Course Code:	Course Title	Credit
CSC603	Mobile Computing	3

Prerequisite: Computer Networks	
Course Objectives:	
1	To introduce the basic concepts and principles in mobile computing. This includes major techniques involved, and networks & systems issues for the design and implementation of mobile computing systems and applications.
2	To explore both theoretical and practical issues of mobile computing.
3	To provide an opportunity for students to understand the key components and technologies involved and to gain hands-on experiences in building mobile applications.
Course Outcomes: On successful completion of course, learner will be able to	
1	To identify basic concepts and principles in computing, cellular architecture.
2	To describe the components and functioning of mobile networking.
3	To classify variety of security techniques in mobile network.
4	To apply the concepts of WLAN for local as well as remote applications.
5	To describe Long Term Evolution (LTE) architecture and its interfaces.

Module		Content	Hrs
1		**Introduction to Mobile Computing**	**4**
	1.1	Introduction to Mobile Computing, Telecommunication Generations, Cellular systems,	
	1.2	Electromagnetic Spectrum, Antenna, Signal Propagation, Signal Characteristics, Multiplexing, Spread Spectrum: DSSS & FHSS, Co-channel interference	
2		**GSM Mobile services**	**8**
	2.1	GSM Mobile services, System Architecture, Radio interface, Protocols, Localization and Calling, Handover, security (A3, A5 & A8)	
	2.2	GPRS system and protocol architecture	
	2.3	UTRAN, UMTS core network; Improvements on Core Network,	
3		**Mobile Networking**	**8**
	3.1	Medium Access Protocol, Internet Protocol and Transport layer	
	3.2	Mobile IP: IP Packet Delivery, Agent Advertisement and Discovery, Registration, Tunneling and Encapsulation, Reverse Tunneling.	
	3.3	Mobile TCP: Traditional TCP, Classical TCP Improvements like Indirect TCP, Snooping TCP & Mobile TCP, Fast Retransmit/ Fast Recovery, Transmission/Timeout Freezing, Selective Retransmission	
4		**Wireless Local Area Networks**	**6**
	4.1	**Wireless Local Area Networks:** Introduction, Infrastructure and ad-hoc network	
	4.2	**IEEE 802.11:**System architecture , Protocol architecture , Physical layer, Medium access control layer, MAC management, 802.11a, 802.11b standard	
	4.3	Wi-Fi security : WEP ,WPA, Wireless LAN Threats , Securing Wireless Networks	

	4.4	Bluetooth: Introduction, User Scenario, Architecture, protocol stack	
5		**Mobility Management**	**6**
	5.1	**Mobility Management :** Introduction, IP Mobility, Optimization, IPv6	
	5.2	Macro Mobility : MIPv6, FMIPv6	
	5.3	Micro Mobility: CellularIP, HAWAII, HMIPv6	
6		**Long-Term Evolution (LTE) of 3GPP**	**7**
	6.1	**Long-Term Evolution (LTE) of 3GPP :** LTE System Overview, Evolution from UMTS to LTE	
	6.2	LTE/SAE Requirements, SAE Architecture	
	6.3	EPS: Evolved Packet System, E-UTRAN, Voice over LTE (VoLTE), Introduction to LTE-Advanced	
	6.4	Self Organizing Network (SON-LTE), SON for Heterogeneous Networks (HetNet), Comparison between Different Generations (2G, 3G, 4G and 5G), Introduction to 5G	

Textbooks:	
1	Jochen Schilller, "**Mobile Communication**", Addision wisely, Pearson Education
2	William Stallings "**Wireless Communications & Networks**", Second Edition, Pearson Education
3	Christopher Cox, "**An Introduction to LTE: LTE, LTE-Advanced, SAE and 4G Mobile Communications**", Wiley publications
4	Raj Kamal, **"Mobile Computing"**, 2/e, Oxford University Press-New
References:	
1	Seppo Hamalainen, Henning Sanneck , Cinzia Sartori, **"LTE Self-Organizing Networks (SON): Network Management Automation for Operational Efficiency",** Wiley publications
2	Ashutosh Dutta, Henning Schulzrinne **"Mobility Protocols and Handover Optimization: Design, Evaluation and Application",** IEEE Press, Wiley Publication
3	Michael Gregg, **"Build your own security lab",** Wiley India edition
4	Dipankar Raychaudhuri, Mario Gerla, **"Emerging Wireless Technologies and the Future Mobile Internet",** Cambridge
5	Andreas F. Molisch, **"Wireless Communications",** Second Edition, Wiley Publication

Assessment:	
Internal Assessment:	
Assessment consists of two class tests of 20 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and second class test when additional 40% syllabus is completed. Duration of each test shall be one hour.	
End Semester Theory Examination:	
1	Question paper will comprise of total six questions.
2	All question carries equal marks
3	Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4	Only Four question need to be solved.
5	In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Useful Links	
1	https://www.coursera.org/learn/smart-device-mobile-emerging-technologies

Lab Code	Lab Name	Credit
CSL603	Mobile Computing Lab	1

Prerequisite: Computer Networks	
Lab Objectives:	
1	To learn the mobile computing tools and software for implementation.
2	To understand the security algorithms in mobile networks
3	To learn security concepts
Lab Outcomes: At the end of the course, the students will be able to	
1	develop and demonstrate mobile applications using various tools
2	articulate the knowledge of GSM, CDMA & Bluetooth technologies and demonstrate it.
3	Students will able to carry out simulation of frequency reuse, hidden/exposed terminal problem
4	implement security algorithms for mobile communication network
5	demonstrate simulation and compare the performance of Wireless LAN

Suggested List of Experiments

The softwares like Android Studio, J2ME, NS2, NS3 and any other software which is suitable are recommended for performing the practical.

Sr. No.	Title of Experiment
1	Implementation a Bluetooth network with application as transfer of a file from one device to another.
2	To implement a basic function of Code Division Multiple Access (CDMA).
3	Implementation of GSM security algorithms (A3/A5/A8)
4	Illustration of Hidden Terminal/Exposed terminal Problem. Consider two Wi-fi base stations (STA) and an access point (AP) located along the x-axis. All the nodes are fixed. The AP is situated at the middle of the two STA, the distance of separation being 150 m. [variable]. Node #0 and node #1 are the hidden terminals. Both are transmitting some data to the AP (almost at same rate) at the same time. The loss across the wireless link between each STA and the AP is fixed at 50 dB irrespective of the distance of separation. To study how RTS/CTS helps in wireless networks, 1. No RTS/CTS is being sent. 2. Nodes do exchange RTS/CTS packets. **Compare the no. of packet retransmissions required in both the cases (as obtained in the output) and compare the results.**
5	To setup & configuration of Wireless Access Point (AP). Analyze the Wi-Fi communication range in the presence of the access point (AP) and the base station (BS). Consider BS and AP are static. Find out the maximum distance to which two way communications is possible. Try multiple iterations by adjusting its distance in the code and test it.
6	Study of security tools (like Kismet,Netstumbler)
7	Develop an application that uses GUI components.
8	Write an application that draws basic graphical primitives on the screen.
9	Develop an application that makes use of database.
10	Develop a native application that uses GPS location information.
11	Implement an application that creates an alert upon receiving a message.

12	Implementation of income tax/loan EMI calculator and deploy the same on real devices (Implementation of any real time application)

Term Work:	
1	Term work should consist of 10 experiments.
2	Journal must include at least 2 assignments on content of theory and practical of " Mobile Computing"
3	The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and minimum passing marks in term work.
4	Total 25 Marks (Experiments: 15-marks, Attendance Theory& Practical: 05-marks, Assignments: 05-marks)

Useful Links	
1	https://nptel.ac.in/courses/106/106/106106147/