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# United States International University

**Fall Semester 2015**

##### MIS6120 MOBILE COMPUTING

##### (Course Outline)

***Lecturer Dr. Gerald Chege*; email:** [***gchege@usiu.ac.ke***](mailto:gchege@usiu.ac.ke) ***;* Lillian Beam Building– 3rd Flr. Rm. 4**

**Class Times: Thursday 5.40pm–9.00 pm (Lab 3)**

**Office Hours: Monday/Wednesday 9.00am - 11.00am; 1.00pm - 3.00pm**

**COURSE DESCRIPTION**

The purpose of this course is to enable students conduct a careful examination of mobile device programming with an emphasis on developing applications as a community that run on the Android platform. This course will also give students an insight into the principal ways in which a mobile computer, or device, can access a network and includes practical laboratory work.

*Pre-requisite: MIS 5020 Fundamentals of Programming Languages*

*Credit Units: 3*

**Link to University Mission Outcomes and School of Science & Technology**

**(a) Link to University Mission Outcomes**

The course content for APT2080 directly contributes to the attainment of University Mission Outcomes in:

1. Higher Order Thinking (U1)
2. Literacy (U2)
3. Preparedness for Career (U3)

**(b) Link to School of Science & Technology Mission Outcomes**

The course content contributes to the School of Science & Technology Mission Outcomes in:

1. Developing competence in critical thinking, creative skills, use of technology, creativity and good communication skills (O-1)
2. Demonstrating preparedness for career and lifelong learning in their chosen disciplines as well as understanding of the interdisciplinary nature of knowledge. (O-3)
3. Demonstrating the use of qualitative and quantitative research skills in Biomedical, Communication and Information Technology (O-4)
4. Applying theories, concepts, and principles found in biological and physical sciences, including a thorough grounding in communication skills in multicultural & global perspectives. (O-5)
5. Demonstrating a thorough understanding of effective, efficient professional and ethical leadership (O-6).

**Course Learning Outcomes:**

By the end of this course, the student will be able to:

1. Describe mobile computing.
2. Explain the components of a mobile computing environment.
3. Define mobile computing application development architectures and environments such as J2ME.
4. Develop and deploy an Android application.
5. Create a mobile applications for other Operating Systems.

**Course Content Summary**

Mobile Computing technology addresses challenges that enable the realization of the global village concept where people can seamlessly access any information from anywhere through any device, while stationary or even at a state of mobility. This course covers all the communication technologies starting from First Generation to Third Generation cellular technology, wireless LAN (WiFi), and wireless broadband (WiMax). It covers intelligent networks (IN) and emerging technologies like mobile IP, IPv6, and VoIP (Voice over IP). The course covers the most recent developments in the world of wireless, and aims to fulfill the growing information and knowledge needs of students aiming to become professionals. The course provides the big picture of all the technologies from CTI (computer technology interface) to 3G (third generation) including Bluetooth, IN, WiFi and WiMax, as well as the service creation aspects, and contemporary developments in the ever-expanding field of wireless services and mobile computing.

**Course Content**

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| --- | --- | --- | --- | --- |
| **Week No.** | **Topic** | **Learning Outcomes** | **Activities/**  **Assignments** | **Aids/References** |
| 1 | **Introduction** | Understanding of:  Introduction to mobility; Internet milestones; Motivations for Mobile Computing; Attributes of ubiquity; Mobile Computing Environment; Mobile Computing Devices; Networks for Mobile Computing; Middleware and Gateways; Mobile applications; Limitations of Mobile Computing; Mobile Computing examples; Standards and standard bodies: Why are they necessary?; Players in the wireless space. |  | Chapter 1 - Course Text |
| 2 | **Mobile Computing Architecture** | Understanding of:  History of Internet; Architecture of Mobile Computing; Presentation Tier; Application Tier; Message Oriented Middleware; Transaction Processing Middleware; Communication Middleware; Transcoding Middleware; Internet Content Adaptation Protocol (ICAP);Data flow in an ICAP environment; Web Services; Data Tier and database middleware; Design Considerations;  Content architecture in Mobile Computing; Client Context Manager (CCM: challenges, contexts and functions; Composite Capabilities/Preference Profiles (CC/PP);Resource Description framework (RDF): formats and perser; Policy Manager; Semantic Web; Security Manager; Adaptability Manager; Content rating and filtering; Content Aggregation; Aspects of Seamless Communication; Autonomous Computing; Context aware systems; Global positioning system (GPS); Making existing applications mobile enabled. | Lab1 Session – Introduction to IBMFirst Studio | Chapter 2 - Course Text |
| 3 | **Mobile Computing through Telephony** | Understanding of:  Evolution of Telephony; Public Switched Telephone Network; Multiple Access Procedures (FDM, TDM, CDMA, SDMA); Satellite Communication Systems; Low Geostationary Earth Orbit Satellite; Satellite Phones; Mobile computing using telephony; Interactive Voice Response Service; Architecture for IVRS; Features of IVRS; Synthesized Voice; Single threaded and multithreaded IVRS programming models; IVRS applications; Architecture for Voice XML; Voice XML in web environment; Elements of Voice XML document; JSpeech Markup Language (JSML); Telephony Application Programming Interface; | Assignment 1  Lab 2 | Chapter 3 - Course Text |
| 4 | **Emerging Technologies** | Understanding of:  Bluetooth protocols (IEEE 8.15); Components of an RFID system; Wireless Broadband  (IEEE 8.16); Mobile IP; Cellular IP; IPv6; Migrating from IPv4 to IPv6; Mobile IP with IPv6; Java Card technology; Architecture of Java Card; Next Generation Networks and convergence: DSL Broadband Networks; WiMAX Broadband Wireless Networks; High Speed Broadband Cellular Networks; High Speed Packet Access (HSPA) - HSUPA and HSDPA; Multi Protocol Label Switching (MPLS);3GPP Long Term Evolution (LTE). | Group Project Specifications | Chapter 4 & 21 - Course Text |
| 5 | **J2ME** | Understanding of:  Java Virtual Machine (JVM); Mobile Application Architecture; Connected Device Configuration (CDC); Connected Limited Device Configuration (CLDC); Foundation Personal and Remote Method Invocation (RMI) profiles; Mobile Information Device Profile (MIDP) and Personal Digital Assistant Profiles; MIDlet Life Cycle; Security Considerations in MIDP; | Quiz | Chapter 15 - Course Text |
| 6 | **GSM** | Understanding of:  Introduction to Global System for Mobile Communications; Use of TDMA and FDMA in GSM; Frequency reuse in GSM; GSM Architecture; Home Location Register (HLR); Entities in GSM;  Mobile Station (MS); Base Station Subsystem (BSS);Base Transceiver Station (BTS); Base Station Controller (BSC); Network and Switching Subsystem (NSS); Mobile Switching Center (MSC), Home Location Register (HLR), Visitor Location Register (VLR), Equipment Identity Register (EIR), Authentication Center (AUC); Operation and Support Subsystem (OSS);Short Message Service (SMS); GSM Addresses and Identifiers; Network aspects in GSM; Handover; Mobility Management (MM); GSM Frequency Allocation; Authentication and Security: Algorithms A3, A8 and A5; | Assignment 2;  Lab3 Session | Chapter 5 - Course Text |
| 7 | **Short Message Service** | Understanding of:  Short Message Service (SMS) basics; SMS Architecture; Mobile Virtual Network Operator(s) (MVNO); Value Added Services (VAS) through SMS; VAS Architecture; Location based services ; Short Message Peer to Peer (SMPP) protocol; Kannel - Open source SMS gateway; Kanel architecture; | Mid Semester Exam | Chapter 6 - Course Text |
| 8 | **General Packet Radio Service (GPRS)** | Understanding of:  GPRS Network Architecture; GPRS Network Enhancements; Transmission Plane Protocol Architecture; Signaling Plane; GPRS backbone; Air Interface; Radio Resource Management; Attachment and Detachment in GPRS; Mobility Management; GPRS Handsets; |  | Chapter 7 - Course Text |
| 9 | **Wireless Application Protocol (WAP)** | Understanding of:  Evolution of Wireless Application Protocol (WAP); WAP Architecture of WAP; Architecture of WAE; user agent; Wireless Markup Language (WML); WAP Push Architecture; WAP Pull v Push Technology; Wireless Session Protocol(WSP); Wireless Transaction Protocol (WTP); Wireless Transport Layer Security (WTLS); Wireless Datagram Protocol; Architecture of WAP Gateway; Multimedia Messaging Service (MMS); MMS architecture; MMS Device Management and Configuration; | Assignment 3  Lab Session | Chapter 8 - Course Text |
| 10 | **Client Programing** | Understanding of:  Evolution of Cellular Technology; Capabilities of different devices; Structure of Mobile Device; Hardware Overview; Circuit Board Chips on a Mobile Phone; Personal Digital Assistants (PDAs); Design Constraints for Handheld Devices; Memory and Storage in Handheld Devices; Clients in Handheld Devices; Clients in Handheld Devices; Components of Android OS. | Lab Session | Chapter 12 - Course Text |
| 11 | **Security Issues in Mobile Computing** | Understanding of:  Introduction to Information Security; Attacks on static and Dynamic Assets; Components of Information Security; Cryptography; Stream and Block Ciphering; Symmetric Key Cryptography; Symmetric Key algorithms; Public Key Cryptography; Public Key algorithms; Protocol for Secure Communication; SSL; TLS; Wireless Transport Layer Security; Public key Infrastructure; Digital certificates; Infrastructure Level Security; VPN; Policy based security; System Level Security; Application Level Security; Java Security; Smartcard Security; 3GPP Security; Mobile Agent security; Mobile VPN; | Assignment 4  Lab Session | Chapter 20 - Course Text |
| 12 | **VoIP and Convergence** | Understanding of:  VoIP and Convergence; H.323, SIP and MGCP; Session Initiation Protocol (SIP); Real Time Protocols; Real-time Transport Protocol (RTP); Real-time Control Protocol (RTCP); Real-time Streaming Protocol (RTSP); Convergence Technologies; Interfaces between IP and PSTN Networks; Media Gateway; Signaling Gateway; Sigtran Protocol Architecture and Stream Control Transmission Protocol (SCTP);Call Routing; SIP to SIP; SIP to PSTN; PSTN to IP; VoIP Applications; IP Multimedia Subsystem (IMS); IMS Architecture; | Lab Session | Chapter 17 - Course Text |
| 13 | **Group Projects** | Presentation of Group Projects | Group Project Presentations |  |
| 14 | **Final Exams Week** |  | **Final Exam** |  |

**Mode of Delivery**

Lectures and delivery through the Blackboard e-learning platform. Presentations by members of the class, Case discussions, Tutorials, Assignments, group work, practical laboratory-based work, Library, appropriate software, manual/notes, classroom based tutorial exercises and directed self-study.

**Instructional Material and/or Equipment**

Textbooks, whiteboard, handouts, seminars, electronic projector and laptop, Internet access, special graphics software’s and library.

**Course Text**

[Asoke K Talukder](http://www.mheducation.co.uk/catalogsearch/advanced/result/?authors=Asoke%20K%20Talukder" \o "Asoke K Talukder), [Roopa Yavagal](http://www.mheducation.co.uk/catalogsearch/advanced/result/?authors=Roopa%20Yavagal" \o "Roopa Yavagal), 2nd Ed. (2010). *Mobile Computing: Technology, Applications and Service Creation. Tata McGraw Hill, ISBN* 0070707316

**Recommended Reference Materials**

* Fitzek, F. H. P., Reichert, F. (2007). *Mobile Phone Programming and its Application to Wireless Networking.* Manhattan, New York City: Springer.
* Bernardo, M., Bogliolo, A. (2005). [*Formal methods for mobile computing*](http://books.google.co.ke/books?id=4d2QHWos5ucC&printsec=frontcover&dq=Advanced+Mobile+Computing&hl=en&ei=FTc8TK2oDIuOjAfwpeWnAQ&sa=X&oi=book_result&ct=result&resnum=1&ved=0CCoQ6AEwAA)*.* Manhattan, New York City: Springer.
* Ibrahim, I.K., Taniar, D. (2006). [*Mobile Multimedia: Communication Engineering Perspective.*](http://books.google.co.ke/books?id=HTAtI4MopGsC&pg=PA259&dq=Advanced+Mobile+Computing&hl=en&ei=FTc8TK2oDIuOjAfwpeWnAQ&sa=X&oi=book_result&ct=result&resnum=5&ved=0CD4Q6AEwBA)  Huppauge, New York: Nova Science Publishers Inc.
* B'Far, R. (2004). [*Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML.*](http://books.google.co.ke/books?id=Vl1H266pOVEC&pg=PA257&dq=Advanced+Mobile+Computing&hl=en&ei=FTc8TK2oDIuOjAfwpeWnAQ&sa=X&oi=book_result&ct=result&resnum=7&ved=0CEgQ6AEwBg)  Cambridge, England: Cambridge University Press.

**TEACHING METHODOLOGY**

A mixture of lectures, presentations by members of the class, case discussions, tutorials, assignments, continuous assessment tests, lab practicals, library, appropriate software, manual/notes, simple projects. Regular attendance and active participation in this class are expected. This is a course that is experiential and requires active involvement to gain maximum benefit. To get involved you must attend class, spend time on the textbooks, WWW and all other provided materials.The student is expected to spend 9 hrs every week outside class to complete assignments and study for the course.

**COURSE EVALUATION**

**Grading**  
Your final grade will be based on several indicators of performance.

**MARK DISTRIBUTION**

Laboratory work: 10%

Assignment 1: 5%

Assignment 2: 10%

Assignment 3: 5%

Quizes: 5%

Group Project: 15%

Mid-Quarter Exam: 20%

Final Exam: 30%

EXAMINATIONS

Mid-Semester Exam: Week 7

Final Exam: Week 14

**Exams**: The exams will cover all chapters listed on the schedule, the material discussed in class lectures, all additional handouts, the term project and the assignments during the Semester until the time point of examination.

**Assignments:** The assignments are designed to be active learning experiences, supplementing class discussions and reading assignments.

**Notes:**Will be made available online in Blackboard.

**Readings:**You are expected to read all materials that are mentioned in the above table in the column "Aids/References" for the assigned week in advance so that you are well prepared for lectures and tutorials. Otherwise you won't be able to participate actively in the lectures and can't complete the tutorials.

**Class Policy**

* Mobile phones should be switched **OFF** during class session.
* Computers should be turned **OFF** during the theory session and used to complete LAB exercises only during practical session.
* Students who come 10min after class has started will not be allowed into the classroom.

**Plagiarism and cheating:** Plagiarism and cheating are considered to be acts of misconduct as per university’s academic code of conduct and ethics. Any student who commits plagiarism or cheating in the university examination will be subject to sanctions up to and including dismissal from the university. **Absenteeism:** Students are expected to attend all classes. Upon being absent from seven (7) classes, a student will get an **F** for the course. If you have to be absent, please contact your instructor in advance.