UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2021/2022
BACHELOR'S DEGREE (BSC)	ELECTRONICS ENGINEERING
SUBJECT	INTERNET NETWORKS
TYPE OF EDUCATIONAL ACTIVITY	B
AMBIT	50290-Ingegneria delle telecomunicazioni
CODE	06243
SCIENTIFIC SECTOR(S)	ING-INF/03
HEAD PROFESSOR(S)	MANGIONE STEFANO Ricercatore Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	102
COURSE ACTIVITY (Hrs)	48
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**MANGIONE STEFANO** Monday 14:00 15:00 In presenza o su microsoft teams, previo appuntamento via email Tuesday 14:00 15:00 In presenza o su microsoft teams, previo appuntamento via email Wednesday 14:00 15:00 In presenza o su microsoft teams, previo appuntamento via email Thursday 14:00 15:00 In presenza o su microsoft teams, previo appuntamento via email Friday 14:00 15:00 In presenza o su microsoft teams, previo appuntamento via email

DOCENTE: Prof. STEFANO MANGIONE

PREREQUISITES	The course is self-consistent.However, it is recommended to have some basics of object-oriented programming .
LEARNING OUTCOMES	Knowledge and understanding At the end of the class, the student will be able to understand in depth the internal Internet architecture, problems and solutions which characterize the design and the optimization of data transport, addressing of machines on heterogeneous networks, problems for the design of distributed applications in specific operation scenarios and requirements. In particular, the student will learn: the TCP/UDP transport protocols and relevant simple models for estimating protocol performance on channels with heterogeneous bandwidth and delay figures; the IP protocol and the IP addressing mechanisms for super-netting and sub-netting; the main Internet applications (such as the web, P2P applications, etc.). The student will also learn the networking instruments offered by the main operating systems. To achieve this goal, the course includes: teacher-led lessons; analysis and discussion of case studies. Applying knowledge The student will be able to solve problems related to network addressing, router configuration, design of distributed applications, network troubleshooting by means of tools offered by the main operating systems and traffic analyzers. To achieve this goal, the course includes teacher-led lessons, exemplar design solutions on network configuration and optimization, as well as practical applications. To verify this goal, the written test includes the analysis of simple network systems. Judgements The student will be stimulated to extrapolate the techniques and the algorithms presented in the course from the relevant contexts and technologies in order to apply/adapt these tools to different network systems and application scenarios. She/he will also be able to compare alternative architectures and protocol solutions, by means of performance evaluation (throughput, delays) based on simplified models. To achieve this goal, the course offers teacher-led lessons and complete examples of system designs, as well as open discussions of case studies. To verify this goal, the written test includes performance evaluation tests related to a specific case study. Communication skills The student will learn the ability to rationally communicate her/his knowledge about the concepts and methods of the discipline, with a good level of clearness, fluency and correct use of technical language. In particular, she/he will be able to justify the design choices and the application of specific tools for solving the proposed analysis problems. To achieve this goal, the student can rely on the teacher-led lessons and presentations of case studies. To verify this goal, the written test presents an open question on the discussion of a case study. Learning skills The student will be able to evaluate autonomously network architectures and protocol interactions. She/he will be also able to read technical standards of the field, in order to be updated on the continuous technological evolutions of Internet, such as the emerging software-defined control plane. To achieve this goal, the course presents some teacher-led solutions and seminars on emerging topics.
ASSESSMENT METHODS	EXAM ORGANIZATION The examination is based on a written test. The grade of the written test is given in the range 0-30/30. The minimum grade to pass the test is 18/30. DESCRIPTION OF THE TEST The written test includes two parts: a first part focused on the design of simple transport and network protocols; a second part with open and semi-structured questions about all the course contents. The written test lasts 2 hours. The test is devised to evaluate: -The knowledge and understanding levels of layers and protocols adopted in Internet; -The capability of applying the acquired knowledge to solve autonomously design problems and protocol optimizations; -The ability to communicate knowledge, analyses and conclusions, and justify the design choices. LEARNING OUTCOMES In order to provide the overall evaluation, we will estimate the results achieved in the following course objectives.

	Knowledge and understanding: Evaluation of knowledge, understanding and integration of principles, concepts, methods and techniques of the discipline. Applying knowledge: Evaluation of capabilities in applying theoretical and technical knowledge for tackling and solving problems; evaluation of the autonomy level and originality of proposed solutions. Making judgements: Evaluation of logical, analytical and critical abilities for reaching appropriate judgments and decisions, based on available information and data. Communication skills and learning skills: Evaluation of the ability to communicate knowledge, analysis and conclusions, with a good level of clearness, fluency and correct use of language. Evaluation of the capability of reinterpretation and interdisciplinary connection, showing evidence for autonomously undertaking further studies or professional activity. GRADES 30-30 and laude: Excellent. Full knowledge and understanding of concepts and methods of the discipline, excellent analytical skills even in solving original problems; excellent communication and learning skills. 27-29: Very good. Very good knowledge and understanding of concepts and methods of the discipline; very good communication skills; very good capability of concepts and methods applications. 24-26: Good. Good knowledge of main concepts and methods of the discipline; discrete communication skills; limited autonomy for applying concepts and methods for solving original problems. 21-23: Satisfying. Partial knowledge of main concepts and methods of the discipline; satisfying communication skills; scarce judgment autonomy. 18-20: Acceptable: Minimal knowledge of concepts and methods of the discipline; minimal communication skills; very poor or null judgement autonomy. Non acceptable: Insufficient knowledge and understanding of concepts and methods of the discipline.
EDUCATIONAL OBJECTIVES	This course provides an overview of Internet, based on the presentation of the general architecture, main protocols and distributed applications. A first educational objective is understanding network configuration and utilizing troubleshooting tools. A second educational objective, is understanding how distributed applications can be designed and developed by exploiting the transport and network abstractions offered by Internet. Finally, a third educational objective is providing methods and approaches for evaluating, at a system level, interactions between protocols, applications and channels, in order to be able to design/adapt existing protocols to the emerging application scenarios.
TEACHING METHODS	Teacher-led lessons and design examples; guided debates on emerging topics.
SUGGESTED BIBLIOGRAPHY	James F. Kurose, Keith W. Ross "Reti di calcolatori e Internet: un approccio top-down", Pearson editore. ISBN: 8891902543

SYLLABUS

Hrs	Frontal teaching
2	Introduction to the Internet: history, layered architecture, protocols and services.
8	Application layer: fundamentals of distributed applications. The Web and the HTTP protocol. Mail service in Internet. The DNS: the directory service in Internet. File distributions based on P2P approaches. Video streaming.
10	Transport layer: multiplexing and demultiplexing between applications. UDP protocol for non-reliable transport. Fundamentals of reliable transport protocols: TCP protocol and congestion control.
10	Network layer: IPv4 protocol, addressing mechanisms and extendions to IPv6. Router architectures. Evolutions to routing solutions based on Software-Defined-Networks.
8	Routing algorithms: intra-domain and inter-domain routing.

Hrs	Practice
4	Examples and exercises with traffic analyzers: Wireshark. Analysis of HTTP, DNS, TCP, UDP.
6	Exercises on perfomance evaluation of trasport protocols.