Ramdeobaba University, Nagpur

Department of Electronics and Communication Engineering

Multi Disciplinary Minor (MDM)

Track – 2: Communication Engineering

Semester	MDM	Course code	Course
III	MDM – 1	**24EE05TH0306-2**	**Fundamentals of Communication**
IV	MDM – 2	**24EE05TH0408-2**	**Mobile Communication**
V	MDM – 3	**24EE05TH0507-2**	**LTE Technologies**
VI	MDM – 4	**24EE05TH0608-2**	**5G and 6G Systems**

Note: This track is not applicable to EC students as there is overlapping of content in their compulsory core courses and program electives.

Syllabus for Semester III

MDM – 1 [Communication Engineering Track]

Course Code: **Course: Fundamentals of Communication (MDM Course)**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course Outcomes:

At the end of this course students will demonstrate the ability to:

CO1: Understand the components of digital communication systems and summarize fundamental concepts such as entropy, channel capacity, and coding techniques.
CO2: Apply sampling, quantization, and various pulse code modulation techniques
CO3: Compare different digital modulation techniques
CO4: Illustrate and differentiate various multiplexing and multiple access techniques
CO5: Analyze the use of spread spectrum modulation schemes

Syllabus:

Unit - I Digital Communication System and Coding Methods

Elements of basic digital communication system, advantages and disadvantages of digital communication, Communication channel characteristics: bit rate, baudrate, bandwidth, Concept of entropy and information rate, channel, capacity: Hartley's law and Shannon-Hartley theorem forchannel capacity, Source coding: Huffman coding, Error detection codes: Vertical Redundancy Check,(VRC) code, Longitudinal Redundancy Check (VRC)code, Cyclic Redundancy Check (CRC) code and Checksum code, Linear block code, error correction capability, Line coding

Unit - II Pulse Code Modulation Techniques

Sampling & quantization process: Nyquist samplingtheorem, types of sampling (natural & flat top sampling), aliasing effect, quantization process, quantization error,companding, PAM, PWM,

PPM, Pulse code modulation (PCM), Differential pulse codemodulation (DPCM), Delta modulation (DM), Adaptive Delta modulation (ADM)

Unit - III Digital Modulation Techniques

Types of digital modulation techniques, coherent and non-coherent, detection,shift keying techniques: Amplitude ShiftKeying (ASK), Frequency Shift keying (FSK), Phase Shiftkeying (PSK), Differential Phase Shift keying (DPSK), Quadrature Phase Shift keying (QPSK), M-ary FSK and M-ary PSK, Quadrature amplitude modulation (QAM)

Unit - IV Multiplexing and Multiple Access Technique

Time DivisionMultiplexing (TDM), Frequency Division Multiplexing(FDM), Code Division Multiplexing (CDM), Time DivisionMultiple Access (TDMA), Frequency Division MultipleAccess (FDMA), Code Division Multiple Access(CDMA), Space Division Multiple Access (SDMA),

Unit - V Spread Spectrum (SS) Modulation

application of spreadspectrum modulation, model of spread spectrummodulation system, Pseudo-noise (PN) sequences, Direct sequence spreadspectrum (DSSS), jamming margin, processing gain, Eb/No ratio, Frequency hopped spread spectrum, slow andfast frequency hopping, Communication Technologies: SONET, Digital Switching Technologies, Video Compression

Text Books

1. Simon Haykin, Digital communications, John Wiley and sons, 1998

2. K Sam Shanmugam, Digital and Analog Communication Systems, John Wiley and sons (Asia) Pvt Ltd.

References

1. B.P. Lathi Modern digital and analog communication systems, 3rd Edition, Oxford University Press

2. Bernard Sklar, Digital Communications: Fundamentals and Applications, Pearson 2021, ISBN-9780134588568

Syllabus for Semester IV

MDM – 2 [Communication Engineering Track]

Course Code: **Course: Mobile Communication (MDM Course)**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course Outcomes:

At the end of this course students will demonstrate the ability to:

CO1: Realize the evolution of wireless communication technologies

CO2: Explain cellular system concepts such as frequency reuse, handoff strategies

CO3: Compare different wireless standards

CO4: Analyze the architecture and protocols of 2G and 3G cellular systems

CO5: Interpret next generation wireless technologies like LTE, MIMO, NOMA etc.

Syllabus:

UNIT I: Introduction to Wireless Communication System:

Evolution of mobile communications, Trend in Cellular radio and personal communication, Cellular Network structure, Wireless Local Area network , Personal Area Networks, Concepts of small and large scale fading, delay spread

UNIT II – 2G and 3G Cellular Systems

The Cellular Concept- frequency reuse, Channel Assignment Strategies, Channel & co-channel interference reduction, Handoff Strategies, Improving Coverage & Capacity in Cellular System, GSM Architecture, overview of UMTS Architecture, Handover

UNIT III – Mobile Communication Standards

IEEE 802.11 WLAN standard and its variants, IEEE 802.15 WPAN standard, IEEE 802.16 Wireless broadband access standard, PHY and MAC layer overview, WiMAX network architecture, Initialization and handover procedures

UNIT IV – Beyond 3G

HSPA and LTE, Architecture, Radio interface and channels, Quality of Service, OFDM, NOMA, Heterogeneous Networks, Internetworking, MIMO Systems, Beamforming Techniques

Unit V - Recent Trends in mobile communication

Introduction to Wi-Fi, WiMAX, ZigBee Networks, Software-Defined Radio, UWB Radio, Wireless Adhoc Network and Mobile Portability, Security issues and challenges in a Wireless network.

Text Books:

1 Wireless Communication, Theodore S. Rappaport, Prentice hall

2 Mobile Communications Engineering, William C. Y. Lee, Mc Graw Hill Publications

Reference books:

1. Iti Saha Misra, “Wireless Communication and Networks – 3G and Beyond”, Mc Graw Hill Education, Second Edition, 2013.

2. Jochen Schiller, “Mobile Communications”, Pearson Education, Second Edition, 2012.