

**COGNITIVE RADIO TECHNOLOGY
(ECEN 6141)**

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

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

**Group - A
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) CDMA based cellular system is an example of
(a) adaptive radio (b) software enabled radio
(c) aware radio (d) both (b) & (c).
 - (ii) Power PC is a class of
(a) FPGA (b) DSP
(c) GPP (d) multimedia processor.
 - (iii) Adaptive Radio
(a) senses all or part of the environment
(b) has fixed modulation capability
(c) can modify operating parameters
(d) uses small number of frequencies.
 - (iv) Basic SDR must include
(a) radio front end (b) cryptographic security functions
(c) power amplifiers (d) all of these.
 - (v) Frequency hopping, Networking, QoS measuring amongst others are characteristics of
(a) software defined radio (b) software capable radio
(c) aware radio (d) adaptive radio.
 - (vi) IEEE 802.11 specifies operation of WRAN (Wireless Regional Area Network) in TV white space of
(a) 54 MHz and 862 MHz (b) 2.4 GHz and 5.2 GHz
(c) 100 MHz to 240MHz (d) None of these.

- (vii) Matched filtering is basically a
(a) modulation technique (b) multiplexing technique
(c) demodulation technique (d) de multiplexing technique.
- (viii) CCC is used
(a) to initiate communication (b) for traffic data transfer
(c) for voice calling (d) none of these.
- (ix) Underlay cognitive users use spectrum of
(a) White Spaces (b) Black Spaces
(c) Gray Spaces (d) Reliable Spaces.
- (x) CVSD is a
(a) voice encoding method (b) MMP software block
(c) DSP system (d) none of these.

Group - B

2. (a) What is the meaning of the word "Cognitive" and what do you understand by the phrases "Cognitive Engine" and "Policy Engine"?
(b) With the help of a block schematic diagram, show the comparison amongst Traditional Radio, software radio and Cognitive Radio.
(1 + 4) + 7 = 12
3. (a) What are the essential architecture goals of a successful "plug and play" module?
(b) What are the various computational processing resources in SDR? Explain in details.
(c) What are the QoS requirements of Secondary Users?
4 + 6 + 2 = 12

Group - C

4. (a) What is CORBA? With a diagram, highlight the CORBA centric software architecture highlighting the APIs.
(b) What are the basic premises of Software Communication Architecture?
(1 + 5) + 6 = 12
5. (a) Elaborate the concept of "Radio Flexibility and capability" of Cognitive Radio.

- (b) Explain, how, Artificial Intelligence techniques are applied in Cognitive Radio.

6 + 6 = 12

Group - D

6. (a) Define Cognitive Radio? What are the key applications of Cognitive Radio?

- (b) With a neat diagram, explain the simplified cognition cycle.

(2 + 3) + 7 = 12

7. (a) Explain briefly one technique to minimize the hidden primary user problem.

- (b) Differentiate centralized and distributed inter-network spectrum sharing. What are the three main functions for Dynamic spectrum access? Explain.

5 + (3 + 4) = 12

Group - E

8. (a) Derive test static of energy detector for analog signal.

- (b) What are the critical factors while designing any energy detector and why? Why cyclostationary based sensing is more reliable than energy based detection?

5 + (4 + 3) = 12

9. (a) What are the upper layer issues in Cognitive Radio Networks? What are the cross layer challenges in upper layers?

- (b) Why cooperative spectrum sensing is superior than non cooperative spectrum sensing?

(5 + 4) + 3 = 12