George Mason University
Graduate Course Approval/Inventory Form

Please complete this form and attach a copy of the syllabus for new courses. Forward it as an email attachment to the Secretary of the Graduate Council. A printed copy of the form with signatures should be brought to the Graduate Council Meeting. Complete the Coordinator Form on page 2, if changes in this course will affect other units.

Please indicate: ___X__ NEW  ____ MODIFY  ____ DELETE

Local Unit: ECE/TCOM  Graduate Council Approval Date:

Course Abbreviation: TCOM  Course Number: 609

Full Course Title: Interior Gateway Protocol Routing

Abbreviated Course Title (24 characters max.): IGP Routing

Credit hours: 3.0  Program of Record: MS in Telecommunications

Repeatable for Credit? ___ D=Yes, not within same term  _____ Up to hours
  ____ T=Yes, within the same term  _____ Up to   hours
  _N__ N=Cannot be repeated for credit

Activity Code (please indicate): ___ Lecture (LEC)  ___ Lab (LAB)  ___ Recitation (RCT)
  ___ Studio (STU)  ___ Internship (INT)  ___ Independent Study (IND)
  ___ Seminar (SEM)

Catalog Credit Format  3.0: 3.0: 0  Course Level: GF(500-600) ___X__ GA(700+)

Maximum Enrollment: 35  For NEW courses, first term to be offered: Spring 2005
Prerequisites or co-requisites: prerequisite course TCOM 509 and TCOM 515, or equivalent
Catalog Description (35 words or less) Please use catalog format and attach a copy of the syllabus for new courses: Course will discuss development of Interior Gateway Protocols, including standards documents; interaction between various interior and exterior gateway protocols; design procedures and implementation aspects; field trial issues; analysis of latest RFC information posted on the IETF web site.

For MODIFIED or DELETED courses as appropriate:
Last term offered:  Previous Course Abbreviation:  Previous number:

Description of modification:

APPROVAL SIGNATURES:
Submitted by:  ___Jeremy Allnutt__________________ email: _jallnutt@gmu.edu_

Department/Program:  ___ECE/MS in Telecommunications ___ Date: _Oct. 18th, 2004____

College Committee:  ________________________________ Date: __Oct. 21st, 2004____

Graduate Council Representative: ________________________________ Date: ________________
GEORGE MASON UNIVERSITY  
Course Coordination Form  

Approval from other units: Not Applicable  

Please list those units outside of your own who may be affected by this new, modified, or deleted course. Each of these units must approve this change prior to its being submitted to the Graduate Council for approval.

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Graduate Council approval: ________________________________ Date: ____________

Graduate Council representative: __________________________ Date: ____________

Provost Office representative: _____________________________ Date: ____________
1. CATALOG DESCRIPTION
   (a) TCOM 609 Interior Gateway Protocol Routing (3:3:0)
   (b) Prerequisites: TCOM 509 and TCOM 515, or equivalent
   (c) Catalog Description:
       Course will discuss development of Interior Gateway Protocols, including standards documents;
       interaction between various interior and exterior gateway protocols; design procedures and
       implementation aspects; field trial issues; analysis of latest RFC information posted on the IETF
       web site.

2. JUSTIFICATION
   (a) Course Objectives:
       This course is intended to build upon the general introduction to TCP/IP (TCOM 509) class. This
       course is designed to be largely theoretical rather than practical – routing protocol configuration
       and hands-on experimentation are covered in the IP Routing Protocols Lab (TCOM515). This
       course will give students the ability to design complex, routed networks for enterprise or service
       providers. This course is also intended to provide students with the theoretical background to
       understand and participate in the evaluation of routing standards documents such as Internet
       Engineering Task Force RFCs.
   (b) Course Necessity:
       The proposed course is one of a group of elective courses that will be part of the Protocol Course
       Progression in the TCOM program to be made available for advanced TCOM students and
       students from other, related programs who desire to become experts in this area. The course will
       form a necessary building block for Ph.D. students interested in developing Protocol Stacks.
   (c) Relationship to Existing Courses:
       The course is a natural progression for students to take following TCOM 509 and the basic
       network lab/lecture course TCOM 515, which introduce the concepts of routing protocols. This
       course is a companion to BGP Routing (TCOM 610) and may be taken simultaneously. A third
       course, TCOM 611 on MPLS, will require either TCOM 609 or TCOM 610 to be taken as a
       prerequisite. TCOM 609, TCOM 610, and TCOM 611 do not have any overlapping courses at
       George Mason University, although elements of all three courses have been taught previously as
       Advanced Topics course in the TCOM program.

3. APPROVAL HISTORY
   ECE Department Date: October 18th, 2004
   IT&E Graduate Committee Date: October 21st, 2004
   IT&E Dean Date:

4. SCHEDULING
   Every spring semester, starting spring 2005 and every spring thereafter.
   Proposed Instructors: Dr. Jeremy Allnutt, Mr. Scott Robohn, Dr. Yunqing Wu, and other suitably
   qualified faculty.
5. COURSE OUTLINE

(a) Syllabus

Week 1
Introduction to IP routing: Origins (OSI model); switching vs. routing; per-hop behavior; router forwarding; routing simulation;
Project discussion

Week 2
(Chapter 1 [Moy])
Mathematical background for IP routing: review of discrete math.; graph theory and IP routing; Dijkstra’s algorithm; Bellman-Ford algorithm; spanning tree; loop and loop-free behavior

Week 3
(Chapters 2, 3 [Moy]; Clark)
Distance vector and link-state protocols: historical development; comparison of different protocol types; earlier protocols (ARPANET)
Project effort initiated

Week 4
(Chapter 4 [Moy]; RFC2328)
Review of OSPF concepts: neighbor discovery process; timers; database exchange process; OSPF neighbor states; OSPF finite state machines; OSPF link state advertisement types

Week 5
(Chapters 5, 6, & 7 [Moy]; RFC2328; RFC3101)
Additional OSPF concepts: use of areas; area types – backbone, transit, stub, NSSA; inter-area routing behavior – summarization and LSAs; area scooping; OSPF on multi-access networks; designated routers; OSPF on non-broadcast multi-access networks

Week 6
(RFC2328)
OSPF network design: Example networks; comparative configuration methodologies

Week 7
Project effort review and mid-term exam: Project work - early progress review and assessments; mid-term exam

Week 8
Advanced OSPF concepts: virtual links; scaling to large networks; discussion of projects – final assignments.

Week 9
(Chapters 13.1, 13.2, and 13.4 [Moy]; [Garcia])
Enterprise IGPs and route redistribution: Routing information protocol (RIP); enhanced interior gateway protocol (IGP); Enhanced interior gateway protocol (EIGRP); DUAL algorithm; examples of
route redistribution and effects of scalability

Week 10
(Chapter 13.5 [Moy]; RFC1195)
ISIS routing: OSI addressing concepts; comparison with OSPF

Week 11
(RFC1195)
ISIS routing: ISIS network design; ISIS configuration methodologies

Week 12
(Chapter 13.3 [Moy]; [Lamport])
IGP protocol interaction: Routing protocol security; exterior gateway protocols

Week 13
(Chapter 9 [Moy])
Survey of advanced topics: Multicast routing; IGP convergence optimization; Ipv6 routing
Projects due

Week 14
Project presentations and discussion: projects presented and discussed; final exam review

Week 15
Final exam

(b) Required Reading and Reference Material

- [RFC3101] P. Murphy, “The OSPF Not-So-Stubby Area (NSSA)”, IETF RFC3101
- Applicable new IETF documents

(c) Student Evaluation Criteria

Mid-term: 35%
Project: 30%
Final: 35%