**The LNM Institute of Information Technology**

**Department of Electronics &Communication Engineering, Sub: Cognitive Radio**

**Online Quiz-2, 26 April, 2020, Time Duration: 30 minutes, Total marks =12x4+2 (for clarity)**

Q1. a) Mention the typical value of **noise floor** in a spectrum measurement system:

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| Ans: -140 dbm |

1. What is the ITU recommendation for the **choice of threshold** in spectrum measurement?

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| Ans: 10 dB |

1. If the threshold is chosen too high, an underestimation of actual occupancy will happen. **True or False**?

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| Ans: True |

1. Which are the **features** fulfilled by a Discone antenna for spectrum measurement? Tick the correct ones.

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| i) | Wide band | iii) | Low noise |
| ii) | Wide gain | iv) | Omnidirectionality |

Q2.

1. Among white, grey and black spaces, which spaces can be used for CR applications and why?

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| Ans: White spaces and grey spacesare obvious candidates for CR, and any unlicensed operation in black spacesmust be avoided. In the white space, there is no interference except noise for the frequency. Here the spectrum is not used most of the time. The grey space indicates that this spectrum is partially used by low power signals under acceptable interference. |

1. A spectrum band of total bandwidth of 50 MHz has 20 frequency channels. The duty cycle of each frequency channel is 25%. What will be the occupied bandwidth of the spectrum band?

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| Ans: Occupied bandwidth = Avg duty cycle x bandwidth of band = 0.25\*50 MHz = 12.5 MHz |

1. Is the threshold set-up in occupancy measurement of each channel in a band same or different?

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| Ans: same. |

1. What are the **set-up configuration parameters** before carrying out spectrum occupancy measurement with the use of spectrum analyzer?

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| Ans: Specifications of different components vary per frequency band of interest, location and many factors.  25-1300 MHz discone antenna, 850 MHz low noise amplifier, Spectrum analyser 100 KHz- 3 MHz and laptop with fsc installed. |

Q3.

1. For a 2-state DTMC spectrum model, write the **expression for duty cycle** in terms of the relevant transition probabilities.

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| Ans: Ψ = p01/(p01 +p10). The stationary DTMC model can therefore be configured to reproduce any arbitrary Ψ by selecting the transition probabilities as p01 = p11 = Ψ and p10 = p00 = 1 – Ψ. |

1. The raw data out of spectrum measurement are stored in a matrix ***M***, where each element of matrix ***M*** (i.e. *M(ti,fj)*) represents the PSD sample at time instant *ti* at frequency *fj*. What is the dimension of ***M***, given the time span *T*, the frequency span *F* and time resolution *Tr* and frequency resolution *Fr*.

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| Ans: It would be unitless, since units of time and frequency are just opposite of each other. So, when they multiply it nulifies the units. |

1. How do you enhance the **measurement accuracy/ system** **sensitivity** of a spectrum measuring system?

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| Ans: A successful spectrum survey requires some basic dimensions that every spectrum measurement strategy to clearly specify: *frequency* (frequency span and frequency points to be measured), *location* (measurement site selection), *direction* (antenna pointing angle), *polarization* (receiving antenna polarization) and *time* (sampling rate and measurement period). The measurement setup employed in the evaluation of spectrum occupancy should be designed considering the previous factors since they play a key role in the accuracy of the obtained results. |

1. In machine learning based prediction, which criterion the secondary user will consider before it starts data transmission? Tick the correct one

Ans: a) longest off period of primary b) average off period of primary c) longest on period of primary