systems in 1G	Book 1, Ch.1
2	Digital radio systems in 2G, Voice and messaging services	Book 1, Ch.1
3	2.5G (GPRS)	Book 1, Ch.13
4	2.75G (EDGE)	Book 1, Ch.13
5	3G UMTS (IMT 2000) & 3G services and data rates	Book 1, Ch.13
6	4G (IMT Advanced)	Book 2, Ch.1
7	LTE, VoLTE	Book 2, Ch.1
8	OFDM	Book 2, Ch.1
9	LTE Advanced Pro (3GPP Release 13+),	Book 2, Ch.1
10	5G (IMT 2020) 5G potential and applications	Book 2, Ch.1
11	Comparison of various generations.	Book 2, Ch.1
Unit-II Basics of 5G		
12	Introduction to enhanced mobile broadband (eMBB)	Book 3, Ch.1
13	Ultra-reliable low latency communications (URLLC)	Book 3, Ch.1
14	Massive machine type communications (MMTC)	Book 3, Ch.1
15	D2D communications	Book 3, Ch.5
16	V2X communications	Book 3, Ch.7
17	Spectrum for 5G	Book 3, Ch.3
18	Spectrum access/sharing	Book 3, Ch.3
19	Millimeter Wave communication.	Book 3, Ch.6
Unit-III 5G Network		
20	New Radio (NR),	Book 3, Ch.7
21	Standalone and non-standalone mode	Book 3, Ch.7
21	Non-orthogonal multiple access (NOMA)	Book 3, Ch.7
22	Massive MIMO	Book 3, Ch.8
23	Beam formation	Book 3, Ch.7
24	Flexible frame structure	Book 3, Ch.7
25	Service Data Adaptation Protocol (SDAP)	Book 3, Ch.7
26	Centralized RAN	Book 3, Ch.7
27	open RAN	Book 3, Ch.7

28	Multi-access edge computing (MEC)	Book 3, Ch.7
29	Network function virtualization (NFV)	Book 3, Ch.7
Unit-IV Current state and Challenges ahead		
30	5G penetration in developed countries	Book 3, Ch.6
31	Stronger backhaul requirements	Book 3, Ch.6
32	Dynamic spectrum access and usage of unlicensed spectrum	Book 3, Ch.6
33	Large cell usage	Book 3, Ch.6
34	LMLC	Book 3, Ch.6
35	Possible solutions for connectivity in rural areas (BharatNet,)	Book 3, Ch.6
36	Possible solutions for connectivity in rural areas (TVWS)	Book 3, Ch.6
37	Possible solutions for connectivity in rural areas (Long-range Wi-Fi, FSO)	Book 3, Ch.6
Unit-V Introduction to Terahertz and 6G Technology		
38	Terahertz communication	Ref Book 1, Ch 1
39	Need for THz Communication, Applications	Ref Book 1, Ch 1
40	Requirements, Challenges	Ref Book 1, Ch 1
41	Introduction to 6G Technology	Ref Book 2, Ch 1
42	Features, Requirements	Ref Book 2, Ch 1
43	Emerging applications, challenges	Ref Book 2, Ch 1

ADDITIONAL WEB RESOURCES

1	*NPTEL: Course on* Advanced 3G and 4G Wireless Mobile communications by Prof. Santanu Chattopadhyay of IIT Kanpur https://archive.nptel.ac.in/courses/117/104/117104099/
2	*NPTEL: Course on Evolution of Air Interface towards 5G by Prof. Suvra Sekhar Das of IIT Kharagpur* https://archive.nptel.ac.in/courses/108/105/108105134/

GRADING AND ASSESSMENT

- **Sessional Test**:20 marks
- **Assignment**: 20 marks
- **Attendance**: 10 marks
- **Final Examination**: 100 marks

COURSE POLICIES

- **Attendance**: Minimum 75% attendance is mandatory to appear in the final examination of the course.
- **Academic Integrity**: MIET's academic integrity policies apply. Plagiarism will not be tolerated.
- **Late Submissions**: Assignments and projects must be submitted by the specified timelines.

FACULTY INFORMATION

- **Office Hours**

  Tuesday (01:00 PM - 01:40 PM)
  Thursdays (01:00 PM - 01:40 PM)

- **Contact Information**
  shiveta.ece@mietjammu.in

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