GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3725413
COGNITIVE RADIO NETWORKS
SEMESTER - II

Type of course: Programme Elective-II

Prerequisite: Wireless Communication, Data Communication and Networking

Rationale: Now a day, many receivers are implemented using software and they are called Software Defined Radios. Cognitive radio network is an emerging technology which utilizes available frequency resources in most efficient way and provides reliable communication. Cognitive radio network is an advanced research area in the field of wireless communication and networking. By learning this subject the students will appreciate the recent trends of software defined radios and cognitive radio networking.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE(E)	PA (M)	PA (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Unit 1:** Introduction to Cognitive Radios: Digital dividend, cognitive radio (CR) architecture, functions of cognitive radio, dynamic spectrum access (DSA), components of cognitive radio, spectrum sensing, spectrum analysis and decision, potential applications of cognitive radio	**07**	20
2	Unit 2:Spectrum Sensing: Spectrum sensing, detection of spectrum holes (TVWS), collaborative sensing, geo-location database and spectrum sharing business models (spectrum of commons, real time secondary spectrum market).	**08**	20
3	**Unit 3:**Optimization Techniques of Dynamic Spectrum Allocation: Linear programming, convex programming, non-linear programming, integer programming, dynamic programming, stochastic programming.	**07**	10
4	**Unit 4:**Dynamic Spectrum Access and Management: Spectrum broker, cognitive radio architectures, centralized dynamic spectrum access, distributed dynamic spectrum access, learning algorithms and protocols	**08**	20
5	**Unit 5:**Spectrum Trading: Introduction to spectrum trading, classification to spectrum trading, radio resource pricing, brief discussion on economics theories in DSA (utility, auction theory), classification of auctions (single auctions, double auctions, concurrent, sequential).	**07**	15
6	**Unit 6:** Research Challenges in Cognitive Radio: Network layer and transport layer issues, cross- layer design for cognitive radio networks, Cognitive radio for Internet of Things,MIMO Cognitive Radio	**06**	15

References:

- Ekram Hossain, Dusit Niyato, Zhu Han, "Dynamic Spectrum Access and Management in Cognitive Radio Networks", Cambridge University Press, 2009.
- Kwang-Cheng Chen, Ramjee Prasad, "Cognitive radio networks", John Wiley & Sons Ltd., 2009.
- Jeffrey H. Reed ,"Software Radio: A Modern Approach to Radio Engineering By Pearson Education .
- Bruce Fette, "Cognitive radio technology", Elsevier, 2nd edition, 2009.
- Huseyin Arslan, "Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems", Springer, 2007.
- FranciscoRodrigoPorto Cavalcanti,Soren Andersson,"OptimizingWireless Communication Systems" Springer, 2009.
- Linda Doyle, "Essentials of Cognitive Radio", Cambridge University Press, 2009

Course Outcomes:

After learning the course the students should be able:

Sr. No.	CO statement	Marks % weightage
CO-1	Understand the fundamental concepts of cognitive radio networks	20
CO-2	Develop the cognitive radio, as well as techniques for spectrum holes detection that cognitive radio takes advantages in order to exploit it	20
CO-3	Understand the basic architecture of cognitive radio	20
CO-4	Study various techniques like spectrum sensing and spectrum analysis	20
CO-5	Understand technologies to allow an efficient use of TVWS for radio communications based on two spectrum sharing business models/policies	10
CO-6	Understand fundamental issues regarding dynamic spectrum access, the radio-resource management and trading, as well as a number of optimisation techniques for better spectrum exploitation	10

List of Open Source Software/learning website:

www.crew-project.eu, GNU Radio , sdrforum.org, ecewp.ece.wpi.edu