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Course Definition:

1- Basic Information:

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| Course Name | Network Services |
| Course ID | NS |
| Contact Hours (Registered Sessions) | 20 |
| Contact Hours (Synchronized Sessions) | 20 |
| Mid Term Exam | - |
| Exam | 75 min |
| Registered Sessions Work Load | 40 |
| Synchronized Session Work Load | 20 |
| Credit Hours | 4 |

2- Pre-Requisites:

| Course | ID |
|------------------------|-----|
| Computer Network | CN |
| Computer Programming 1 | CP1 |

3- Course General Objectives:

This course is intended to study some of basic network protocols used on the internet and belong to the application layer in the TCP/IP Model and to present the essential Internet Services based on this protocols using client/server model.

4- Intended Learning Outcomes (ILO):

| Code | Intended Learning Outcomes |
|------|--|
| ILO1 | Understand Client/Server Model |
| ILO2 | Understand how the Domain Name Service works and what its main functions are |
| ILO3 | Explain the general specifications of the DNS protocol and understand how it works and identifying the structure of the exchanged data between the client and the server |
| ILO4 | Understand how the remote login service works and what its main functions are |
| ILO5 | Explain the general specifications of the TELNET protocol and understand how it works and identifying the structure of the exchanged data between the client and the |

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| | server |
| ILO6 | Understand how the e-mail service works and what its main functions are |
| ILO7 | Explain the general specifications of the e-mail message as defined by RFC822 and MIME |
| ILO8 | Explain the general specifications of the SMTP protocol and understand how it works and identifying the structure of the exchanged data between the client and the server |
| ILO9 | Explain the general specifications of the POP3 protocol and understand how it works and identifying the structure of the exchanged data between the client and the server |
| ILO10 | Explain the general specifications of the IMAP protocol and understand how it works and identifying the structure of the exchanged data between the client and the server |
| ILO11 | Understand how the file transfer service works and what its main functions are |
| ILO12 | Explain the general specifications of the FTP protocol and understand how it works and identifying the structure of the exchanged data between the client and the server |
| ILO13 | Explain the general specifications of the TFTP protocol and understand how it works and identifying the structure of the exchanged data between the client and the server |
| ILO14 | Understand how the web service works and what its main functions are |
| ILO15 | Explain the general specifications of the HTTP protocol and understand how it works and identifying the structure of the exchanged data between the client and the server |
| ILO16 | Understand how the Remote Authentication service works and what its main functions are |
| ILO17 | Explain the general specifications of the RADIUS protocol and understand how it works and identifying the structure of the exchanged data between the client and the server |
| ILO18 | Analyzing the data passed through the networks and identifying the application layer protocols it belong to. |

5- Course Syllabus (18 hours of total synchronized sessions)

- **RS:** Recorded Sessions; **SS:** Synchronized Sessions;

| ILO | Course Syllabus | RS | SS | Type | Additional Notes |
|------|--|-----|----|------|------------------|
| ILO1 | <ul style="list-style-type: none"> • Protocol Concept • Review of OSI and TCP/IP Model • TCP Connection and port number | 1.5 | 1 | | Exercises |

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| | <ul style="list-style-type: none"> Client/Server Model Concept | | | | |
| ILO2 | <ul style="list-style-type: none"> Domain Name System Domain Tree Zones Type of Name Servers Name Server's database and different record types | 1.5 | 1.5 | <input type="checkbox"/> exercises <input type="checkbox"/> experiments <input type="checkbox"/> assignments | <ul style="list-style-type: none"> DNS Configuration DNS tools (nslookup, dig) Simulation of the work of name server to resolve dns query |
| ILO3, ILO13 | <ul style="list-style-type: none"> The general specifications of the DNS protocol and how it works Structure of the exchanged data between the client and the server | 1 | 1 | <input type="checkbox"/> exercises <input type="checkbox"/> experiments <input type="checkbox"/> assignments | <ul style="list-style-type: none"> Sending requests to dns server Capture and analyze requests and their replies using Wireshark |
| ILO4, ILO5, ILO18 | <ul style="list-style-type: none"> Historic review of remote login service Network Virtual Terminal Negotiation | 1.5 | 1 | <input type="checkbox"/> exercises <input type="checkbox"/> experiments <input type="checkbox"/> assignments | <ul style="list-style-type: none"> Using telnet command and putty Capturing TELNET connections and analyzing them using wireshark |
| ILO6 | <ul style="list-style-type: none"> e-mail service main components of email systems and how it works | 1 | 1 | <input type="checkbox"/> exercises <input type="checkbox"/> experiments <input type="checkbox"/> assignments | <ul style="list-style-type: none"> Configuring outlook and thunderbird Sending and receiving emails |
| ILO7 | <ul style="list-style-type: none"> the general specifications of the e-mail message as defined by RFC822 MIME standard <ul style="list-style-type: none"> Content types Encoding | 1.5 | 1.5 | <input type="checkbox"/> exercises <input type="checkbox"/> experiments <input type="checkbox"/> assignments | <ul style="list-style-type: none"> Viewing email message source code Viewing source code of MIME messages |
| ILO8, ILO18 | <ul style="list-style-type: none"> The general specifications of the SMTP protocol and how it works Main commands and their functions Replies and Status code EMSTP and the new functionalities <ul style="list-style-type: none"> Authentication | 1 | 1 | <input type="checkbox"/> exercises <input type="checkbox"/> experiments <input type="checkbox"/> assignments | <ul style="list-style-type: none"> Capturing SMTP connections and analyzing it using wireshark Making SMTP sessions using telnet |

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| | ○ Secure Connection SSL | | | | |
| ILO9, ILO18 | <ul style="list-style-type: none"> • The general specifications of the POP3 protocol and how it works • Main commands and their functions • Replies and Status code | 1 | 1 | <input type="checkbox"/> exercises <input type="checkbox"/> experiments <input type="checkbox"/> assignments | <ul style="list-style-type: none"> • Capturing POP3 connections and analyzing it using wireshark • Making POP3 sessions using telnet |
| ILO10, ILO18 | <ul style="list-style-type: none"> • The general specifications of the IMAP protocol and how it works • Main commands and their functions • Replies and Status code • Comparing IMAP with POP3 | 1 | 1 | <input type="checkbox"/> exercises <input type="checkbox"/> experiments <input type="checkbox"/> assignments | <ul style="list-style-type: none"> • Capturing IMAP connections and analyzing it using wireshark • Making IMAP sessions using telnet |
| ILO11 | <ul style="list-style-type: none"> • File sharing and file transfer service • Different methods for accessing the service • Command line interface <ul style="list-style-type: none"> ○ Browsers ○ File managers ○ Special software | 1.5 | 1.5 | <input type="checkbox"/> exercises <input type="checkbox"/> experiments <input type="checkbox"/> assignments | <ul style="list-style-type: none"> • Exercises for using: <ul style="list-style-type: none"> ○ ftp command ○ internet browsers ○ windows explorer ○ FileZilla |
| ILO12, ILO18 | <ul style="list-style-type: none"> • The general specifications of the FTP protocol and how it works • Main commands and their functions • Replies and Status code • Overview of FTPS and SFTP | 1 | 1.5 | <input type="checkbox"/> exercises <input type="checkbox"/> experiments <input type="checkbox"/> assignments | <ul style="list-style-type: none"> • Capturing FTP connections and analyzing it using wireshark • Making FTP sessions using telnet |
| ILO13, ILO18 | <ul style="list-style-type: none"> • Historic overview of TFTP use • The general specifications of the TFTP protocol and how it works • Structure of the exchanged messages between the client and the server <ul style="list-style-type: none"> ○ File Transfer | 1 | 1 | <input type="checkbox"/> exercises <input type="checkbox"/> experiments <input type="checkbox"/> assignments | <ul style="list-style-type: none"> • Transferring file using tftp command • Capturing file transferring and analyzing it using wireshark |

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| | ○ Sorcerer's apprentice syndrome | | | | |
| ILO14 | <ul style="list-style-type: none"> The difference between Internet and the Web The Web Service Historic overview | 0.5 | 0 | <input type="checkbox"/> | Exercises |
| ILO15, ILO18 | <ul style="list-style-type: none"> The general specifications of the HTTP protocol and how it works Main commands and their functions Replies and Status code Headers and the functions | 1.5 | 1.5 | <input type="checkbox"/> exercises <input type="checkbox"/> experiments <input type="checkbox"/> assignments | <ul style="list-style-type: none"> Capturing HTTP connections and analyzing it using wireshark Making HTTP sessions using telnet |
| ILO16 | <ul style="list-style-type: none"> Remote access to company's or ISP's networks. Authentication and authorization service Accounting service RADIUS Solution | 1.5 | 0.5 | <input type="checkbox"/> exercises <input type="checkbox"/> experiments <input type="checkbox"/> assignments | <ul style="list-style-type: none"> Viewing server configurations |
| ILO17, ILO18 | <ul style="list-style-type: none"> The general specifications of the RADIUS protocol and how it works Structure of the exchanged messages between the client and the server | 1 | 1 | <input type="checkbox"/> exercises <input type="checkbox"/> experiments <input type="checkbox"/> assignments | <ul style="list-style-type: none"> Sending requests to RADIUS server Capture and analyze requests and their replies using Wireshark |
| - | <ul style="list-style-type: none"> Installation and configuration of the Lab platform | 1 | 1 | <input type="checkbox"/> exercises <input type="checkbox"/> experiments | <ul style="list-style-type: none"> Testing the Lab platform exercises |
| - | <ul style="list-style-type: none"> Assignments solving | | 2 | <input type="checkbox"/> | |

6- Assessment Criteria (Related to ILOs)

| | | | | | |
|------|--|----|---------------|-----|---------|
| ISC | Interactive Synchronized Collaboration | Ex | Exams | Rpt | Reports |
| PF2F | Presentations and Face-to-Face Assessments | PW | Practice Work | | |

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| ILO Code | ILO | Intended Results | Assessment Type | | | | |
|----------|---|------------------|-----------------|----|----|------|-----|
| | | | ISC | PW | Ex | PF2F | Rpt |
| ILO1 | Understand Client/Server Model | | | | ✓ | | ✓ |
| ILO2 | Understand how the Domain Name Service works and what its main functions are | | ✓ | ✓ | ✓ | | ✓ |
| ILO3 | Explain the general specifications of the DNS protocol and understand how it works and identifying the structure of the exchanged data between the client and the server | | ✓ | ✓ | ✓ | | ✓ |
| ILO4 | Understand how the remote login service works and what its main functions are | | ✓ | ✓ | ✓ | | ✓ |
| ILO5 | Explain the general specifications of the TELNET protocol and understand how it works and identifying the structure of the exchanged data between the client and the server | | ✓ | ✓ | ✓ | | ✓ |
| ILO6 | Understand how the e-mail service works and what its main functions are | | ✓ | ✓ | ✓ | | ✓ |
| ILO7 | Explain the general specifications of the e-mail message as defined by RFC822 and MIME | | ✓ | ✓ | ✓ | | ✓ |
| ILO8 | Explain the general specifications of the SMTP protocol and understand how it works and identifying the structure of the exchanged data between the client and the server | | ✓ | ✓ | ✓ | | ✓ |
| ILO9 | Explain the general specifications of the POP3 protocol and understand how it | | ✓ | ✓ | ✓ | | ✓ |

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| | works and identifying the structure of the exchanged data between the client and the server | | | | | | |
| ILO10 | Explain the general specifications of the IMAP protocol and understand how it works and identifying the structure of the exchanged data between the client and the server | | ✓ | ✓ | ✓ | | ✓ |
| ILO11 | Understand how the file transfer service works and what its main functions are | | ✓ | ✓ | ✓ | | ✓ |
| ILO12 | Explain the general specifications of the FTP protocol and understand how it works and identifying the structure of the exchanged data between the client and the server | | ✓ | ✓ | ✓ | | ✓ |
| ILO13 | Explain the general specifications of the TFTP protocol and understand how it works and identifying the structure of the exchanged data between the client and the server | | ✓ | ✓ | ✓ | | ✓ |
| ILO14 | Understand how the web service works and what its main functions are | | ✓ | | ✓ | | |
| ILO15 | Explain the general specifications of the HTTP protocol and understand how it works and identifying the structure of the exchanged data between the client and the server | | ✓ | ✓ | ✓ | | ✓ |
| ILO16 | Understand how the Remote Authentication service works and what its main functions are | | ✓ | | ✓ | | |

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| ILO17 | Explain the general specifications of the RADIUS protocol and understand how it works and identifying the structure of the exchanged data between the client and the server | | ✓ | ✓ | ✓ | | ✓ |
| ILO18 | Analyzing the data passed through the networks and identifying the application layer protocols it belong to. | | ✓ | ✓ | ✓ | | ✓ |

7- Practice Tools:

| Tool Name | Description |
|---|--|
| Linux RedHat VM | A virtual machine with Linux RedHat 7.2 and has all services needed for the Labs prepared on it and ready to use |
| Vmware Player | virtual machine player needed to play the Linux RedHat VM |
| Wireshark | Open source network protocol analyzer |
| Personal Computer with Microsoft windows | Personal Computer with Microsoft Windows installed on it (including all network applications and commands) |
| ThunderBird | Open source software for sending and receiving emails |
| winradius | A free software package including radius server (we will use only the client tool included with the package) |

8- Main References:

- Course handbook available on the course's page on the LMS
- PPT Presentations available on the course's page on the LMS

9- Additional References

- 1) RFCs (Request For Comments) for all Studied protocols:
 - <http://www.ietf.org/rfc.html>
 - <http://www.rfc-editor.org/cgi-bin/rfcsearch.pl>
 - <http://community.roxen.com/developers/idocs/rfc/>
- 2) TCP/IP Illustrated: The Protocols, Vol. 1, W. Richard Stevens.