

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(END SEMESTER EXAMINATION)

CLASS: M.Tech  
BRANCH: ECE

SEMESTER : II  
SESSION : SP/2025

SUBJECT: EC521 WIRELESS SIGNAL PROPAGATION

TIME: 3 Hours

FULL MARKS: 50

**INSTRUCTIONS:**

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
  2. Attempt all questions.
  3. The missing data, if any, may be assumed suitably.
  4. Before attempting the question paper, be sure that you have got the correct question paper.
  5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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		CO	BL
Q.1(a)	How does signal propagation differ between dynamic and static multipath scenarios? Discuss the key differences.	[5] 01	01
Q.1(b)	Consider an indoor wireless LAN with $f_c = 900$ MHz, cells of radius 100 m, and non-directional antennas. Under the free-space path loss model, what transmit power is required at the access point such that all terminals within the cell receive a minimum power of $10 \mu\text{W}$ . How does this change if the system frequency is 5 GHz?	[5] 01	02
Q.2(a)	Define critical distance and determine it for the two-ray model in an urban microcell ( $h_t = 9$ m, $h_r = 3$ m) and an indoor microcell ( $h_t = 3.5$ m, $h_r = 1.5$ m) for $f_c = 1.5$ GHz.	[5] 02	02
Q.2(b)	Find the median path loss using Okumura's model for $d=50\text{km}$ , $h_t=100\text{m}$ , $h_r=10\text{m}$ in a suburban environment. If the base station transmitter radiates an EIRP of 1kw at a carrier frequency of 900MHz, find the power at the receiver. Given parameters: $A_{mu}(900 \text{ MHz}, 50\text{km})=43 \text{ dB}$ , $G_{AREA}=9\text{dB}$ and assume a unity gain receiving antenna	[5] 02	02
Q.3(a)	Explain coherence bandwidth and coherence time.	[5] 03	01
Q.3(b)	Discuss various types of dispersive channel.	[5] 03	02
Q.4(a)	How does a linear equalizer differ from a non-linear equalizer? Using a block diagram explain the operation of an equalizer as implemented in the receiver.	[5] 04	01
Q.4(b)	How does selection combining technique functions? Derive an expression to represent the average SNR improvement realized in equal gain combining.	[5] 04	02
Q.5(a)	Discuss the capacity in flat fading channel when CSI is known only to receiver.	[5] 05	02
Q.5(b)	Consider a time-invariant frequency-selective block fading channel consisting of three sub-channels of bandwidth $B = 1\text{MHz}$ . The frequency response associated with each channel is $H_1 = 1$ , $H_2 = 2$ and $H_3 = 3$ . The transmit power constraint is $P = 10\text{mW}$ & the noise PSD is $N_0 = 10^{-9} \text{ W/Hz}$ . Find the Shannon capacity of this channel & the optimal power allocation that achieves this capacity.	[5] 05	03

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