Reg. No.																

Question Paper Code	14686

M.E. / M.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2026

Second Semester

M.E. - Communication Systems

24PCOPC201 - ADVANCED WIRELESS COMMUNICATION SYSTEMS

Regulations - 2024

Duration: 3 Hours | Max. Marks: 100

PART – A (i) (MCQ)
(16 × 1 = 16 Marks)
Answer ALL Questions

		Marks	K – Level	CO
1.	In an i.i.d. MIMO channel model, the channel coefficients are assumed to be ___. a) Correlated b) Independent and identically distributed c) Constant over time d) Frequency selective	1	K1	CO1
2.	The antenna correlation reduces the capacity of a MIMO system because _____. a) It increases bandwidth b) It reduces independent spatial paths c) It improves diversity gain d) It decreases noise power	1	K2	CO1
3.	A 3 × 3 MIMO system operates in a rich scattering environment with independent channel coefficients. Select channel model that is most suitable. a) Correlated channel model b) Frequency selective model c) Classical i.i.d. channel model d) Deterministic channel model	1	K3	CO1
4.	The diversity technique which uses multiple antennas at the receiver side is __. a) Time diversity b) Frequency diversity c) Spatial diversity d) Polarization diversity	1	K1	CO2
5.	Channel knowledge is important in diversity systems since a) It increases antenna size b) It helps improve signal detection performance c) It removes modulation requirements d) It eliminates fading completely	1	K2	CO2
6.	A MIMO receiver uses Zero Forcing detection in a channel with high noise power. Identify the expected effect. a) Improved diversity gain b) Noise enhancement occurs c) Complete elimination of fading d) Reduced channel estimation requirement	1	K3	CO2
7.	Massive MIMO technology is mainly used in _____. a) GSM systems b) LTE and 5G systems c) Bluetooth systems d) Satellite radio systems	1	K1	CO3
8.	The Massive MIMO improves spectral efficiency since _____. a) It decreases antenna count b) It enables simultaneous servicing of multiple users c) It removes fading completely d) It reduces bandwidth usage	1	K2	CO3
9.	A massive MIMO base station experiences pilot contamination from neighboring cells. Identify the system component that should be improved to reduce this effect. a) Modulation index b) Pilot design c) Carrier frequency d) Source coding	1	K3	CO3

10.	The RF section in a Massive MIMO system mainly performs _____. a) Source encoding b) Frequency upconversion and downconversion c) Data compression d) Error detection	*1*	*K1*	*CO4*
11.	Channel models are important in Massive MIMO system design since ____. a) They reduce antenna size b) They help predict wireless propagation characteristics c) They eliminate fading effects d) They replace transceiver circuits	*1*	*K2*	*CO4*
12.	A communication engineer analyzes a wireless environment with severe multipath propagation. Identify the channel model should be applied for system evaluation. a) Free space model b) Rayleigh fading model c) Static channel model d) Deterministic model	*1*	*K3*	*CO4*
13.	Millimeter wave communication mainly operates in the frequency range of _____. a) 300 Hz – 3 kHz b) 3 kHz – 300 kHz c) 30 GHz – 300 GHz d) 300 MHz – 3 GHz	*1*	*K1*	*CO5*
14.	A mobile mmWave user experiences frequent link interruption due to movement. Select the technique that should be applied to maintain reliable communication. a) Beam tracking and beam finding b) Source encoding c) Frequency interleaving d) Pulse shaping	*1*	*K3*	*CO5*
15.	SDR architecture is considered flexible compared to conventional radio systems since _. a) It removes antennas completely b) Radio functionalities can be modified through software updates c) It eliminates modulation techniques d) It avoids signal processing	*1*	*K2*	*CO6*
16.	A communication engineer needs to upgrade modulation techniques in a wireless system without changing hardware components. Choose the technology that should be applied. a) Conventional radio b) Software Defined Radio c) Optical communication d) Circuit switching	*1*	*K3*	*CO6*

PART – A (ii) (Short Answer Questions)
(6 × 3 = 18 Marks)

Answer ALL Questions

17.	Use the concept of ergodic capacity to evaluate the average performance of a MIMO channel in a fading environment.	*3*	*K3*	*CO1*
18.	Analyze the effect of Rayleigh fading on the performance of diversity techniques in wireless communication systems.	*3*	*K4*	*CO2*
19.	Apply pilot design techniques to improve channel estimation in Massive MIMO systems.	*3*	*K3*	*CO3*
20.	Examine the impact of RF implementation challenges on Massive MIMO system performance.	*3*	*K4*	*CO4*
21.	Analyse the impact of channel propagation characteristics on mmWave communication performance.	*3*	*K4*	*CO5*
22.	Implement the concept of SDR architecture to modify radio functionalities through software control.	*3*	*K3*	*CO6*

PART - B (Descriptive Answer Questions)
(6 × 11 = 66 Marks)
Answer ALL Questions

23.	a)	Apply the concepts of SISO fading communication channels and classical i.i.d. MIMO channel models to illustrate wireless communication performance.	*11*	*K3*	*CO1*
		OR			
	b)	Use frequency selective and correlated channel models, to determine their influence on the capacity of MIMO communication systems.	*11*	*K3*	*CO1*
24.	a)	Examine the sources and types of diversity in wireless communication systems and analyze their performance under Rayleigh fading conditions.	*11*	*K4*	*CO2*
		OR			
	b)	Analyze the performance of ML, ZF, and MMSE receivers used in MIMO spatial multiplexing systems.	*11*	*K4*	*CO2*
25.	a)	Apply Massive MIMO techniques in LTE systems, to determine their impact on wireless communication performance.	*11*	*K3*	*CO3*
		OR			
	b)	Use pilot design techniques in Massive MIMO systems, to improve channel estimation performance.	*11*	*K3*	*CO3*
26.	a)	Assess the role of baseband implementation techniques in Massive MIMO communication systems.	*11*	*K5*	*CO4*
		OR			
	b)	Interpret the RF implementation challenges in Massive MIMO systems and their impact on communication performance.	*11*	*K5*	*CO4*
27.	a)	Assess the propagation characteristics and mobility challenges in millimeter wave communication systems with suitable illustrations.	*11*	*K5*	*CO5*
		OR			
	b)	Evaluate different beamforming and beam finding techniques used in mmWave communication systems.	*11*	*K5*	*CO5*
28.	a)	Apply the concepts of Software Defined Radio to illustrate its key characteristics and architecture in wireless communication systems.	*11*	*K3*	*CO6*
		OR			
	b)	Utilise ontology-based Cognitive Radio concepts, to determine the operation of Cognitive Radio as a self-controlling system.	*11*	*K3*	*CO6*