COGNITIVE RADIOS AND NETWORKS
(ECEN 5241)

Time Allotted : 2½ hrs **Full Marks : 60**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 4 (four) from Group B to E, taking one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A

1. Answer any twelve: **12 × 1 = 12**

Choose the correct alternative for the following

(i) GNU Radio operates with programming language known as
(a) FORTRAN (b) COBOT
(c) JAVA (d) PYTHON

(ii) One of the functional units is not included in SDR Front end
(a) Low Noise Amplifier (b) Antenna
(c) Mixer (d) Signal Processor

(iii) What is the range of white space in TV Broadcasting Band
(a) 200 - 500 MHz (b) 2.4 – 5 GHz
(c) 470 - 698 MHz (d) 1 - 5 GHz

(iv) IEEE 802.22 standard is proposed by
(a) WTN (b) WRAN
(c) RAN (d) RLA

(v) Middleware layer CORBA provides
(a) authentication (b) segregation
(c) field programming (d) none of these

(vi) Distributive Cognitive Radio network means
(a) Fusion Centre based network (b) Infrastructure based network
(c) Local Sensing based network (d) Data network

(vii) Spectrum Mobility defines
(a) secondary data speed (b) primary data speed
(c) spectrum adaptation (d) spectrum sensing

(viii) In a Cognitive Radio, Hardware governs the
(a) IF Block (b) RF block
(c) Modulation Block (d) RF and modulation blocks

(ix) Which radio access technologies use the same frequency band
(a) network centric (b) spectrum sharing
(c) spectrum sensing (d) RF band centric approach

(x) Which among the following techniques requires prior knowledge of the primary signal?
(a) Matched filter detection (b) Energy detection
(c) Cooperation detection (d) Cyclostationary detection

Fill in the blanks with the correct word

(xi) Common control channel is used for _____.

(xii) Digital modular radio is an example for _____.

(xiii) The spectrum sensing techniques are categorized into _____ types.

(xiv) _____ is used to switch to the selected opportunities.

(xv) _____is a challenge for spectrum mobility in the time domain.

Group - B

2. (a) Identify the benefits of SDR over hardware radios. *[(CO1)(Analyse/IOCQ)]*
(b) Mention the metrics to measure the capacity of the processor of SDR. *[(CO2)(Understand/LOCQ)]*
(c) How these metric help the designer to design the processor. *[(CO2)(Analyse/IOCQ)]*
5 + 2 + 5 = 12

3. (a) Draw the block diagram of SDR transmitter & receiver. *[(CO1)(Understand/LOCQ)]*
(b) Identify the implementation difficulties of this system. *[(CO1)(Analyse/IOCQ)]*
(c) Mention the types of hardware that are mostly used in SDR. *[(CO2)(Apply/IOCQ)]*
6 + 4 + 2 = 12

Group - C

4. (a) Why position awareness are considered as essential element for smart radio. *[(CO3)(Analyse/IOCQ)]*
(b) Elaborate the functionality of a positioning system. *[(CO3)(Understand/LOCQ)]*
(c) Draw the block diagram of location awareness engine. *[(CO3)(Apply/IOCQ)]*
2 + 6 + 4 = 12

5. (a) How does CR adapt and optimize the performance of the radio platform? *[(CO3)(Analyse/IOCQ)]*
(b) Which parameters need to be optimized? *[(CO3)(Understand/LOCQ)]*
(c) What are the approaches need to be followed to provide the accurate position awareness? *[(CO3)(Analyse/IOCQ)]*
2 + 6 + 4 = 12

Group - D

6. (a) What are the five periods of cognitive cycle? *[(CO4)(Remember/LOCQ)]*
   (b) Identify the key security issues in cognitive radio networks (CRNs). *[(CO4)(Analyse/IOCQ)]*

2 + 10 = 12

7. (a) Identify the necessary steps to be followed for SDR to CR architecture transition. *[(CO5)(Analyse/IOCQ)]*
   (b) Mention the challenges faced by the designer while designing a CR system. *[(CO5)(Remember/LOCQ)]*

6 + 6 = 12

Group - E

8. (a) Define spectrum sensing. *[(CO5)(Remember/LOCQ)]*
   (b) List the components of spectrum sensing. *[(CO5)(Understand/LOCQ)]*
   (c) Compare transmitter detection, cooperative detection & interference based detection. *[(CO5)(Analyse/IOCQ)]*

2 + 4 + 6 = 12

9. (a) Identify the steps followed in energy detection for transmitter sensing. *[(CO6)(Analyse/IOCQ)]*
   (b) Mention the challenges and limitations of energy detection method for transmitter sensing. *[(CO6)(Understand/LOCQ)]*
   (c) Identify the two key uncertainties in the process of energy detection in Next-Generation (xG) Networks. *[(CO6)(Apply/IOCQ)]*

4 + 4 + 4 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	39.58	60.42	0