Module Name: **Next Generation Networks**

Module Acronym: NGN

Module Manager: Dr Clive Poole

**Course Summary:**
Several forms of convergence are currently occurring within the telecommunications and IT industry, notably: IT and entertainment, fixed and mobile communications, and voice and data. This module examines the concepts, technology and architecture of next-generation networks (NGN). It also considers the drivers for moving to an NGN, namely: the convergence of services and the associated integration of networks, and in particular addresses the shift of telephony to Internet-based networks. In addition to examining voice over IP technology, we consider the requirements of an integrated IP-based network supporting a range of converged voice and data services.

**Old Learning Outcomes – please replace:**
At the end of the course, students should be able to understand:

- The need and drivers for service convergence.
- The generally agreed definition of an NGN and its main characteristics
- The architecture of an NGN and the logic for this approach
- The concept of VoIP and how full feature telephony is provided over an IP network
- The portfolio of broadband access mechanisms in a fixed network and the relative merits of each type.
- The principles of connection-orientated and connectionless packet switching and the protocols available to enable such networks.
- The design processes and methodologies of an NGN
- The concept of mobile IP
- The principles of mobile networks and they relate to NGN.

**Intended Learning Outcomes**
On completion of this course, students should be able to:

- analyse an NGN in terms of its circuit vs packet elements, having a deep and comprehensive understanding of the engineering principles and methodologies behind the transition from separate circuit-switched voice networks and packet-switched data networks, to a single packet-switched NGN, supporting both voice and data protocols.

- analyse NGN in terms of the fundamental separation of application layers from the transport layers allowing services to be decoupled from underlying networks.
design a basic IP Multimedia Subsystem (IMS), having acquired a comprehensive understanding of the underlying principles of the IMS, its role and function within NGN.

design a converged fixed/wireless NGN having acquired a comprehensive understanding of 4G mobile network technologies and architectures as essentially the wireless complement to fixed line NGN.

be able to write a marketing strategy making reference to the key business drivers of NGN, such as reduced operational costs, reduced capital expenditure, obsolescence of traditional PSTN equipment, and shifts in user behavior and expectations.

be able to approximately calculate the impact on business profitability of the transition from legacy networks to NGN, taking into account the financial implications of having to operate both systems in parallel during the transition phase.

identify and classify the key metrics required to assess and ensure end-to-end QoS management of data through the network and hence be able to evaluate the cost associated with a given quality level.

be able to prepare a successful business case for a typical NGN deployment.

Course Content

Convergence and Integration
• What is convergence and why is it now possible
• Service convergence
• Network integration
• The service stack model
• Drivers for network integration & Service convergence

Next Generation Networks (NGN)
• Principles and definition of an NGN
• The NGN architecture
• Outline of technology choices
• Network and implementation issues with NGN
• Numbering & Addressing

Broadband Access
• Review of broadband access systems for
• Relative merits of the various systems and their enabling role in NGNs

Next Generation Core Network
• The role of the core network
• Enabling Control and Reconfigurability.

Packet Switching
• ATM
• IP
• MPLS
• Ethernet
IP Multi-Media System (IMS)
- Principles of control for IP networks
- Concept of IMS
- The architectural principles and the key components
- Service aspects

VoIP and SIP
- VoIP principles
- How telephony is provided over an IP network
- The various VoIP scenarios
- The principles of SIP
- Comparison of SIP with other signalling systems (e.g. SS7)
- SIP encapsulation in ISUP

NGN Service Aspects
- Services on an NGN
- Service compatibility with PSTN and IN
- Use of APIs and service provider interfaces

Mobile IP
- The concept of mobile IP
- Mobile IP application and limitations

Mobile Systems
- Brief review of the principles of mobile networks
- Relationship of mobile developments to NGN

Assessment:
Assessment is by undertaking a personal assignment

Tutorials/Workshops:
Two-hour tutorial to address the principles of NGN as taught on the module and to help the students tackle the assignment question.

Guest Speakers:
Normally a speaker from an operator is invited to give the latest situation on their NGN.

Suggested Reading
Books

Journals
doi: 10.1109/MCOM.2005.1522123
URL: http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=1522123&isnumber=32552

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