Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2019

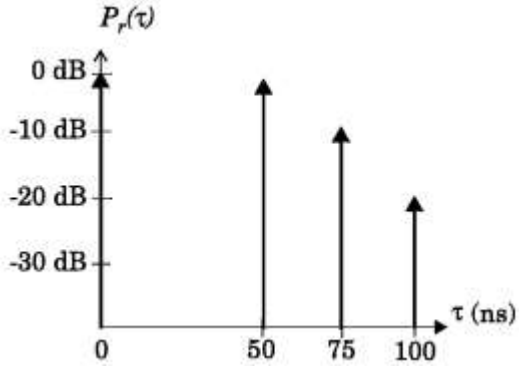
Course: Cellular & Mobile Data Communication **Semester: VII**
Program: B Tech Electronics with spz BCT **Time 03 hrs.**
Course Code: ELEG428 **Max. Marks: 100**

Instructions:

- Attempt all questions as per the instruction.
- Assume any data if required and indicate the same clearly.
- Unless otherwise indicated symbols and notations have their usual meanings.
- Strike off all unused blank pages

SECTION A

S. No.		Marks	CO
Q 1	Assume a 1 Amp-hour battery is used on a cellular telephone (often called a cellular subscriber unit). Also, assume that the cellular telephone draws 35 mA in idle mode and 250 mA during a call. How long would the phone work (i.e., what is the battery life) if the user leaves the phone on continually and has one 3-minute call every day? Every 6 hours?	**5**	**CO1**
Q 2	What is need of frequency reuse? Show that for a hexagonal cell geometry, the co-channel reuse ratio is $\sqrt{3N}$, where $N = i^2 + ij + j^2$	**5**	**CO2**
Q 3	Discuss near-far problem in cellular systems. Find the far-field distance for an antenna with maximum dimension of 1 m and operating frequency of 900 MHz.	**5**	**CO3**
Q 4	What are different types channels used in GSM? Explain any one of them.	**5**	**CO4**
	SECTION B		
Q 5	Draw the block diagram of a cellular system and explain step by step how a cellular telephone call is made.	**10**	**CO1**
Q 6	What are the different techniques used for improving the cellular system capacity? Explain them. OR Explain co-channel interference and how affects the system capacity. Also derive the expression for signal to interference ratio for 7-cell reuse system.	**10**	**CO2**
Q 7	Describe code division multiple access (CDMA). Why power control mechanism is required in CDMA based systems? Explain the mechanisms.	**10**	**CO3**
Q 8	Describe the GSM architecture. Also mentions the services of GSM	**10**	**CO4**

SECTION-C **Attempt any one from Q 9 and Q10** **Q11 is compulsory**			
Q 9	**(a)** Suppose that a mobile is moving along a straight line from BS1 to BS2 with a speed of 60 km/hr. The distance between the base stations is 2 km. For simplicity, assume small scale fading is neglected and the received power (in dBm) at the mobile station from the BS is modeled as a function of distance. Assume that P_0 = 0 dBm, d_0 = 3 m, and n=4. The minimum usable signal level for acceptable voice quality is -99dBm and Δt = 2 sec. Find the handoff threshold ($P_{r,HO}$) and power margin Δ in dBm. **(b)** If a transmitter produces 50 W of power, express the transmit power in units of (a) dBm, and (b) 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 100m from the antenna. What is Pr(10 km)? Assume unity gain for the receiver antenna.	**12+8**	**CO2**
Q 10	The power delay profile for a particular RF channel shown in **Fig. 1.**  (a) Estimate the 90% correlation and 50% correlation coherence bandwidth. (b) If a particular modulation provides suitable BER performance whenever a, $\frac{\sigma_\tau}{T_s} \leq$ 0.1. Determine the smallest symbol period T_S, without using an equalizer. (c) If the modulation carrier frequency is 5.8 GHz, what is the coherence time of the channel, assuming a vehicle speed of 30 miles per hour? (d) For your answer in (c), is the channel "fast" or "slow" fading?	**20**	**CO2**
Q 11	**(a)** Calculate the capacity and spectral efficiency of a TDMA system using the following parameters: bandwidth efficiency factor b = 0.9, bit efficiency (with QPSK) = 2, voice activity factor = v_f = 1.0, one-way system bandwidth BW = 12.5 MHz, information bit rate R = 16.2 Kbps, and frequency reuse factor N = 19. **(b)** Determine the maximum throughput that can be achieved using ALOHA and slotted ALOHA protocols. **(c)** In a single-cell CDMA system using spatial division multiple access (SDMA), determine the number of simultaneous users that can be supported at an average probability of error of $10^{-3}$when a processing gain of R_c/R_b = 511 is used. Assume 10 dB gain beam patterns may be formed and that perfect power control is used. Neglect voice activity. Given that the inverse Q-function value $Q^{-1}(10^{-3}) = 3.1$	**7+5+8**	**CO3** **CO4**