GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRONICS & COMMUNICATION (WIRELESS COMMUNICATION SYSTEMS & NETWORKS) (27)
RADIO NETWORK PLANNING AND OPTIMIZATION
SUBJECT CODE: 2722703
SEMESTER: II

Type of course: Major Elective-II

Prerequisite: NA

Rationale: Radio Network Planning and Optimization subject is very important for Wireless communication engineers because planning intended to meet current status and demands, also comply with the future requirements by providing an acceptable development path in wireless communication. Radio network planning and optimization provides solid understanding of how to design and plan high quality radio networks.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks		Practical Marks				
				ESE (E)	PA (M)	ESE (V)		PA (I)		
						ESE	OEP	PA	RP	
3	2#	2	5	70	30	20	10	10	10	150

Content:

Sr. No	Content	Hours	% Weightage
1.	Introduction to Radio Network Planning and Optimization, Future trends towards a service driven network management, Wireless Local Area Networks (WLANs), Next-generation Mobile Communication	**6**	10
2.	WCDMA Radio Network Planning: Dimensioning, Detailed Planning - Verification of Dimensioning with Static Simulations - Verification of Static Simulator with Dynamic Simulations - Optimization of the Radio Network Plan.	**10**	20
3.	WCDMA–GSM Co-planning Issues - Radio Frequency Issues - Radio Network Planning Issues; Coverage and Capacity Enhancement Methods - Techniques for Improving Coverage - Techniques for Improving Capacity .	**10**	20
4.	Radio Resource Utilization: Introduction to Radio Resource Management – Power Control - Handover Control - Congestion Control - UMTS system and radio network planning - UMTS introduction - UMTS configuration planning - UMTS coverage and capacity enhancements - UMTS topology planning - UMTS radio resource management and functionality, System improvements towards higher packet data rate services - HSDPA - HSUPA - LTE system - LTE performance	**12**	30
5.	Radio Network Optimization Process - Introduction to Radio Network Optimization Requirements - Introduction to the Telecom Management Network Model, Tools in Optimization; Advanced Analysis Methods and Radio Access Network Auto tuning - Advanced Analysis Methods for Cellular Networks - Automatic Optimization.	**10**	20

Reference Books:

1. "Radio Network Planning and Optimisation", By. Jaana Laiho, Achim Wacker & Tomas Novosad, John Wiley, 2006.
2. "Indoor Radio Planning: A Practical Guide for GSM, DCS, UMTS and HSPA", By. Morten Tolstrup, John Wiley, 2008.
3. "Advanced Cellular Network Planning and Optimisation: 2G/2.5G/3G...Evolution to 4G" By. Ajay R Mishra, Wiley Publication
4. "Planning and Optimization of 3G and 4G Wireless Networks", By. J. I. Agbinya, River Publishers
5. "Radio Network Planning and Optimisation for UMTS", By. Jaana Laiho, Achim Wacker, Nokia Network group

Course Outcomes:

After learning the course the students should be able to:

- Familiarize with cellular radio network planning process
- Learn coverage planning, capacity planning and frequency planning
- Understand the fundamental radio network planning problem and become aware of planning related phenomena of multi path radio propagation environment.
- Understand and calculate how the coverage- and capacity planning are bound together in UMTS
- Know the basics of radio resource management, system functionality and air interface of high packet data rate technologies such as HSDPA, HSUPA, and LTE
- Learn radio network optimization process

List of Experiments:

- To Install Q-Rap Open Source Radio Planning software package
- Set up map in QGIS, Set up antenna patterns, Plot defaults
- Creating site and perform Link analysis
- Field visit and study of how radio network planning is done by wireless network operators and prepare report based on it
- Perform experiments on static radio network simulator based on MATLAB

Open Ended Problems:

- Optimization design problem: maximization of the coverage of a given area while minimizing the base station (BS) deployment

List of Open Source Software/learning website:

Q-Rap: Open source radio planning tool
URL for Manual and code for Q-Rap tool:
http://svn.code.sf.net/p/qrap/code/qrap
Matlab Code for Static Radio Network Simulator: www.wiley.com/go/laiho

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for

seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website