

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

**CLASS: M.TECH/PRE-PHD  
BRANCH: ECE**

**SEMESTER : II/NA  
SESSION : SP/19**

**SUBJECT: EC560 WIRELESS SIGNAL PROPAGATION AND FADING**

**TIME: 3.00 Hrs.**

**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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- Q.1(a) Define channel impulse response and channel transfer function. Derive an expression for time varying channel impulse response. [5]
- Q.1(b) Discuss basic propagation mechanisms influencing signal propagation in wireless mobile environment. Identify the propagation mechanism responsible for signal reception in shadowed region and explain how it happens. [5]
- Q.2(a) A transmitter radiates 50 watt of power uniformly in all directions. Express the transmission power in units of dBW and dBm. Find the received power at a distance of 100 meter in free space in units of dBm. Assuming the frequency of operation is 900 MHz and transmitter and receiver antenna gains are 0dB and  $L=1$ . [5]
- Q.2(b) Discuss large scale fading and small scale fading. Analyze the factors responsible to cause them. [5]
- Q.3(a) What do you mean by power delay profile? Sketch typical power delay profile to explain different delay parameters of wireless mobile environment. [5]
- Q.3(b) If a baseband binary message with a bit rate  $R_b = 100$  kbps is modulated by an RF carrier using BPSK, answer the following: [5]
- a. Find the range of values required for the rms delay spread of the channel such that the received signal is flat fading.
  - b. If the modulation frequency is 5.8 GHz, what is the coherence time of the channel, assuming a vehicle speed of 30 miles? Is the channel is fast or slow?
- Q.4(a) How does selection combining functions? Derive an expression to represent the average SNR improvement realized in selection combining. [5]
- Q.4(b) Discuss the three signal processing techniques that improve received signal quality and link performance in a hostile mobile radio environment. Justify your opinion that Whether they can be used together or independently. [5]
- Q.5(a) Discuss wireless system capacity under different channel condition. Discuss outage capacity and give reason why notion of outage capacity doesn't exist in presence of CSIT. [5]
- Q.5(b) Consider a wireless channel, where the relation between transmit and receive power is expressed as  $P_r(d) = P_t(d_0/d)^3$ . Assume  $d_0 = 10$ m and transmit power is 1W and channel has noise power spectral density  $N_0/2$ , where  $N_0 = 10^{-9}$  W/Hz. Find the capacity of this channel at a distance of 100 m and 1 km from the transmitter, considering channel bandwidth to be 30 kHz. [5]

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