# University of Toronto Edward S. Rogers Sr. Dept. of Electrical & Computer Engineering

# ECE361 Computer Networks I – Winter 2022

## Course Management Form

### **Instructor**

- Hamid S. Timorabadi, P.Eng.
- Email: h.timorabadi@utoronto.ca

## **Criteria for Emails:**

• Subject area of the email should include course name, section number, and intention, e.g.

○ ECE361: Missing mark
Office Hour: Wednesdays 1 – 2 PM

**Important Note:** All course components are online until Jan. 31 after which we will follow guidelines provided by the University.

Lectures (start: Jan. 10)

■ Mondays, Wednesdays, Thursdays 2 – 3 PM BA1130

#### **Tutorials**

■ TUT0101: Fridays 5 – 6 PM GB304 (Starts Jan. 21)
■ TUT0102: Mondays Noon – 1 PM GB304 (Starts Jan. 17)

### **Textbook**



Kurose and Ross, "Computer Networking: A Top Down Approach", 8<sup>th</sup> Ed., Pearson, ISBN: 13 978-0-13-670713-4

## Complementary Readings

Peterson and Davie, "Computer Networks", Morgan Kaufmann, 2003.

### Course description in the calendar

- Layered network architectures; overview of TCP/IP protocol suite. Introduction to sockets; introduction to application layer protocols. Peer-to-Peer Protocols: ARQ; TCP reliable stream service; flow control. Data Link Controls: Framing; PPP; HDLC. Medium access control and LANs: Aloha; Ethernet; Wireless LANs; Bridges. Packet Switching: Datagram and virtual circuit switching; Shortest path algorithms; Distance vector and link state algorithms.
- Prerequisite: <u>STA286H1</u> or <u>ECE302H1</u>
   Co-requisite: <u>ECE302H1</u>. (Students must take the co-requisite, <u>ECE302H1</u> in the same term as ECE361H, OR in a term before taking <u>ECE361H1</u>.)

#### Wireshark Labs

• Students will form groups of two. Each group submits only one report and the mark will be assigned to both members, however, both members must know and understand the content of the lab and the report. Read and follow the schedule provided in the Wireshark handout as posted under Files/Labs/Wireshark. There will be a Wireshark lab training that you can attend and learn about Wireshark labs. The schedule will be posted.

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## **Programming Labs**

- Students will form groups of two (the same group as the Wireshark lab. There are no labs during the first week of classes and the schedule is found at the end of this document.
- All programming labs will use C language.

#### **Tutorials**

• In each tutorial session, the TA will solve some sample problems. Please refer to the detailed list of tutorials and the coverage of each tutorial for more information as posted on the course website.

#### Evaluation

• Labs:

	<ul> <li>Wireshark Labs</li> </ul>	5%
	<ul> <li>Programming Labs</li> </ul>	22.5%
•	Quizzes/Participations	5%
•	Midterm	27.5%
•	Final Exam	<u>40%</u>
		100%

#### > Midterm

• Date: Monday February 28

• Time: 6:10-8pm

• Duration: Approximately 90 minutes

• Location: if not online then in TBD.

• Aids for Midterm and Final Exam:

o Calculator Type: 2 (non-programmable calculators)

o No other aids.

## > Quizzes/Participations

- Are designed to promote gradual learning of the concepts in the course.
- Occur once or more in almost every lecture depending how course progresses.
- Are marked when lectures are over and may have different weights.

**There are no make-up midterm or Labs.** If you miss the midterm or a lab then consideration will be given, provided an approved petition by the department (petitions are submitted online) as follows:

- If you missed a lab session and your petition is approved, you will be provided with an opportunity to redo the missed lab during your upcoming labs.
- If you missed the last Lab and your petition is approved then:
  - o If resources are available then you will be given a chance to make up for that lab.
  - o If resources are not available then your average lab mark will be calculated based on other labs and course average on the labs.
- If you missed midterm and your petition is approved, your midterm mark will be transferred to the final exam.

## **Academic Offences**

• Will be handled according to faculty policy (see the <u>Academic Regulations</u> section of the Faculty of Applied Science and Engineering Calendar).

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# ECE361 - Winter 2022

## **Course Schedule and Reading**

Note: this is a tentative list and basesd on the course progress may change in terms of content or order.

4       Jan. 30- Feb. 5       11       Stop-and-Wait ARQ       3.4         5       Feb. 6-12       14       Flow Control Protocol (TCP)       3.5         6       Feb. 6-12       14       Flow Control       3.6         Congestion Control       3.7         6       Feb. 13-19       17       Inside a router, Internet Protocol       4.1, 4.2         18       Review/IP Addressing       4.4         7       Feb. 20-26       Reading Week         8       Feb. 27 - Mar. 5       20       CIDR, DHCP         NAT       4.4         9       March 6 - 12       23       IPV6       4.4         9       March 13 - 19       26       Routing- Distance Vector       4.5.2         9       March 13 - 19       26       Routing in the Internet, RIP, OSPF       4.6.1, 4.6.2         9       March 20 - 26       29       Genoting in the Internet, RIP, OSPF       4.6.1, 4.6.2         10       March 20 - 26       29       Link layer, Error Detection       5.1         10       March 20 - 26       29       Link layer, Error Detection       5.2         10       March 20 - 26       29       Link layer, Error Detection       5.1         10	Week	Date	Lecture	d on the course progress may change in terms of content or order  Topic	Reading
3   Circuit Switching and Packet Switching   1.3			1	Course Introduction	-
2	1	Jan.9-15	2	Introduction to Computer Networks	1.1-1.2
2         Jan.16-22         5         Applications 6         HyperText Transfer Protocol (HTTP)         2.1 - 2.2           3         Jan.23-29         8         Domain Name System         2.5           9         P2P File Sharing         2.6           4         Jan. 30- Feb. 5         11         Stop-and-Wait ARQ         3.4           4         Jan. 30- Feb. 5         11         Stop-and-Wait ARQ         3.4           5         Feb. 6-12         14         Flow Control Protocol (TCP)         3.5           6         Feb. 6-12         14         Flow Control Congestion Control         3.7           6         Feb. 13-19         16         Virtual Circuits and Datagram         4.1, 4.2           18         Review/IP Addressing         4.3, 4.4.1           7         Feb. 20-26         Reading Week           8         Feb. 27 - Mar. 5         20         CIDR, DHCP         4.4           NAT         4.4         4.4         4.4           9         March 6 - 12         23         IPV6         4.4.4, 4.5.1           9         March 13 - 19         26         Routing- Distance Vector - Hierarchical         4.5.2, 4.5.3           9         March 13 - 19         26         Rout			3	Circuit Switching and Packet Switching	1.3
Selective Repeat ARQ/Go-Back-N ARQ   3.4			4	Layered Architecture	1.4, 1.5
3	2	Jan.16-22	5	Applications	2.1 - 2.2
Sample			6	HyperText Transfer Protocol (HTTP)	2.2
9 P2P File Sharing 2.6  10 Transport layer, UDP 3.1, 3.2, 3.3  11 Stop-and-Wait ARQ 3.4  12 Selective Repeat ARQ/Go-Back-N ARQ 3.4  Transport Control Protocol (TCP) 3.5  Feb. 6-12 14 Flow Control 15 Congestion Control 2.7  Feb. 13-19 17 Inside a router, Internet Protocol 3.7  Feb. 20-26 Reading Week  7 Feb. 20-26 Reading Week  8 Feb. 27 - Mar. 5 20 CIDR, DHCP 4.4  9 March 6 - 12 23 IPV6 4.4.4, 4.5.1  22 ICMP 4.4  9 March 13 - 19 26 Routing- Distance Vector 4.5.2  9 March 13 - 19 26 Routing- Distance Vector - Hierarchical 4.5.2, 4.5.3  10 March 20 - 26 29 Link layer, Error Detection 3.0  10 March 20 - 26 29 Link layer, Error Detection 5.1  31 Multiple Access - ALOHA - Slotted ALOHA 5.3.1, 5.3.2  11 Mar. 27-Apr. 2 32 Carrier Sense Multiple Access, Ethernet 5.3.2, 5.4.2			7	Cookies, Caching, Conditional Get, FTP	2.3
10	3	Jan.23-29	8	Domain Name System	2.5
4       Jan. 30- Feb. 5       11       Stop-and-Wait ARQ       3.4         5       Feb. 6-12       14       Flow Control Protocol (TCP)       3.5         6       Feb. 6-12       14       Flow Control       3.6         Congestion Control       3.7       4.1, 4.2         6       Feb. 13-19       17       Inside a router, Internet Protocol       4.3, 4.4.1         7       Feb. 20-26       Reading Week       4.4         7       Feb. 27 - Mar. 5       20       CIDR, DHCP       4.4         8       Feb. 27 - Mar. 5       20       CIDR, DHCP       4.4         9       March 6 - 12       23       IPV6       4.4         9       March 13 - 19       26       Routing- Distance Vector       4.5.2         9       March 13 - 19       26       Routing in the Internet, RIP, OSPF       4.6.1, 4.6.2         9       March 20 - 26       29       BGP - Flooding       4.6.3, 4.7         10       March 20 - 26       29       Link layer, Error Detection       5.1         10       March 20 - 26       29       Link layer, Error Detection       5.1         10       March 20 - 26       29       Link layer, Error Detection       5.1			9	P2P File Sharing	2.6
12   Selective Repeat ARQ/Go-Back-N ARQ   3.4     13			10	Transport layer, UDP	3.1, 3.2, 3.3
Transport Control Protocol (TCP)   3.5	4	Jan. 30- Feb. 5	11	Stop-and-Wait ARQ	3.4
5         Feb. 6-12         14         Flow Control         3.6           6         Feb. 13-19         16         Virtual Circuits and Datagram         4.1, 4.2           7         Feb. 13-19         17         Inside a router, Internet Protocol         4.3, 4.4.1           7         Feb. 20-26         Reading Week         4.4           8         Feb. 27 - Mar. 5         20         CIDR, DHCP         4.4           9         March 6 - 12         21         NAT         4.4           9         March 6 - 12         23         IPV6         4.4.4, 4.5.1           9         March 13 - 19         25         Routing- Distance Vector         4.5.2           9         March 13 - 19         26         Routing in the Internet, RIP, OSPF         4.6.1, 4.6.2           27         BGP - Flooding         4.6.3, 4.7         4.6.3, 4.7           10         March 20 - 26         29         Broadcast and Multicast         4.7           10         March 20 - 26         29         Link layer, Error Detection         5.1           30         Cyclic Redundancy Check (CRC)         5.2           31         Multiple Access - ALOHA - Slotted ALOHA         5.3.1, 5.3.2           41         March 27-Apr. 2			12	Selective Repeat ARQ/Go-Back-N ARQ	3.4
15   Congestion Control   3.7			13	Transport Control Protocol (TCP)	3.5
6       Feb. 13-19       16       Virtual Circuits and Datagram       4.1, 4.2         17       Inside a router, Internet Protocol       4.3, 4.4.1         18       Review/IP Addressing       4.4         7       Feb. 20-26       Reading Week         8       Feb. 27 - Mar. 5       20       CIDR, DHCP         21       NAT       4.4         4.4       4.4         9       March 6 - 12       23       IPV6         24       Routing- Distance Vector       4.5.2         25       Routing- Distance Vector - Hierarchical       4.5.2, 4.5.3         9       March 13 - 19       26       Routing in the Internet, RIP, OSPF       4.6.1, 4.6.2         27       BGP - Flooding       4.6.3, 4.7         10       March 20 - 26       29       Link layer, Error Detection       5.1         30       Cyclic Redundancy Check (CRC)       5.2         31       Multiple Access - ALOHA - Slotted ALOHA       5.3.1, 5.3.2         11       Mar. 27-Apr. 2       32       Carrier Sense Multiple Access, Ethernet       5.3.2, 5.4.2	5	Feb. 6-12	14	Flow Control	3.6
6         Feb. 13-19         17         Inside a router, Internet Protocol         4.3, 4.4.1           7         Feb. 20-26         Reading Week           8         Feb. 27 - Mar. 5         20         CIDR, DHCP         4.4           9         March 6 - 12         23         IPV6         4.4.4, 4.5.1           9         March 13 - 19         26         Routing- Distance Vector         4.5.2, 4.5.3           9         March 13 - 19         26         Routing in the Internet, RIP, OSPF         4.6.1, 4.6.2           10         March 20 - 26         29         Link layer, Error Detection         5.1           10         March 20 - 26         29         Link layer, Error Detection         5.2           11         Mar. 27-Apr. 2         31         Multiple Access - ALOHA - Slotted ALOHA         5.3.1, 5.3.2           11         Mar. 27-Apr. 2         32         Carrier Sense Multiple Access, Ethernet         5.3.2, 5.4.2			15	Congestion Control	3.7
Teb. 20-26         Reading Week         4.4           Feb. 20-26         Midterm, Monday Feb. 28, 6:10-8PM           Beb. 27 - Mar. 5         20 CIDR, DHCP         4.4           NAT         4.4           9 March 6 - 12         10 CMP         4.4           9 March 13 - 19         26 Routing - Distance Vector         4.5.2           9 March 13 - 19         26 Routing in the Internet, RIP, OSPF         4.6.1, 4.6.2           27 BGP - Flooding         4.6.3, 4.7           10 March 20 - 26         29 Eroadcast and Multicast         4.7           10 March 20 - 26         29 Link layer, Error Detection         5.1           30 Cyclic Redundancy Check (CRC)         5.2           Multiple Access - ALOHA - Slotted ALOHA         5.3.1, 5.3.2           11 Mar. 27-Apr. 2         32 Carrier Sense Multiple Access, Ethernet         5.3.2, 5.4.2			16	Virtual Circuits and Datagram	4.1, 4.2
7         Feb. 20-26         Reading Week           8         Feb. 27 - Mar. 5         20         CIDR, DHCP         4.4           9         March 6 - 12         1PV6         4.4, 4.5.1           9         March 13 - 19         26         Routing- Distance Vector - Hierarchical         4.5.2           9         March 13 - 19         26         Routing in the Internet, RIP, OSPF         4.6.1, 4.6.2           27         BGP - Flooding         4.6.3, 4.7           10         March 20 - 26         29         Broadcast and Multicast         4.7           10         March 20 - 26         29         Multiple Access - ALOHA - Slotted ALOHA         5.3.1, 5.3.2           11         Mar. 27-Apr. 2         32         Carrier Sense Multiple Access, Ethernet         5.3.2, 5.4.2	6	Feb. 13-19	17	Inside a router, Internet Protocol	4.3, 4.4.1
19   Midterm, Monday Feb. 28, 6:10-8PM   4.4     9			18	Review/IP Addressing	4.4
8       Feb. 27 - Mar. 5       20       CIDR, DHCP       4.4         9       March 6 - 12       1 CMP       4.4         9       March 6 - 12       23       IPV6       4.4.4, 4.5.1         24       Routing- Distance Vector       4.5.2         9       March 13 - 19       26       Routing- Distance Vector - Hierarchical       4.5.2, 4.5.3         10       March 13 - 19       26       Routing in the Internet, RIP, OSPF       4.6.1, 4.6.2         27       BGP - Flooding       4.6.3, 4.7         10       March 20 - 26       29       Link layer, Error Detection       5.1         30       Cyclic Redundancy Check (CRC)       5.2         31       Multiple Access - ALOHA - Slotted ALOHA       5.3.1, 5.3.2         41       Mar. 27-Apr. 2       32       Carrier Sense Multiple Access, Ethernet       5.3.2, 5.4.2	7	Feb.20-26		Reading Week	
21       NAT       4.4         9       March 6 - 12       22       ICMP       4.4         24       Routing- Distance Vector       4.5.2         25       Routing- Distance Vector - Hierarchical       4.5.2, 4.5.3         9       March 13 - 19       26       Routing in the Internet, RIP, OSPF       4.6.1, 4.6.2         27       BGP - Flooding       4.6.3, 4.7         28       Broadcast and Multicast       4.7         10       March 20 - 26       29       Link layer, Error Detection       5.1         30       Cyclic Redundancy Check (CRC)       5.2         31       Multiple Access - ALOHA - Slotted ALOHA       5.3.1, 5.3.2         41       Mar. 27-Apr. 2       32       Carrier Sense Multiple Access, Ethernet       5.3.2, 5.4.2		Feb. 27 - Mar. 5	19		
9       March 6 - 12       22       ICMP       4.4         24       Routing- Distance Vector       4.5.2         25       Routing- Distance Vector - Hierarchical       4.5.2, 4.5.3         30       Routing in the Internet, RIP, OSPF       4.6.1, 4.6.2         40       4.6.3, 4.7         40       4.6.3       4.7         40       4.6.3       4.7         40       4.6.3       4.7         40       4.6.3       4.7         40       4.6.3       4.7         40       4.6.3       4.7         40       4.6.3       4.7         40       4.6.3       4.7         40       4.6.3       4.7         40       4.6.3       4.7         40       4.6.3       4.7         40       4.6.3       4.7         40       4.6.3       4.6.3         40       4.6.3       4.6.3         40       4.6.3       4.6.3         40       4.6.3       4.6.3         40       4.6.3       4.6.3         40       4.6.3       4.6.3         40       4.6.3       4.6.3         40       4.6	8		20	CIDR, DHCP	4.4
9       March 6 - 12       23       IPV6       4.4.4, 4.5.1         24       Routing- Distance Vector       4.5.2         9       March 13 - 19       26       Routing in the Internet, RIP, OSPF       4.6.1, 4.6.2         27       BGP - Flooding       4.6.3, 4.7         28       Broadcast and Multicast       4.7         Link layer, Error Detection       5.1         30       Cyclic Redundancy Check (CRC)       5.2         31       Multiple Access - ALOHA - Slotted ALOHA       5.3.1, 5.3.2         11       Mar. 27-Apr. 2       32       Carrier Sense Multiple Access, Ethernet       5.3.2, 5.4.2			21	NAT	4.4
24       Routing- Distance Vector       4.5.2         25       Routing- Distance Vector - Hierarchical       4.5.2, 4.5.3         9       March 13 - 19       26       Routing in the Internet, RIP, OSPF       4.6.1, 4.6.2         27       BGP - Flooding       4.6.3, 4.7         28       Broadcast and Multicast       4.7         Link layer, Error Detection       5.1         30       Cyclic Redundancy Check (CRC)       5.2         31       Multiple Access - ALOHA - Slotted ALOHA       5.3.1, 5.3.2         11       Mar. 27-Apr. 2       32       Carrier Sense Multiple Access, Ethernet       5.3.2, 5.4.2			22	ICMP	4.4
9       March 13 - 19       26       Routing in the Internet, RIP, OSPF       4.6.1, 4.6.2         27       BGP - Flooding       4.6.3, 4.7         10       March 20 - 26       29       Link layer, Error Detection       5.1         30       Cyclic Redundancy Check (CRC)       5.2         31       Multiple Access - ALOHA - Slotted ALOHA       5.3.1, 5.3.2         Mar. 27-Apr. 2       32       Carrier Sense Multiple Access, Ethernet       5.3.2, 5.4.2	9	March 6 - 12	23	IPV6	4.4.4, 4.5.1
9       March 13 - 19       26       Routing in the Internet, RIP, OSPF       4.6.1, 4.6.2         27       BGP - Flooding       4.6.3, 4.7         10       March 20 - 26       29       Broadcast and Multicast       4.7         10       Link layer, Error Detection       5.1         30       Cyclic Redundancy Check (CRC)       5.2         31       Multiple Access - ALOHA - Slotted ALOHA       5.3.1, 5.3.2         Mar. 27-Apr. 2       32       Carrier Sense Multiple Access, Ethernet       5.3.2, 5.4.2			24	Routing- Distance Vector	4.5.2
27     BGP - Flooding     4.6.3, 4.7       10     March 20 - 26     28     Broadcast and Multicast     4.7       10     March 20 - 26     29     Link layer, Error Detection     5.1       30     Cyclic Redundancy Check (CRC)     5.2       31     Multiple Access - ALOHA - Slotted ALOHA     5.3.1, 5.3.2       11     Mar. 27-Apr. 2     32     Carrier Sense Multiple Access, Ethernet     5.3.2, 5.4.2			25	Routing- Distance Vector - Hierarchical	4.5.2, 4.5.3
10       March 20 - 26       28       Broadcast and Multicast       4.7         10       March 20 - 26       29       Link layer, Error Detection       5.1         30       Cyclic Redundancy Check (CRC)       5.2         31       Multiple Access - ALOHA - Slotted ALOHA       5.3.1, 5.3.2         11       Mar. 27-Apr. 2       32       Carrier Sense Multiple Access, Ethernet       5.3.2, 5.4.2	9	March 13 - 19	26	Routing in the Internet, RIP, OSPF	4.6.1, 4.6.2
10       March 20 - 26       29       Link layer, Error Detection       5.1         30       Cyclic Redundancy Check (CRC)       5.2         31       Multiple Access - ALOHA - Slotted ALOHA       5.3.1, 5.3.2         11       Mar. 27-Apr. 2       32       Carrier Sense Multiple Access, Ethernet       5.3.2, 5.4.2			27	BGP - Flooding	4.6.3, 4.7
30         Cyclic Redundancy Check (CRC)         5.2           31         Multiple Access - ALOHA - Slotted ALOHA         5.3.1, 5.3.2           11         Mar. 27-Apr. 2         32         Carrier Sense Multiple Access, Ethernet         5.3.2, 5.4.2			28	Broadcast and Multicast	4.7
11 Mar. 27-Apr. 2 31 Multiple Access - ALOHA - Slotted ALOHA 5.3.1, 5.3.2 Carrier Sense Multiple Access, Ethernet 5.3.2, 5.4.2	10	March 20 - 26	29	Link layer, Error Detection	5.1
11 Mar. 27-Apr. 2 32 Carrier Sense Multiple Access, Ethernet 5.3.2, 5.4.2			30	Cyclic Redundancy Check (CRC)	5.2
	11	Mar. 27-Apr. 2	31	Multiple Access - ALOHA - Slotted ALOHA	5.3.1, 5.3.2
33 MAC Addressing - ARP 5.4.1			32	Carrier Sense Multiple Access, Ethernet	5.3.2, 5.4.2
33 INITIO TABLE STRING TARE			33	MAC Addressing - ARP	5.4.1
, ,	12		34	, ,	5.4.3, 5.4.4
12 April 3 - 9 35 Simple Mail Transfer Protocol (SMTP) (Will be covered later) 2.4		April 3 - 9	35	Simple Mail Transfer Protocol (SMTP) (Will be covered later)	2.4
36 FTP 2.3			36	FTP	2.3
37 Link Layer Switches, VLAN 5.4.3, 5.4.4			37	Link Layer Switches, VLAN	5.4.3, 5.4.4
<b>13</b> April 10 - 14 <b>38</b> CSMA/CA 6.3	13	April 10 - 14	38	CSMA/CA	6.3
39 Review			39	Review	

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ECE361 Programming Labs Schedule (Winter 2022)

ECESOT Frogramming Easts Schedule (Whiter 2022)								
Section	Date	Time	Location	Programming Lab	Material Due	Marks		
PRA0101	26-Jan-22							
PRA0102	02-Feb-22			1	Section 1 of File Transfer Lab	2		
PRA0103	24-Jan-22	1		1	Section 1 of File Transfer Lab	1 works; 1 questions		
PRA0101	09-Feb-22	i						
PRA0102	16-Feb-22			2	Section 2 of File Transfer Lab	4		
PRA0103	07-Feb-22	1		2	Section 2 of File Transfer Lab	2 works; 2 questions		
PRA0101	09-Mar-22	1						
PRA0102	02-Mar-22	3 - 6 PM	GB 243	3	Section 3/Overall File Transfer Lab	4		
PRA0103	07-Mar-22	3 - 0 FIVI	GB 243	3	Section S/Overall File Transfer Lab	2 works; 2 questions		
PRA0101	23-Mar-22	1						
PRA0102	16-Mar-22	]		4	Section 1 of Tout Confession Lab	6		
PRA0103	21-Mar-22	l		4	Section 1 of Text Conferencing Lab	4 works; 2 questions		
PRA0101	06-Apr-21	1						
PRA0102	30-Mar-22	]		5	Section 2 of Text Conferencing Lab	4		
PRA0103	04-Apr-21	}		5	Section 2 of Text Conferencing Lab	2 works; 2 questions		

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