KUMARAGURU
college of technology
character is life

Register Number:……

M.E DEGREE EXAMINATIONS: MAY 2018

(Regulation 2015)

Second Semester

COMMUNICATION SYSTEMS

P15COT201**:** Wireless Communication Engineering

COURSE OUTCOMES

CO1: Explain various wireless channel models
CO2: Analyze the performance of digital modulation schemes over wireless channel
CO3: Compare different diversity and combining techniques
CO4: Explain and analyze multicarrier modulation technique
CO5: Analyze various MIMO signal processing algorithms
CO6: Describe various standards for wireless systems.

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Assertion (A): The signal could be severely influenced by frequency selective fading CO1 [K_2]
Reason (R): The bandwidth of transmitted signal is larger than coherence bandwidth
a) Both A and R are Individually true and R is the correct explanation of A
b) Both A and R are Individually true but R is not the correct explanation of A
c) A is true but R is false
d) A is false but R is true

2. The Alamouti scheme is designed for ____ transmit antennas. CO2 [K_{L1}]
(2x2)
a) 1
b) 3
c) 4
d) 2

3. There is a ___ dB per decade attenuation in signal strength as a function of distance in free space propagation CO1 [K_1]
a) 6
b) 12
c) 20
d) 40

4. Match with List I and List II CO6 [K_2]

List I	List II
A.FDMA	i. LTE
B.TDMA	ii. CDMA one
C.CDMA	iii. AMPS
D.OFDMA	iv. GSM

	A	B	C	D
a)	ii	i	iii	iv
b)	iii	iv	ii	i
c)	ii	iv	iii	i
d)	iii	i	ii	Iv

5. Assertion (A): MIMO channel can support spatial multiplexing of multiple streams CO5 [K2]
Reason (R): In a line-of-sight only environment, a MIMO channel will not provide a power gain.

a) Both A and R are Individually true and R is the correct explanation of A
b) Both A and R are Individually true but R is not the correct explanation of A
c) A is true but R is false
d) A is false but R is true

6. Staggered interleaving of the streams of V-BLAST among the transmit Antennas is called as CO1 [$K1_L$]

a) D-BLAST
b) I- BLAST
c) B-BLAST
d) None of the above

7. The following statements are false CO4 [K_2]

1. OFDM avoids complex equalizers
2. OFDM has high symbol rate and guard interval
3. OFDM avoids ISI
4. OFDM faces time synchronization problems

a) 1,3
b) 1,4
c) 1,2
d) 2,4

8. Assertion (A): In the water filling power allocation, transmitter allocates more power to stronger subcarriers CO4 [K2]
Reason (R): Transmitter allocates less power to Weaker ones.

a) Both A and R are Individually true and R is the correct explanation of A
b) Both A and R are Individually true but R is not the correct explanation of A
c) A is true but R is false
d) A is false but R is true

9. When a channel is found to be idle, the packet is transmitted in the first available slot with certain probability in CO6 [K_1]

a) 1- persistant CSMA
b) Non persistant CSMA
c) p-persistant CSMA
d) CSMA-CA

10. **The RAKE receiver involves the steps** CO3 [K_1]

1. bank of co-rrelations.
2. estimation of transmitted signal,
3. combinar.

a) 1-3-2
b) 2-1-3
c) 3-2-1
d) 1-2-3

PART B (10 x 2 = 20 Marks)

11.	Define coherence Time.	CO1	[K1]
12.	If a received power at a reference distance d_0 = 1 km is equal to 1 microwatt, find the received power at distances of 5 km and 20 km from the same transmitter for the free space propagation model.	CO1	[K3]
13.	Mention the advantages of Digital Modulation.	CO2	[K1]
14.	What do you mean by receiver diversity	CO3	[K1]
15.	What are the problem in OFDM technique?	CO4	[K2]
16.	Mention the three key specifications of IEEE 802.11a	CO4	[K1]
17.	The multiple antennas at the transmitter and receiver can be used to obtain diversity gain instead of capacity gain.Justify this statement	CO5	[K2]
18.	For an 8X8 MIMO system with an SNR of 15 dB, if we require a data rate per unit Hertz of 15 bps, what is the maximum diversity gain the system can provide?	CO5	[K3]
19.	What is the purpose of power control?	CO6	[K1]
20.	Recommend a solution to the hidden and exposed terminal problem.	CO6	[K2]

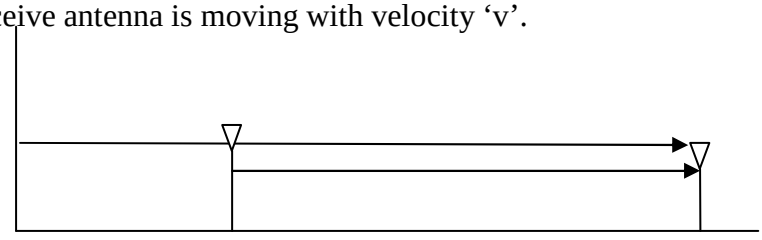
PART C (6 x 5 = 30 Marks)

21.	Consider a wireless channel model with two paths as LOS and reflected paths. The signal is transmitted at carrier frequency f_c as 1 GHz, signal bandwidth 1 MHz, velocity of the mobile receiver as 64 km/hr. Verify whether the channel is fast fading or slow fading, if the delay requirement is 200 μs	CO1	[K3]
22.	Compare the exact probability of symbol error of 16QAM with the symbol error probability for 16PSK with the same Signal to Noise Ratio and comment.	CO2	[K4]
23.	Explain in detail equal gain about comb ring technique.	CO3	[K3]
24.	Briefly explain a technique to mitigate Subcarrier fading in multicarrier modulation.	CO4	[K4]
25.	Describe the Diversity –Multiplexing tradeoff in MIMO communications.	CO5	[K4]
26.	Derive the expression for the capacity of downlink AWGN channel with two users assuming that successive interference cancellation is carried out at the receiver.	CO6	[K3]

Answer any FOUR Questions

PART D (4 x 10 = 40 Marks)

27.	Consider the two path wireless channel model shown in fig below. Analyze the received signal if the transmitted signal is cos2πft, when (a) the receive antenna is fixed, (b) the receive antenna is moving with velocity 'v'.	CO1	[K3]



28.	How does diversity improve the performance of radio system with respect to BER. Explain the Maximal ratio combining in detail.	CO3	[K5]
29.	Describe a discrete implementation of OFDM multicarrier transmission system with a neat block diagram.	CO4	[K2]
30.	Explain space time block coding technique with an example.	CO5	[K3]
31.	The multiuser sum capacity of uplink and downlink flat fading channel with a power constraint equal to total transmit power (in the uplink this is equal to kP and in downlink it is equal to P), Compare this with a single transmitting user (AWGN) with high and low SNR regime. Also compares the capacity under Rayleigh fading channel with Full CSI and CSI only at receiver	CO6	[K5]

****