

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- 2024

M.Tech-I Semester (ECE)

COURSE CODE (CREDITS): 21M1WEC137 (3)

MAX. MARKS: 25

COURSE NAME: Advanced Cognitive Radio

COURSE INSTRUCTORS: Dr. Shweta Pandit

MAX. TIME: 1 Hour 30 Minutes

*Note: (a) All questions are compulsory.*

*(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems*

Q.No	Question	CO	Marks
Q1	Describe the various functions of Cognitive Radio. Organize these functions inside the cognitive cycle to demonstrate the components of cognitive cycle along with cognitive radio functionalities.	1	3
Q2	Assess how setting an interference temperature limit (IL) impacts both licensed and unlicensed spectrum users. What is the unit of interference temperature? Assume a receiver experiences interference from multiple unlicensed sources. The interference power from each source is given as $10 \mu\text{W}$ , $15 \mu\text{W}$ , and $20 \mu\text{W}$ . Using Boltzmann's constant ( $1.38 \times 10^{-23} \text{ J/K}$ ) and unit bandwidth, calculate the total interference temperature observed by the receiver.	2	2+3
Q3	a) Describe situations where cooperative spectrum sensing would be more beneficial than non-cooperative sensing and vice-versa. b) Evaluate the effectiveness of cyclostationary detection in low signal-to-noise ratio (SNR) environments compared to energy detection. Discuss the impact of noise uncertainty on the performance of energy detection techniques in spectrum sensing.	2	2+3
Q4	Analyze the trade-offs between spectrum sensing accuracy and throughput maximization in cognitive radios.	4	2
Q5	Design a solution for handling spectrum scarcity issue in urban environments using cognitive radio technology.	4	3
Q6	Explain the spectrum sensing mechanism in IEEE 802.22 WRAN standard. You are asked to build and deploy WRAN in a 50 km radius area using omnidirectional antennas. If the propagation loss exponent is 3.5, calculate the estimated received signal strength at the edge of the coverage area for a transmitter power of 20 dBm.	3	2+3
Q7	A Dynamic Spectrum Access (DSA) system can allocate 15 MHz of unused spectrum in a 100 MHz band, calculate the percentage of spectrum utilization before and after DSA implementation if only 60 MHz of the band was being used initially.	1	2