Question Paper Code: U5209

M.E. DEGREE EXAMINATION, DEC 2025

Professional Elective

21PCM 509 – ULTRA WIDE BAND COMMUNICATION

(Regulations 2021)

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions

PART - A (5 x 20 = 100 Marks)

1. (a) Design the near field antenna used for Wireless Personal Area   CO3 - App   (20)
         Networks and analyze its characteristics with respect to the
         received power over a large
         frequency band.

                                            Or

    (b) Calculate the amplitude and Magnitude of the Legendre   CO3 - App   (20)
         functions for the order of n= 1,2,3,4 and 5.

2. (a) Analyze the characteristics and structure of UWB wireless   CO4-Ana   (20)
         channel models, focusing on the Saleh–Valenzuela and IEEE
         802.15.4a approaches. Justify the results.

                                            Or

    (b) Analyze how the Directivity, Gain, and Antenna Height   CO4-Ana   (20)
         influence the performance of WiMAX communication in
         integration with the existing OFDM system. Justify your
         analysis with suitable technical reasoning.

3. (a) Analyze the DS-UWB and MB-OFDM UWB techniques in   CO4-Ana   (20)
         terms of system complexity, communication range, and
         achievable data rate for WPAN applications. Justify which
         technique provides better overall performance in real-world
         implementations.

                                            Or

(b) Consider the UWB waveform p(t) as the nth order derivative of Gaussian shape.   CO4-Ana   (20)

$$p(t) = \frac{d^n}{dt^n}\left(\frac{A}{\sigma\sqrt{2\pi}}\exp(-t^2/2\sigma^2)\right)$$

A is the amplitude of the pulse and the he total duration of the pulse is considered to be Tp =1 nsec. Complying with the indoor FCC mask, for n=1,3,5 and 7, obtain the proper value of A and the spread of the pulse s. Analyze the range-rate performance of the system with different n.

4. (a) Consider three access points at (0,0), (5 m,12 m) and (13 m,15 m) and the mobile at (10 m,10 m). Draw the circles corresponding the distances measured from the access points. Analyze how increasing the path-loss exponent n_0 from the free-space value 2 to 4 alters the circles' radii and their intersection geometry, and justify the consequences of these changes for localization accuracy and reliability.   CO5-Ana   (20)

Or

(b) Analyze the Angle of Arrival (AoA) and Time of Arrival (ToA) positioning techniques in terms of line-of-sight requirements and positioning error.   CO1-App   (20)

5. (a) Compare UWB regulation in Japan and Europe. Justify your answer.   CO2-U   (20)

Or

(b) Compare the narrow-band RFID with the UWB RFID. What is the major draw back of narrow-band RFID system?   CO2-U   (20)

U5209