



COURSE OUTLINE SCHOOL FOR COMPUTER TECHNOLOGY

COURSE Name: Introduction to Voice Network Technologies

COURSE CODE: COMP 1159

CREDIT HOURS: 70

PREREQUISITES:

COREQUISITES:

PLAR ELIGIBLE: YES (X) NO ()

EFFECTIVE DATE: January, 2010

PROFESSOR: Sheref El Sabawy **OFFICE #:**

PHONE: (416) 457-5285 **EMAIL:** selsabaw@georgebrown.ca

NOTE TO STUDENTS: Academic Departments at George Brown College will **NOT** retain historical copies of Course Outlines. We urge you to retain this Course Outline for your future reference.

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ORIGINATOR: _____	SIGNATURE	DATE
CHAIR: _____	SIGNATURE	DATE
DATE OF REVISION: _____		

EQUITY STATEMENT: George Brown College values the talents and contributions of its students, staff and community partners and seeks to create a welcoming environment where equity, diversity and safety of all groups are fundamental. Language or activities which are inconsistent with this philosophy violate the College policy on the Prevention of Discrimination and Harassment and will not be tolerated. The commitment and cooperation of all students and staff are required to maintain this environment. Information and assistance are available through your Chair, Student Affairs, the Student Association or the Human Rights Advisor.

George Brown College is dedicated to providing equal access to students with disabilities. If you require academic accommodations visit the Disability Services Office or the Deaf and Hard of Hearing Services Office on your campus.

STUDENT RESPONSIBILITIES: Students should obtain a copy of the *Student Handbook* and refer to it for additional information regarding the grading system, withdrawals, exemptions, class assignments, missed tests and exams, supplemental privileges, and academic dishonesty. Students are required to apply themselves diligently to the course of study, and to prepare class and homework assignments as given. Past student performance shows a strong relationship between regular attendance and success.

COURSE DESCRIPTION:

This course will emphasize the very different roles of voice networks in the telecom/datacom industry and the different approaches and technologies used to support these approaches. Students will be introduced to switched voice Network and VoIP networks. The student will learn the legacy Class 5/4 switches and they will be able to compare legacy PSTN switches to IP soft switches. Students will understand the essential role of network planning and operational excellence in the support of such networks. Structure of a voice network and its elements are included in this course. The student will be introduced to VoIP Signaling protocols (H.323 and SIP) and their architecture. Quality of Service (QoS) will be introduced and the student will be able to differentiate between the various QoS protocols. The role of the network operations centre will be examined, as will the requirements for high availability in networks.

ESSENTIAL EMPLOYABILITY SKILLS:

As mandated by the Ministry of Training, Colleges and Universities essential employability skills (EES) will be addressed throughout all programs of study. Students will have the opportunity to **learn (L)** specific skills, to **practice (P)** these skills, and/or **be evaluated (E)** on the EES outcomes in a variety of courses. The EES include communication, numeracy, critical thinking & problem solving, information management, interpersonal and personal skills. The faculty for this course has indicated which of the EES are either Learned (**L**), Practiced (**P**) or Evaluated (**E**) in this course:

Skill	L	P	E	Skill	L	P	E
1. communicate clearly, concisely and correctly in the written, spoken and visual form that fulfills the purpose and meets the needs of the audience		x	x	7. locate, select, organize and document information using appropriate technology and information sources		x	x
2. respond to written, spoken or visual messages in a manner that ensures effective communication		x	x	8. show respect for the diverse opinions, values, belief systems, and contributions of others		x	
3. execute mathematical operations accurately		x		9. interact with others in groups or teams in ways that contribute to effective working relationships and the achievement of goals		x	x
4. apply a systematic approach to solve problems		x	x	10. manage the use of time and other resources to complete projects		x	x
5. use a variety of thinking skills to anticipate and solve problems		x	x	11. take responsibility for one's own actions, decisions and consequences		x	
6. analyze, evaluate, and apply relevant information from a variety of sources		x	x	12. Using search tools to locate information on professional sites.	x	x	x

COURSE OUTCOMES:

Upon successful completion of this course the students will have reliably demonstrated the ability to:

Upon successful completion, students will be able to:

1. Compare the features of the traditional voice telephony networks to modern switching networks
2. Differentiate between the telecommunication structures of Centrex and PBX
3. Compare digital voice & video in standard networks such as T1, T3, ISDN, and BISDN.
4. Configure the call flows for Plain Old Telephone Service (POTS), VoIP, and default dial peers
5. Compare the centralized and decentralized call control and signaling protocols
6. Understand the analog and digital voice characteristics, processes and standards for voice digitization, compression, digital signaling, and Fax transport as they relate to Voice over IP (VoIP) networks, Voice encodings and signaling.
7. Compare the functionality of legacy PSTN switch to IP soft switch
8. Compare and configure the quality of Service techniques for "non-quality-of-service" Networks (such as IP and Frame Relay)
9. Understand the Voice Over IP environments (SIP, H.323, MGCP), Integrated voice/data Network design and optimization, Voice/data network configuration and troubleshooting

DELIVERY METHODS:

Lecture, Lab, Presentations, Seminars

LIST OF TEXTBOOKS AND OTHER TEACHING AIDS:

Primary Text

“Voice over IP Fundamentals, 2nd Edition”

By Manoj Bhatia, Jonathan Davidson, Satish Kalidindi

Published by Cisco Press., ISBN: 1587052571

Secondary Text

“Voice & Data Communications Handbook” by Bates, Regis J., Gregory, Donald W. (4th Edition), McGraw Hill, ISBN 0-07-213188-8

Reference Text

“Cisco Voice over Frame Relay, ATM, and IP by Stephen Foy, Kelly McGrew, Stephen McQuerry” Published by Cisco ,ISBN: 1578702275

TESTING POLICY:

1. A score of zero will be recorded for a missed quiz or examination, project and seminar presentation unless the student presents the professor with official substantiation of the absence the first day she or he returns to class.
2. Students are responsible for reading the appropriate material before classes so that they may benefit from their practical activities and examples.

ASSIGNMENT POLICY:

1. Students are responsible for keeping a **back-up copy** of each assignment submitted.
2. All assignments submitted should adhere to the documentation standards distributed by the professor.
3. Students should check the course introduction handouts for the instructions for submission policy

EVALUATION SYSTEM:

Assessment Tool:	Description:	Outcome (s) assessed:	EES assessed:	Date / Week:	% of Final Grade:
Assignments/ Labs	<ul style="list-style-type: none"> Legacy PSTN Network infrastructure VoIP Network Architectures The Digital Switch and IP soft switch SS7 VoIP signalling protocols QoS and its role in VoIP Traffic Engineering 		1,2,4,5 6, 12	Across the length of semester Lab/Assignment dead-line for each lab is the end of the weekend of the week of the lab.	20%
Lab Attendance and Lab participation	Students lab interaction is evaluated during the lab and the level of participation.		7,9,10, 12		10%
Midterm Exam			2,10		20%
Quiz and interaction			2,10		15%
Final Exam			2,10		35%
				TOTAL:	100%

GRADING SYSTEM

The passing grade for this course is: D

A+	90-100	4.0	B+	77-79	3.3	C+	67-69	2.3	D+	57-59	1.3	Below 50	F	0.0
A	86-89	4.0	B	73-76	3.0	C	63-66	2.0	D	50-56	1.0			
A-	80-85	3.7	B-	70-72	2.7	C-	60-62	1.7						

Excerpt from the College Policy on Academic Dishonesty:

The *minimal* consequence for submitting a plagiarized, purchased, contracted, or in any manner inappropriately negotiated or falsified assignment, test, essay, project, or any evaluated material will be a grade of zero on that material. To view George Brown College policies please go to www.georgebrown.ca/policies

TOPICAL OUTLINE:

Week	Topic / Task	Outcome(s)		Content / Activities
Week 1	Course Outline Expectations/Responsibilities Introduction <ul style="list-style-type: none"> • The Telephone Network Terminology The Public Switched Network Common Carriers The Local Loop (Outside Plant) Inside Plant Private & Hybrid Networks Local Access & Transport Areas (LATA) Types of Communications <ul style="list-style-type: none"> <input type="checkbox"/> Simplex <input type="checkbox"/> Half Duplex <input type="checkbox"/> Duplex Customer Premise Equipment and Applications <ul style="list-style-type: none"> • Inside a Telephone • Private Switching Equipment PBX Centrex <ul style="list-style-type: none"> • Voice Processing Interactive Voice Response Automatic Call Distribution CTI Applications	Explain the basic infrastructure of the PSTN network, Understanding the terms and concepts associated with legacy PSTN network		
Week 2	Signalling and Switching <ul style="list-style-type: none"> • Review: Modulation • Review: Multiplexing • Switching <ul style="list-style-type: none"> o Circuit Switching o Message Switching o Packet Switching • Switching Systems <ul style="list-style-type: none"> o Lucent ESS Switch o Nortel DMS • Switch Signalling <ul style="list-style-type: none"> o Subscriber Loop o Interoffice <input type="checkbox"/> Common Channel Signalling <input type="checkbox"/> Signalling System No.7 	Explain the difference between circuit switching and packet switching. Brief overview of the switching systems.		
Week 3	Signalling System 7 (SS7): Detailed Study <ul style="list-style-type: none"> • Pre-SS7 • SS7 Defined & Purpose • In-Band/Out-of-Band Signalling • SS7 Network Architecture • Function of SS7 Network • Signalling Links 	Explain the PSTN signalling system and signalling exchange techniques between legacy PSTN and VoIP network.		Router Voice Ports Lab2: Connecting a Voice-Enabled Router Assignment :SS7

Week 4	VoIP: An In-Depth Analysis. Delay/Latency. Propagation Delay. Handling Delay. Queuing Delay. Jitter. Pulse Code Modulation. What Is PCM? A Sampling Example for Satellite Networks. Voice Compression. Voice Coding Standards. Mean Opinion Score. Perceptual Speech Quality Measurement. Echo. Packet Loss. Voice Activity Detection.	Explain the various factors affecting the quality of voice in the VoIP		Lab3: Configuring Voice Interfaces Lab4: Configuring Dial Peers Lab5: Configuring POTS Dial Peers
Week 5	Digital-to-Analog Conversion. Tandem Encoding. Transport Protocols. RTP. Reliable User Data Protocol. Dial-Plan Design. End Office Switch Call-Flow Versus IP Phone Call. References.	To study the Sampling and PCM techniques. Overview of the compression techniques used in various codec		Lab6:Configuring Voice Port Network Connections Lab7: Configuring Special-Purpose Connections Lab8: Configuring Basic VoIP Network Connections Assignment: VoIP Network Architectures
Week 6	Quality of Service. QoS Network Toolkit. Edge Functions. Bandwidth Limitations. cRTP. Queuing, Packet Classification.Traffic Policing. Traffic Shaping. Edge QoS Wrap-Up. Backbone Networks. High-Speed Transport. Congestion Avoidance. Backbone QoS Wrap-Up. Rules of Thumb for QoS. Cisco Labs' QoS Testing.	Explain the need for QoS in the VoIP network and different QoS techniques		Lab9: Configuring Qos (PQ,CQ,WFQ,LLQ) in the VoIP Network
Week 7	Mid-term Exam			
Week 8	<i>INTERSESSION WEEK</i>			

Week 9	H.323. H.323 Elements. Terminal. Gateway. Gatekeeper. The MCU and Elements. H.323 Proxy Server. H.323 Protocol Suite. RAS Signalling. Call Control Signalling (H.225). Media Control and Transport (H.245 and RTP/RTCP). H.323 Call-Flows.	Explain the details of the H323 protocol and its implementations in the VoIP.		Lab 10: Configuring VoIP with H.323 Assignment: VoIP signalling protocols (H323)
Week 10	Session Initiation Protocol. SIP Overview. User Agents. Network Servers. Addressing. Locating a Server. SIP Transactions.	Explain the details of the SIP protocol and its implementations in the VoIP.		Lab 11:Configuring Session Initiation Protocol (SIP) Assignment: VoIP signalling protocols (SIP) using Xlite
Week 11	Locating a User. SIP Messages. Message Headers. Message Requests. Message Responses. Basic Operation of SIP. Proxy Server Example. Redirect Server Example.			
Week 12	Digital and IP soft switches Digital switch overview IP soft switch overview Digital and IP soft switch comparison Overview of IP PBX	Explain the difference between the PSTN digital switch and IP soft Switch		Assignment : The Digital Switch and IP soft switch servers/ using SIP clients
Week 13	New Trends in Voice over IP Open Source Asterisk Server Introduction Introduction to VoIP Services and side line features of Asterisk Cons/Pros of using Open Source.	Study the new trends in the VoIP		Lab 12: Demo of how to use Xlite to register to Remote Asterisk Server across WAN
Week 14	Introduction to VoIP SIP open Source Advances Services. - Voice Mail - Voice Conference Bridges - Music On Hold. - IVR Menus.	Study the new trends in the VoIP		Lab 12: Demo of how to use Asterisk Server Advanced services Voice Mail/Voice Conference / Music on hold/ IVR menus

Week 15	Final Exam			
<p style="text-align: center;">Please note: this schedule may change as resources and circumstances require.</p> <p>For information on withdrawing from this course without academic penalty, please refer to the College Academic Calendar: http://www.georgebrown.ca/Admin/Registr/PSCal.aspx</p>				