Subject Description Form

Subject Code	COMP4322
Subject Title	Internetworking Protocols, Software and Management
Credit Value	3
Level	4
Pre-requisite / Co-requisite / Exclusion	**Pre-requisite**: COMP2322
Objectives	The objectives of this subject are to: 1. let students acquire a foundational understanding on the concept of Internetworking in terms of the technologies and techniques that drive Internet; 2. equip students with knowledge and understanding of the software aspects of protocol interactions, characteristics and its architecture; and 3. provide students with practical exposure of TCP/IP operations in the form of realistic and practical experiments.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: *Professional/academic knowledge and skills* (a) differentiate the essential components that drive internetworking; (b) show an in-depth understanding of the important issues encompassing internetworking and how these issues affect the evolution of Internet and its applications; (c) demonstrate a comprehensive understanding of the complete architecture of Internetworking and the operations of underlying protocols and software; (d) examine new techniques and relate new technologies to existing Internetworking infrastructure; (e) utilise practical knowledge on both routine configuring and managing network operations and non-routine operations using Internet tools and software; *Attributes for all-roundedness* (f) analyse internetworking problems in a systematic and principled approach and generate innovative solutions; (g) develop practical software and generate results in the form of technical report; and (h) accept responsibility and accountability for determining and achieving personal and group outcomes while exhibiting leadership in a project team.

Subject Synopsis/ Indicative Syllabus	**Topic** **1.** Hierarchical address routing; connecting LAN and WAN technologies; IP classful addressing: IP classes, special IP addresses, subnet addressing, multihome addresses; address resolution protocol and RARP. **2.** Advanced addressing and IP. Supernetting; assigning address blocks; classless addressing; slash notation; IP packet format; ICMP error reporting. **3.** Transport protocol. Transport services and protocols; protocol mechanisms including error, flow and congestion control; transport addressing; connection control; connection termination; credit-based flow control; silly window syndrome: Nagle's algorithm; TCP timers: setting timeouts; TCP congestion control: slow-start, multiplicative decrease and additive increase; TCP packet format; TCP state transitions; User Datagram Protocol. **4.** Internet routing. Direct versus indirect internet routing; routing methods; routing decisions; interior gateway routing versus exterior gateway routing; routing protocols: RIP versus OSPF, BGP, autonomous systems; OSPF routing mechanisms: area border routers, Dijkstra's algorithm; link state routing. **5.** Simple Network Management Protocol: Management Information Base (MIB); Structure of Management Information (SMI); SNMP protocol; setting traps. **6.** Internet multicast. N-to-N unicast; proxy and Internet multicast; hardware multicast; Internet Group Management Protocol (IGMP); Distance Vector Multicast Protocol (DVMP); Core Base Tree (CBT) multicast; MOSPF; Protocol Independent Multicast (PIM); reliable multicast. **7.** Internet services. BOOTP versus DHCP; Domain Name Services (DNS); Inverse Domain Mapping; SMTP; POP3; IMAP4; private networks and security: Virtual Private Networks (VPN); intranet versus extranet; private network addressing; IP Security (IPSec); Authentication Header mode versus Encapsulating Security Payload (ESP); Network Address Translation (NAT).
Teaching/ Learning Methodology	During the lectures, students will be taught the basic concepts and foundational knowledge on Internet protocols. Whenever possible, to reinforce students' understanding of the concepts taught, practical case examples and studies will be included. During tutorials, students will be exposed to practical experiments related Internet protocols and software development. Several lab sessions will be set up to teach students to use software and tools that capture real Internet packets. Students can fully understand the protocols by inspecting the real Internet packets. In addition, students will be asked to design and implement application-level protocols using socket programming interface.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed							
		a	b	c	d	e	f	g	h
Continuous Assessment	**50%**	✓	✓	✓	✓	✓	✓	✓	✓
Examination	**50%**	✓	✓	✓	✓	✓	✓		
Total	100%								

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

The course will be accessed by continuous assessments and a final examination. The continuous assessment methods include individual assignments, quizzes and group projects.

The individual assessments are designed to help students reinforce their understanding on the materials that are taught in the class. The questions are set with practical case examples that help students to apply the theory into practical solutions. This will help students to think independently and to assess individual student's analytic and problem-solving skills. Group projects are designed to help students work collectively on a large problem that requires collaborative efforts and coordination among group members. In addition, the projects will require them to write comprehensive reports on the findings and, to present and communicate effectively to the audience. Final exam is comprehensive. It tests the knowledge of the whole course.

Student Study Effort Expected

Class contact:	
▪ Lecture	39 Hrs.
▪ Laboratory	0 Hrs.
Other student study effort:	
▪ Assignments, Coursework, Reading, Exam	66 Hrs.
Total student study effort	105 Hrs.

Reading List and References

Textbook:

1. Kurose, James F. and Ross, Keith W., *Computer Networking: A Top-Down Approach*, Fifth Edition, Addison Wesley, 2009.

Reference Books:

1. Comer, Douglas, *Internetworking with TCP/IP: Principles. Protocols, and Architectures*, 5th Edition, Prentice Hall, 2005.

2. Stevens, W. Richard, *TCP/IP Illustrated, Volume 1*, Addison Wesley, 1994.

3. Tanenbaum, Andrew, *Computer Networks*, 5th Edition, Prentice Hall, 2010.

	4. Articles from IEEE/ACM Transactions on Networking, IEEE Internet Computing, The Internet Protocol Journal, ACM Communications Magazine.