

**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) Radio Spectrum scarcity is largely due to
 (a) physical shortage of spectrum (b) inefficient allocation
 (c) lack of flexibility (d) a mixture of all of these.
- (ii) QoS requirement for secondary users are
 (a) Data Rate (b) Error Rate
 (c) Delay (d) All of these.
- (iii) Power PC is a class of
 (a) GPP (b) cognitive radio
 (c) Aware Radio (d) FPGA.
- (iv) Basic SDR must include
 (a) radio front end
 (b) cryptographic security functions
 (c) power amplifiers
 (d) all of these.
- (v) RSSI means
 (a) Radio Signal Strength Indicator
 (b) Reverse Signal Strength Indication
 (c) Received Signal Strength Indicator
 (d) Receiver Signal strength Indication.
- (vi) What is the range of white space in TV Broadcasting Band?
 (a) 84-850 MHz (b) 80-854 MHz
 (c) 52-854 MHz (d) 54-852 MHz.

- (vii) Matched filtering is basically
 (a) Modulation Technique (b) Multiplexing Technique
 (c) Demodulation Technique (d) Demultiplexing Technique.
- (viii) Primary emulation attack affects
 (a) Cognitive Users (b) Primary Users
 (c) Fusion Centres (d) Cellular Networks.
- (ix) Hyken's proposed Cognitive Cycle is completed in
 (a) Three Steps (b) Four Steps
 (c) Six Steps (d) Seven Steps.
- (x) IEEE 802.22 standard is proposed by
 (a) WTN (b) WRN (c) RAN (d) RLA.

Group - B

2. (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**
3. (a) What are the QoS requirements of Secondary users? Explain the terms.
 (b) What are the various computational processing resources in SDR? Justify. **6 + 6 = 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? **6 + 6 = 12**
5. (a) What do you mean by "Plug and Play" modules? Give examples. Under what conditions these modules can be added in an existing architecture?
 (b) Elaborate the Interface topology among Plug and Play modules with a diagram showing interface points and plug and play modules. **(3 + 3) + 6 = 12**

Group - D

6. (a) What do you mean by spectrum sensing and detection? Why cooperative spectrum sensing is more suitable than non-cooperative sensing?
- (b) Explain briefly one technique to minimize the hidden primary user problem in cognitive radio networks.

$$(2 + 4) + 6 = 12$$

7. (a) Define Cognitive Radio? What are the key applications of Cognitive Radio? What are the differences between software defined radio and software control radio?
- (b) With a neat diagram, explain the simplified cognition cycle.

$$(2 + 2 + 2) + 6 = 12$$

Group - E

8. (a) What do you mean by localization in Cognitive Radio Network? Why location awareness is an essential feature in Cognitive Radio Network?
- (b) Why cyclostationary based sensing is more reliable than energy based detection? What are the application areas of matched filter detection?

$$(3 + 3) + (3 + 3) = 12$$

9. (a) Differentiate centralized and distributed inter-network spectrum sharing.
- (b) What are the upper layer issues in Cognitive Radio Networks?
- (c) What are the cross layer challenges in upper layers?

$$3 + 4 + 5 = 12$$