

Course Code	Course Name	Credits
<b>CSC702</b>	<b>Mobile Communication &amp; Computing</b>	<b>4</b>

**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:

1. To identify basic concepts and principles in mobile communication & 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 and apply the concepts of mobility management
6. To describe Long Term Evolution (LTE) architecture and its interfaces.

**Prerequisite: Computer Networks**

Module No.	Unit No.	Topics	Hrs
<b>1.0</b>	1.1	Introduction to Mobile Computing, Telecommunication Generations, Cellular systems,	06
	1.2	Electromagnetic Spectrum, Antenna ,Signal Propagation, Signal Characteristics, , Multiplexing, Spread Spectrum: DSSS & FHSS	
<b>2.0</b>	2.1	GSM Mobile services, System Architecture, Radio interface, Protocols , Localization and Calling, Handover, security (A3,A5 & A8)	10
	2.2	GPRS system and protocol architecture	
	2.2	UTRAN , UMTS core network ; Improvements on Core Network,	
<b>3.0</b>	3.1	<b>Mobile Networking</b> : Medium Access Protocol, Internet Protocol and Transport layer	12
	3.2	Medium Access Control: Motivation for specialized MAC, , Introduction to multiple Access techniques (MACA)	

	<b>3.3</b>	Mobile IP: IP Packet Delivery, Agent Advertisement and Discovery, Registration, Tunneling and Encapsulation, Reverse Tunneling, Routing (DSDV,DSR)	
	<b>3.4</b>	Mobile TCP : Traditional TCP, Classical TCP Improvements like Indirect TCP, Snooping TCP & Mobile TCP, Fast Retransmit/ Fast Recovery, Transmission/Timeout Freezing, Selective Retransmission	
<b>4.0</b>	<b>4.1</b>	<b>Wireless Local Area Networks</b> : Introduction, Infrastructure and ad-hoc network	<b>08</b>
	<b>4.2</b>	<b>IEEE 802.11</b> :System architecture , Protocol architecture , Physical layer, Medium access control layer, MAC management, 802.11a, 802.11b	
	<b>4.3</b>	Wi-Fi security : WEP ,WPA, Wireless LAN Threats , Securing Wireless Networks	
	<b>4.4</b>	HiperLAN 1 & HiperLAN 2	
	<b>4.5</b>	Bluetooth: Introduction, User Scenario, Architecture, protocol stack	
<b>5.0</b>	<b>5.1</b>	<b>Mobility Management</b> : Introduction, IP Mobility, Optimization, IPv6	06
	<b>5.2</b>	Macro Mobility : MIPv6, FMIPv6,	
	<b>5.3</b>	Micro Mobility: CellularIP, HAWAII, HMIPv6,	
<b>6.0</b>	<b>6.1</b>	<b>Long-Term Evolution (LTE) of 3GPP</b> : LTE System Overview, Evolution from UMTS to LTE	10
	<b>6.2</b>	LTE/SAE Requirements, SAE Architecture	
	<b>6.3</b>	EPS: Evolved Packet System, E-UTRAN, Voice over LTE (VoLTE), Introduction to LTE-Advanced,	
	<b>6.4</b>	System Aspects, LTE Higher Protocol Layers, LTE MAC layer, LTE PHY Layer,	
	<b>6.5</b>	Self Organizing Network (SON-LTE),SON for Heterogeneous Networks (HetNet), Introduction to 5G	
		<b>Total</b>	<b>52</b>

### 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 6 questions, each carrying 20 marks.
2. The students need to solve total 4 questions.
3. Question No.1 will be compulsory and based on entire syllabus.
4. Remaining question (Q.2 to Q.6) will be selected from all the modules.

**Text Books:**

- 1 Jochen Schilller,"Mobile Communication ", Addison Wesley, Pearson Education
- 2 "Wireless Communications & Networks," By William Stallings, Second Edition, Pearson Education
- 3 Raj Kamal, Mobile Computing, 2/e , Oxford University Press-New Delhi

**Reference Books:**

- 1 LTE Self-Organizing Networks (SON): Network Management Automation for Operational Efficiency, [Seppo Hamalainen](#), [Henning Sanneck](#) , [Cinzia Sartori](#), Wiley publications
- 2 Christopher Cox, "An Introduction to LTE: LTE, LTE-Advanced, SAE and 4G Mobile Communications," Wiley publications
- 3 Mobility Protocols and Handover Optimization: Design, Evaluation and Application By Ashutosh Dutta, Henning Schulzrinne, IEEE Press, Wiley Publication
- 4 Michael Gregg, "Build your own security lab," Wiley India edition
- 5 Emerging Wireless Technologies and the Future Mobile Internet, Dipankar Raychaudhuri, Mario Gerla, Cambridge.
- 6 Andreas F.Molisch, "Wireless Communications," Second Edition, Wiley Publications.

Lab Code	Lab Name	Credits
CSL702	Mobile Application Development Lab	1

#### Lab Outcome:

1. To develop and demonstrate mobile applications using various tools
2. Students will articulate the knowledge of GSM, CDMA & Bluetooth technologies and demonstrate it.
3. Students will be able to carry out simulation of frequency reuse, hidden terminal problem
4. To develop security algorithms for mobile communication network
5. To demonstrate simulation and compare the performance of Wireless LAN
6. To implement and demonstrate mobile node discovery and route maintains.

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

#### Suggested List of Experiments:

Sr. No.	Title of Experiments
01	To understand the cellular frequency reuse concept to find the co-channel cells for a particular cell. Design a game based application on the above concept.
02	To understand the cellular frequency reuse concept to find the cell clusters within certain geographic area. Design a game based application on the above concept.
03	Implementation a Bluetooth network with application as transfer of a file from one device to another.
04	To implement a basic function of Code Division Multiple Access (CDMA) to test the orthogonality and autocorrelation of a code to be used for CDMA operation. Write an application based on the above concept.
05	To implement Mobile node discovery
06	Implementation of GSM security algorithms (A3/A5/A8)
07	<p><u>Illustration of Hidden Terminal Problem (NS-2)</u>  Consider two Wifi 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 <u>irrespective of the distance of separation</u>.</p> <p>To study how RTS/CTS helps in wireless networks,  1. No RTS/CTS is being sent.  2. Nodes do exchange RTS/CTS packets.  <b>Compare the no. of packet retransmissions required in both the cases (as obtained in the output) and compare the results.</b></p>



08	To setup & configuration of Wireless Access Point (AP) using NS3. 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.
09	Develop an application that writes data to the SD card.
10	Develop an application that uses GUI components.
11	Write an application that draws basic graphical primitives on the screen.
12	Develop an application that makes use of database.
13	Develop a native application that uses GPS location information.
14	Implement an application that creates an alert upon receiving a message.
15	Implementation of income tax/loan EMI calculator and deploy the same on real devices.

#### Digital Material (if Any):

1. <http://www.isi.edu/nsnam/ns/> : NS-2 software download
2. [https://nsnam.isi.edu/nsnam/index.php/NS\\_manual](https://nsnam.isi.edu/nsnam/index.php/NS_manual)
3. <https://www.nsnam.org/> : Ns-3 Software Download
4. <http://vlssit.iitkgp.ernet.in/ant/ant/>

#### Text Books:

1. Jochen Schilller, "Mobile Communication", Addison Wesley, Pearson Education
2. "Wireless Communications & Networks," By William Stallings, Second Edition, Pearson Education
3. Ekram Hossain and Teerawat Issariyakul, "Introduction to Network Simulator NS-2," Springer, Second Edition.
4. Michael Burton, "Android Application Development for Dummies," A Wiley brand
5. Marko Gargenta & Masumi Nakamura, "Learning Android," O'Reilly publications
6. James Keogh, "The complete reference J2ME," McGraw-Hill.

#### Term Work:

Laboratory work will be based on above syllabus with minimum 10 experiments to be incorporated.

Laboratory work (experiments): ..... (15) Marks.

Assignments: ..... (05) Marks.

Attendance (Theory + Practical)..... (05) Marks

**TOTAL: ..... (25) Marks.**

**Oral & Practical exam** will be based on the above and CSC702: Mobile Communication & Computing syllabus.