VIT

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

SCHOOL OF ELECTRONICS ENGINEERING
CONTINUOUS ASSESSMENT TEST - I
FALL SEMESTER 2025-2026

SLOT: B1+TB1

Programme Name & Branch : B.Tech (Electronics and Communication Engineering)
Course Code and Course Name: BECE317L/Wireless and Mobile Communications
Faculty Name(s) : Dr. Prakasam P

Q. No	Question	M
1.	(a) Explain the practical handoff approach that efficiently handles both high-speed and low-speed users in an urban environment. Umbrella Cell Approach, Soft Handoff and Hard handoff	5
	(b) Cell dragging is a pertaining problem in cellular deployment strategy – justify your answer with suitable illustration. Devise some strategy to combat the same. Justification, strategies	5
2.	If a transmitter utilizes 50 W of power, express the transmit power in units of (i) dBm and (ii) dBW. If 50 W is applied to a unity gain antenna with a 900 MHz carrier frequency, find the received power in dBm at a free space distance of 100 m from the antenna. What is $Pr\ (10\ km)$? Assume unity gain for the receiver antennas. (i) 16.99 dBW (ii). 46.99 dBm **(2)** λ = 0.333 m, P_r(100m) = 3.45 uW = - 24.62 dBm **(4)** P_r(10 km) = 0.345 nW = - 64.62 dBm **(4)**	10
3.	A cellular system using a four cell reuse pattern has hexagonal cells, each having a radius of 1.387 km. A total number of 60 channels are used within the entire system. If the average traffic load / user is 0.02 Erlangs and λ = 2 call / hour, compute the following for the trunking system that has a 2 % blocking probability of a delayed call. (a) How many users per square kilometre will this system support? The number of channels per cell = 60 /4 = 15 channels **(2)** From Erlang C chart, for 2% probability of delay with C = 15, traffic intensity = 8.035 Erlangs Numbers of users = Total traffic intensity / traffic per user = 8.035 / 0.02 = 401.75 = 401 users = 401 users/ 5 sq km = 80.2 = 80 users/sq km **(3)** (b) What is the probability that delayed call will have to wait for more than 30 s? Given λ = 2, holding time H = A_u / λ = 0.02 /(2/hour) = 0.029 x 60 x60 = 36 seconds The probability that a delayed call will have to wait for more than 30 s is $(P_r[Delay > t] \| P_r[Delay > 0]) = exp(-(C-A)t/H)$ $= \exp(-(15-8.035)30/36) = 0.00301 = 0.301\%$ **(3)** (c) What is the probability that a call will be delayed for more than 30 s? Given $P_r[Delay > 0]$ = 2% = 0.02 Probability that a call is delayed more than 10 seconds, $P_r[Delay > 30] = P_r[Delay > 0](P_r[Delay > t] \| P_r[Delay > 0])$ = 0.02 x 0.00301 = 0.000060=0.0060% **(2)**	10

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4.	Find the mean path loss at the receiver which is 40 m from the transmitter, through two floors of Office Building I for two cases (same Floor and multiple floors). Assume the transmitting frequency as 1.0 GHz. Assume that one concrete wall, two foil insulations and one aluminium siding each on both side of foil insulation exist between transmitter and receiver on the intermediate floors. The mean path loss exponent for same floor measurements in a building is n = 3.27, the mean path loss exponent for three-floor measurements is n = 5.04, and the average floor attenuation factor is FAF = 18.7 dB for two floors between the transmitter and receiver. The attenuation of the concrete block wall, foil insulation and aluminium siding are 13dB, 3.9 dB and 20.4 dB respectively. $$\overline{PL}(d)[dB] = \overline{PL}(d_o)[dB] + 10n_{SF}\log\frac{d}{d_o} + FAF[dB] + \sum PAF[dB]$$ $$\overline{PL}(d_o)[dB] = -10\log\frac{G_tG_r\lambda^2}{(4\pi)^2d^2}\ @\ d=1,\ \ = 32.45\ dB \qquad \textbf{(2)}$$ $\overline{PL}(d)[dB]$ = 32.45 + 10*3.27*log(40) + 18.7 + 1*13+2*3.9+4*20.4 = 205.64 dB **(4)** $$\overline{PL}(d)[dB] = \overline{PL}(d_o)[dB] + 10n_{MF}\log\frac{d}{d_o} + \sum PAF[dB]$$ $$\overline{PL}(d)[dB] = 215.56\ dB \quad \textbf{(4)}$$	10
5.	A drone is flying at a speed of 30 m/s and communicating at a carrier frequency of 2.4 GHz. (i). Calculate the Doppler spread for the channel. λ = 0.125 m, B_D = 240 Hz **(2)** (ii). Determine the spatial sampling interval required to make small-scale propagation measurements. $\Delta x = \lambda/2$ = 0.0625 m **(2)** (iii). How many samples will be needed to cover a distance of 15 meters? N = d/Δx = 240 samples **(2)** (iv). If these measurements can be made in real-time, how long will it take to cover the 15 meters? t =d/v = 0.5 s **(2)** (v). If the signal bandwidth is 10 MHz, analyze the effect of Doppler spread on channel performance. Compare Doppler spread to signal bandwidth, B_D = 240 Hz and B_S = 10 MHz Since $B_D \ll B_S$ the channel is considered slowly varying, Doppler spread will have a negligible effect on channel performance. **(2)**	10

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