CVM UNIVERSITY
Aegis: Charutar Vidya Mandal (Estd.1945)

FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: **BACHELOR OF TECHNOLOGY (Electronics and Communication)**

Semester: **VII**

Course Code: **202060703**

Course Title: **Wireless Communication**

Course Group: Professional Core Course

Course Objectives: To make the student acquainted regarding Basis of Wireless communication, Fading mechanism and cell topology. In this course, the core concept of wireless communication will be introduced with advanced technology like MIMO and OFDM to understand presents state of art in the field of wireless communication and the future scope.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	0	2	4	50/18	50/17	25/9	25/9	150/53

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Introduction to Wireless Communication and Cell Topology:** Evolution of Mobile Radio Communication, Frequency Reuse, Channel Assignment Strategies, Handoff Strategies, Interference and System Capacity, Trunking and Grade of Service, Cell splitting, Sectoring and Microcell Zone Concept.	08
2	**Large Scale and Small-Scale Fading Models:** Introduction to Radio wave propagation, Free Space Propagation Model, Reflection, Diffraction and Scattering Mechanism, Outdoor Propagation Models and Indoor Propagation Model. Small Scale Fading and influential factors, Doppler effect, Impulse response model for Multipath Fading, Channel Sounding methods, Parameters of mobile Multipath channels, Types of Small-Scale Fading: Flat fading, Frequency Selective Fading, Fast Fading and Slow Fading, Rician Fading and Rayleigh Fading, Statistical models for multipath fading.	10

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3	**Multiple Access Techniques for Wireless Communication and Diversity:** Introduction to Multiple Access methods, Time Division Multiple Access, Frequency Division Multiple Access, Code Division Multiple Access, Space Division Multiple Access Method. Fundamentals of Equalizer, Linear and Non-Linear Equalizer, Adaptive Equalizer, Types of Diversity, Space Diversity Techniques: Polarization Diversity, Selection Diversity, Feedback Diversity, Maximum Ratio Combining, Equal gain diversity, Rake Receiver.	**08**
4	**Global System for Mobile (GSM) and Code Division Multiple Access (CDMA):** GSM system Architecture, GSM Radio Subsystem, GSM Channel types, GSM call examples, Frame structure of GSM, Signal Processing in GSM. Introduction of CDMA. Merits of CDMA over GSM. Direct Spread Spectrum (DSSS) and Frequency Hopping Spread Spectrum (FHSS). Transmitter and Receiver of CDMA. PN sequence generation and spreading concept.	**08**
5	**Multiple input Multiple Out (MIMO) Communication, OFDM and Advance Topics:** MIMO Channel Model, Capacity of MIMO Communication systems, Diversity performance of MIMO channels, Space Time Block Coding schemes, Multi-user MIMO communications. Massive MIMO Concept and Beam forming. OFDM Basics, OFDM Modulation & Demodulation, OFDM, Synchronization in OFDM. Peak-to-Average Power Ratio Reduction (PAPR) Schemes.	**08**
6	**Advanced Topics in Wireless Communication:** Software Defined Radio, Millimeter Wave Communication, Cognitive Radio, Femto cell Concept, Non-Orthogonal Multiple Access (NOMA), Bluetooth, Zigbee, Wifi and Wi-max Concept. Introduction of Intelligent Refractive Surface (IRS).	**3**
		45

List of Practicals / Tutorials:

1	To Study and analyses blocking probability using Erlang B and Erlang C formula for various traffic and channel.
2	To simulate and study multipath communication using Rayleigh and Rician channel model,
3	To study transmission and reception of signals using Frequency Division Multiplexing.
4	To study and simulate BER performance of BPSK and QPSK using MMSE equalizer.
5	To study and simulate BER performance of BPSK and QPSK using Maximum Likehood equalizer.
6	To study comparative analysis of BER performance for 2*1 and 2*2 MIMO with SISO using simulation.
7	To study comparative analysis of channel capacity for various MIMO and SISO scheme.
8	To study and simulate transmission and reception of OFDM signal.
9	To study and simulate Successive Interference Calculation for NOMA signal.

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10.	To study following experiments using real time set-up of USRP test-bed. 1. QPSK transmission and reception. 2. Data Packet transmission and reception. 3. FM radio receiver and play back of transmitted song.
11	**Complex Lab Problem:** Make a report on test-bed set-up of communication system using USRP. Mentioning all the basic blocks of transmitter and receiver for the set-up of testbed environment.

Reference Books:

1	Theodore S. Rappaport, **Wireless Communication, 2nd** Edition, Prentice Hall
2	Andrew Goldsmith, **Wireless Communication**, 1st Edition, Cambridge university Press 2007.
3	TSE, David and Pramod Viswanath, **Fundamentals of Wireless Communication,** 2nd Edition, Cambridge University, UK, 2005.
3	Simon Haykin, and Michael Moher, **Modern Wireless Communications**, Parson Education, 2011.
4	**Evolution of Air Interface Towards 5G: Radio Access Technology and Performance Analysis**, Suvra Shekhar das and Ramji prasad, 1st Edition, River Publishers.

Supplementary learning Material:	
1	NPTEL and Coursera Video lectures.
2	MIT Course materials.

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods
- Seminar/Poster Presentation
- Industrial/ Field visits
- Course Projects

Internal Evaluation:

The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
25	10	15	15	15	20	

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Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	To understand fundamental concepts of cell topology and structure.	**30**
CO-2	To Understand small scale and large-scale fading mechanism and various channel models.	**30**
CO-3	To Acquainted with diversity and multiple access method, application of Equalizer and their mathematical modelling.	**25**
CO-4	To learn advance technology like MIMO, OFDM, milimeter communication and acquainted with futuristic technology lie Intelligent Refractive Surface and femto cell.	**15**

Curriculum Revision:	
Version:	**2.0**
Drafted on (Month-Year):	June -2022
Last Reviewed on (Month-Year):	-
Next Review on (Month-Year):	June-2025

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