# Voice over IP – TCOM 631/Sec 001
# Fall 2022

## INSTRUCTOR

**Instructor:** Dragan Hrnjez
**E-mail:** dhrnjez@gmu.edu
**Location:** remote/offsite
**Office Hours:** Tuesdays, 6:30 PM to 7:00 PM, Room 3707
(Please schedule office hour no later than 24 hours in advance). Alternate arrangements can be made. We will discuss these in our first meet up.

## TIME AND PLACE:

Tuesdays, 7:20 pm - 10:00 pm
Nguyen Engineering Building, Room 4457

## CALENDAR AND SCHEDULE:

Class calendar and proposed schedule will be available via Blackboard and at the URL listed below. Any potential changes will be announced and discussed during the semester.

## ALTERNATE WEBSITE:

http://mason.gmu.edu/~dhrnjez
user id: tcom631, password: voiceIP

## TEXTBOOKs

There are no required books for this course. The following books are optional (used during previous semesters):

***Carrier Grade Voice over IP,*** *McGraw-Hill Education; Richard Swale and Daniel Collins; 3rd Edition; October 2013*
***ISBN: 978-0-07-182771-3***
*This book will be available for purchase in the GMU Bookstore.*

***Voice over IP Fundamentals;*** *Cisco Press; Davidson, Peters, Gracely, Bhatia, Kalidindi, Mukherjee; 2nd Edition; July 2006*
***ISBN: 1-58705-257-1***

***IP Telephony: Deploying VoIP Protocols and IMS Infrastructure;*** *John Wiley & Sons Ltd.; Oliver Hersent; 2011*
***ISBN: 978-0-470-66584-8***

***RTP: Audio and Video for the Internet;*** *Addison Wesley; Colin Perkins; June 2003*
***ISBN: 978-0-470-02359-4***

*Supplemental Readings: Additional materials will be distributed on an ongoing basis.*

## GRADING POLICY

| Grading* | |
|---|---|
| Midterm | 12% |
| Labs | 12% |
| Homewoks | 12% |
| Discusion boards | 6% |
| Project | 34% |
| Final exam | 24% |

*Final grade determined by a weighted average

**Midterm**
Option 1: in-class, closed-book/closed-notes, MC/TF questions, simple problems and essay questions
Option 2: remote and timed, MC/TF questions, simple problems
The decision will be made during next few weeks

**Labs**
We will have 3 labs and the facilitation for these will be determined during the semester
We will discuss and explain lab activities in more details as we kick in this semester
All three lab reports need to be turned in no later then December 8th, 2020

**Homeworks**
Several homework assignments throughout the semester
Due the following week after they are assigned
Return hard or softcopy in a single file with the student name visible in the file name

**Discussion boards**
Throughout the semester we will have few discussion boards.
These are mandatory and they will be graded based on involvement and effort.

**Project**
Assigned second week and is due last week of semester
This is a group project (3-4 students)

**Final Exam** (take home – last week of the semester)
Comprehensive MC/TF questions, more complex engineering problems and essay questions

**Honor Code:**

All assignments are conducted under the rules and regulations of the GMU Honor Code Policy

## Proposed Topics

| Topics |
| --- |
| **Introduction to Voice and Voice Transmission Technologies:** Voice characteristics, digitalization and encoding. Traditional circuit switched equipment and networks used in telephony. Signaling basics. Potential use-cases for VoIP deployments (benefits/challenges). Enterprise/Campus and Commercial Telephony. Typical VoIP Connection Strategies. |
| **Concept of Transporting Voice over a Packet Switched Network:** Internet Protocol (IP) introduction. Real time protocols: RTP, RTCP, RTSP, SCTP, UDP-Lite/Liter - packet formats, functionality and features. Real-time media synchronization. |
| **Voice over IP Decomposition:** Human voice and coding techniques, compression. Factors that affect VoIP quality: delay, jitter, packet loss, echo. Performance and quality metrics for VoIP: MOS, R-Factor, PESQ. VoIP performance measurement and monitoring tools. |
| **Intro to VoIP Signaling Protocols**: Overview. H.323 signaling protocol: format and inter-workings. |
| **SIP Signaling Protocol:** Architecture, format and inter-workings. |
| **SS7 Signaling Protocol:** Architecture, format and inter-workings. |
| **The Softswitch Architecture:** Interoperability of different signaling protocols (H.323, SIP, SS7) using Softswitches, Applications of Softswitches in a carrier grade VoIP environment. (SS7 signaling over IP-based networks). VoIP – PSTN migration and integration strategies. |
| **Voice over IP Network Planning and Design:** Traffic analysis and forecasting (advanced), numbering and dial plans, number routing, vendor selection criteria for LAN and WAN deployments. E.911, CALEA. |
| **VoIP Quality and QoS:** A thorough explanation of QoS components, protocols and trade-offs. RSVP, Diffserv, MPLS and 801.2q protocols are covered in detail in terms packet format, features and functions and their pros and cons. |
| **VoIP Security:** Vulnerabilities, security requirements and protection technologies. NAT/Firewall considerations. VoIP encryption analysis. |
| **NextGen VoIP:** VoIP Mobility. VoIP Equipment: Adapters, soft phones, WiFi phones, mobile phones. Collaboration and presence. Billing and Mediation. VoiceXML. IP Multimedia Subsystem (IMS). |
| **Future of VoIP** – Challenges, Concerns, Way Ahead. Open Source, Use Cases – Skype, Vonage, etc. |