

**III B.Tech – II Semester
(20EC6639) COGNITIVE RADIO
(Honors)**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	4

Pre-Requisites: Analog & Digital Communications

Course Objectives:

- To understand the evolving software defined radio and cognitive radio techniques and their essential functionalities.
- To study the basic architecture and standard for cognitive radio
- To understand the concept of spectrum sensing.
- To understand the physical, MAC and Network layer design of cognitive radio.
- To expose the student to evolving applications and advanced features of cognitive radio.

UNIT-I: INTRODUCTION TO SOFTWARE-DEFINED RADIO AND COGNITIVE RADIO:

Evolution of Software Defined Radio and Cognitive radio: goals, benefits, definitions, architectures, relations with other radios, issues, enabling technologies, radio frequency spectrum and regulations.

UNIT-II: COGNITIVE RADIO ARCHITECTURE

Cognition cycle – orient, plan, decide and act phases, Organization, SDR as a platform for Cognitive Radio – Hardware and Software Architectures, Overview of IEEE 802.22 standard for broadband wireless access in TV bands.

UNIT-III: SPECTRUM SENSING AND DYNAMIC SPECTRUM ACCESS:

Introduction – Primary user detection techniques – energy detection, feature detection, matched filtering, cooperative detection and other approaches, Fundamental Trade-offs in spectrum sensing, Spectrum Sharing Models of Dynamic Spectrum Access - Unlicensed and Licensed Spectrum Sharing, Fundamental Limits of Cognitive Radio.

UNIT-IV: MAC AND NETWORK LAYER DESIGN FOR COGNITIVE RADIO:

MAC for cognitive radios – Polling, ALOHA, slotted ALOHA, CSMA, CSMA / CA, Network layer design – routing in cognitive radios, flow control and error control techniques.

UNIT-V: ADVANCED TOPICS IN COGNITIVE RADIO:

Overview of security issues in cognitive radios, auction based spectrum markets in cognitive radio networks, public safety and cognitive radio, cognitive radio for Internet of Things.

Course Outcomes:

S. No	Course Outcome	BTL
1	Understand the fundamental concepts of cognitive radio networks.	L2
2	Gain knowledge on the design principles of cognitive radio.	L3
3	Design and implement algorithms for cognitive radio spectrum sensing and dynamic spectrum access.	L4
4	Understand network layer design for cognitive radio	L2
5	Apply the knowledge of advanced features of cognitive radio for real world applications.	L3

Correlation of COs with POs & PSOs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	2	2	-	-	-	-	-	-	-	-	-	2	-
CO3	2	2	2	-	-	-	-	-	-	-	-	-	2	-
CO4	2	-	2	-	-	-	-	-	-	-	-	-	2	-
CO5	2	-	2	-	-	-	-	-	-	-	-	2	2	-

Text Books:

1. Alexander M. Wyglinski, Maziar Nekovee, Thomas Hou, —Cognitive Radio Communications and Networks, Academic Press, Elsevier, 2010. (Unit I to IV)
2. Huseyin Arslan (Ed.), —Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems, Springer, 2007. (Unit V)

Reference Books:

1. Bruce Fette, —Cognitive Radio Technology, Newnes, 2006.
2. Kwang-Cheng Chen, Ramjee Prasad, — Cognitive Radio Networks, John Wiley and Sons, 2009.
3. Ezio Biglieri, Professor Andrea J. Goldsmith, Dr Larry J. Greenstein, Narayan B. Mandayam, H. Vincent Poor, —Principles of Cognitive Radio, Cambridge University Press, 2012.