NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF ELECTRICAL AND ELECTRONICS ENGINEERING
TELECOMMUNICATIONS ENGINEERING PROGRAM

SYLLABUS - IT524 TELECOMMUNICATIONS NETWORKS

I. GENERAL INFORMATION

CODE	**:**	IT524
SEMESTER	**:**	8
CREDITS	**:**	3
HOURS PER WEEK	**:**	4 (Theory – Practice)
PREREQUISITES	**:**	IT514 Telecommunications II
CONDITION	**:**	Compulsory
INSTRUCTOR	**:**	Daniel Diaz

II. COURSE DESCRIPTION

Introduction to data network. Protocol concept and data network architecture. Commutation methods: by packet and by circuits. OSI model and TCO/IP architectures. Analysis of ARP, IPv4, IPv6, ICMPv4, UDP, DNS protocols. Analysis of interconnection devices used in IP networks: router, switch, Ethernet hub. Addressing of layer 2 devices. Addressing of 3 layer devices (IP addressing). IP routing fundamentals (Static routing in routers and their basic configuration). Data network wiring.

III. COURSE OUTCOMES

1. Learn fundamental concepts of data network, as well as, usual protocols in this type of communication systems.
2. Learn basic concepts of data network design defining topology, protocols and routing.
3. Learn technical advantages and disadvantages of various data network protocols, so as to identify the best choice depending on the circumstances.

IV. LEARNING UNITS

1. ANALYSIS OF PROTOCOLS IN IP NETWORKS / 6 HOURS

Introduction to data network and the Internet / Commutation techniques: circuits and packets / Standardization organizations / Concept of protocol: characteristics and functions / Connection-oriented protocols and connectionless protocols / Mixed services / Protocol models: OSI model, TCP/IP architecture / OSI model analysis / Analysis of its 7 layers / TCP/IP architecture analysis / Analysis of its structure.

2. DATA LINK LAYER: LAN TECHNOLOGY/ 9 HOURS

Introduction. LAN network topology / IEEE 802.x protocol model / IEEE 802 standards / IEEE 802.3 LAN network/ Ethernet: framework analysis. IP encapsulation / Media access

control in IEEE 802.3/Ethernet networks. CSMA/CD protocols / MAC addresses / ARP protocol/ ARP proxy.

3. INTERNET LAYER: IPV4 AND IPV6 PROTOCOLS / 9 HOURS

Concept / Dominant protocol IPv4: Internet Protocol. IPv4 characteristics. IPv4 format analysis. Optional headers. Rout register, source routing, timestamp / IPv6 protocol. IPv6 characteristics. IPv6 format analysis / IPv6 header. IPv6 new fields: traffic class and flow label.

4. IP ADDRESSING, INTERCONNECTION AND CONFIGURATION DEVICES/12 HOURS

Types of address in IPv4. Subnetting and netmasks / IP addressing fundamentals / IPv6 addresssing. IPv6 address definition: Unicast, Anycast and Multicast. / Case study in IP addressing / ICMPv4: Internet Control Message Protocol. Characteristics. ICMP format analysis. Types of ICMP messages / Ping command / Tracerout command / Introduction / Position in OSI model / Hub characteristics / Switch characteristics / Router characteristics / Static routing and routing tables / Router description / Router operation modes / Router basic commands / Router configuration / Case studies.

5. FREQUENCY RESPONSE METHOD / 15 HOURS

Introduction / Type of services at transport level / UDP: User Datagram Protocol. UDP format / TCP: Transmission Control Protocol. TCP format / Congestion control. Sliding window / TCP operation analysis / TCP problem in real-time applications. Acknowledgment of receipt problem / DNS concept / Recursive and iterative methods / DNS protocol method / DNS protocol analysis.

V. LABORATORY EXPERIENCES

Lab 1: Structured wiring and data network.
Lab 2: Network commands and utilities.
Lab 3: IPv4 and ICMPv4 analysis.
Lab 4: LAN and WAN networks, simulators for router configuration.
Lab 5: WAN network design.

VI METHODOLOGY

The course is carried out in computing lab, theory and practice sessions. In theory sessions, the instructor introduces concepts, theorems and applications. In practice sessions, skills and aptitudes mentioned in the outcomes are developed; students are proposed exercises and practical cases to be solved with knowledge acquired in theory sessions. In lab session, proper and specialized software is used to allow students to visualize the most important aspects of the analysis of a continuous-time control system.

VIII EVALUATION FORMULA

The average grade PF is calculated as follows:

PF = (EP + EF + (P1+P2+P3+P4)/4 + (L1+L2+L3+L4+L5)/5) / 3

EP: Mid-Term Exam EF: Final Exam #: Quizzes L#: Labs

VIII BIBLIOGRAPHY

1. **W. RICHARD STEVENS**
   TCP/IP Illustrated. Volume 1
   Addison-Wesley Professional Computing Series, 2010

2. **BRIAN HILL**
   CISCO Reference Manual (Spanish)
   McGraw Hill, 2010

3. **ANDREW S. TANENBAUM**
   Computer Networks (Spanish)
   Prentice Hall, 2009