REPORT OF GRADUATE COUNCIL
March 3, 2005

The Graduate Council approved the new course request BIOL 603 Advanced TEM Methodologies in Life and Material Sciences which was remanded back to Graduate Council for course hour correction.
Texas A&M University  
Departmental Request for a New Course  
Undergraduate • Graduate • Professional

Submit original form and 25 copies. Attach a course syllabus to each.

1. This request is submitted by the Department of Biology

2. Course prefix, number and complete title: BIOL 603  
Advanced TEM Methodologies in Life and Material Sciences

3. Course description (not more than 50 words): This course is designed to provide students with advanced TEM methodologies including specimen preparation and TEM imaging/analysis techniques as applicable to both biological and material samples. The theory is designed to support a strong hands-on component comprising specimen preparation, different imaging/diffraction/spectroscopic techniques & data interpretation.

4. Prerequisite(s): normally BIOL 602  
Cross-listed with

5. Is this a variable credit course? ☐ Yes ☐ No
If yes, from _______ to _______.

6. Is this a repeatable course? ☐ Yes ☐ No
If yes, this course may be taken _______ times. Will the course be repeated within the same semester/term? ☐ Yes ☐ No

7. Has this course been taught as a 489/689? ☐ Yes ☐ No
If yes, how many times? _______ Enrolled for each academic period it was taught: _______ and _______.

8. This course will be:
   a. required for students enrolled in the following degree program(s) (e.g., B.A. in history)

   b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)

   M.S. and Ph.D. in all programs

9. If other departments are teaching or are responsible for related subject matter, the course must be coordinated with these departments. Attach approval letters.

10. Prefix: BIOL  
Course #: 603  
Title (exclude punctuation): Advanced TEM

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Do not complete shaded area.

Approval recommended by:

Head of Department Date  
Chair, College Review Committee Date

Head of Department (if cross-listed course) Date  
Dean of College Date

Submitted to Coordinating Board by:

Director of Academic Support Services Date  
Effective Date

* Attach a syllabus according to the guidelines on the Internet site www.tamu.edu/admissions/oaras. To have this form reviewed, please send to Linda F. Lacoy, Mail Stop 1265 or fax to 847-8737.
Texas A&M University
Departmental Request for a New Course
Undergraduate • Graduate • Professional
Submit original form and 25 copies. Attach a course syllabus to each.*

1. This request is submitted by the Department of __________ Biology.

2. Course prefix, number and complete title Biol 693-

3. Course description (not more than 50 words) This course is designed to provide students with advanced TEM methodologies including specimen preparation and TEM imaging/analysis techniques as applicable to both biological and material samples. The theory is designed to support a strong hands-on component comprising specimen preparation, different imaging/diffraction/spectroscopic techniques & data interpretation.

4. Prerequisite(s) normally BIOL 602 Cross-listed with __________ Cross-listed courses require the signatures of both department heads.

5. Is this a variable credit course? ☐ Yes ☐ No If yes, from _______ to _______.

6. Is this a repeatable course? ☐ Yes ☐ No If yes, this course may be taken _______ times. Will the course be repeated within the same semester/term? ☐ Yes ☐ No

7. Has this course been taught as a 489/689? ☐ Yes ☐ No If yes, how many times? _______ Indicate the number of students enrolled for each academic period it was taught. 8 and 8

8. This course will be:
   a. required for students enrolled in the following degree program(s) (e.g., B.A. in History)

   b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in Geography)

M.S./Ph.D. in all programs

9. If other departments are teaching or are responsible for related subject matter, the course must be coordinated with these departments. Attach approval letters.

10. Prefix Course # Title (exclude punctuation)

    BioL 693 ADVANCED TEM

    Lect Lab SCH Subject Matter Content Code Admin Unit Acad Year FICE Code
    1 5 9 3

    Do not complete shaded area.

Approval recommended by:

Head of Department Date

Chair, College Review Committee Date

Dean of College Date

Submitted to Coordinating Board by:

Dean of College Date

Director of Academic Support Services Date Effective Date

* Attach a syllabus according to the guidelines on the Internet site www.tamu.edu/admissions/cras. To have this form reviewed, please send to Linda F. Lacey, Mail Stop 1265 or fax to 947-8737.

OAIS-1099
BIOL603
Advanced TEM methodologies in Life and Material Sciences (TEM II)
Summer 2005

This 3-credit course in TEM has a strong emphasis on specimen preparation techniques for different applications, data acquisition, analysis and interpretation as well as artefact avoidance and recognition. This course normally requires successful completion of Fundamentals of Transmission Electron Microscopy (TEM I) or equivalent experience, i.e. demonstrated proficiency in the independent operation of a transmission electron microscope. This will be waived if specific needs to take this course can be demonstrated by the student. After evaluation by the relevant MIC teaching committee, permission to enroll in the course will be issued.

Course Description: This course is designed to provide students with advanced TEM methodologies including specimen preparation and TEM imaging/analysis techniques as applicable to both biological and material samples. Students will be equipped with the necessary theoretical background in support of a strong hands-on laboratory component comprising specimen preparation, different imaging/diffraction/spectroscopic techniques and data interpretation. The course is suitable for students in both, Life and Material Sciences and admitted candidates will, for this purpose, be divided into two cohorts.

Course format: The Life Sciences cohort meets on Monday and Wednesday and the Material cohort on Tuesday and Thursday.

Lectures and laboratory: There will be two 1-hour theory and application-oriented theory sessions (1-2 pm) per week for a period of five weeks. These sessions will involve theory of the techniques and practical applications with common and advanced protocols as well as algorithms to determine the best protocol or combination of techniques for the problem at hand. In addition to the theory and application-oriented theory sessions, there will be two 3-hour laboratory sessions (2-5 pm) per week over the entire 10-week period. These two laboratories each week will involve demonstrations by the MIC staff, hands-on experience by each student to re-enforce the theory sessions, and time for the students to advance their own research projects under lighter supervision. In addition to these scheduled hours, the students will spend approximately an additional 3 hours per week doing laboratory work (prep and TEM) at times that are suitable to them amounting to a total of 9 laboratory hours per week over the entire summer semester.

Homework: Each student is required to prepare a final write-up (see below).

Grading: There are two pieces of assessed coursework each accounting for 50% of the grade: an exam paper based on the lecture material probing the theoretical knowledge level attained, and a write-up in the style of a short research paper including an Introduction, Materials & Methods, Results and Discussion. The assessment of which takes into consideration as to whether the student is able to (i) correctly annotate and interpret the images/diffraction patterns, spectra etc. and (ii) critically appraise his/her results in the light of the relevant current literature.
THE AMERICANS WITH DISABILITIES ACT
The American with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Department of Student Life for Students with Disabilities in Room 126 of the Koldus Building, or call 845-1637.

ACADEMIC INTEGRITY
The Aggie Honor Code: An Aggie does not lie, cheat, or steal, or tolerate those who do. Academic misconduct, a violation of the Texas A&M Honor System, involves any of the following: cheating, fabrication, falsification, multiple submission, plagiarism, and complicity.
For explanations and examples of what constitutes academic dishonesty visit http://www.tamu.edu/aggiehonor

COPYRIGHTS
The handouts used in this course are copyrighted. By "handouts," is meant all materials generated for this class, which includes but is not limited to syllabi, lab problems, in-class materials, review sheets, and problem sets. Because these materials are copyrighted, you do not have the right to copy the handouts, unless the author expressly grants permission.
Lecture and Laboratory Schedule for TEM II (Biological Sciences)

Weeks 1-5

Theory and application-oriented theory session 1. Primary fixation, aqueous immersion and perfusion. Choice of primary fixative based on specimen and problem at hand. Vapor fixation for specific, anhydrous preparations. 1 h
Lab 1. Preparation of working protocols for safety and efficiency; preparation of buffers; primary fixation of plant and animal tissue to post fixation in osmium tetroxide. 3 h

Theory and application-oriented theory session 2. Post fixation, dehydration, infiltration, and embedding: Theory and practice for routine morphology and immunolabeling. 1 h
Lab 2. Post fixation, dehydration, infiltration and embedding. 3 h

Theory and application-oriented theory session 3. Embedding Media I. Epoxy resin components and formulations. 1 h
Lab 3. Making glass knives; cutting semi-thin sections and staining with toluidine blue. 3 h

Theory and application-oriented theory session 4. Embedding Media II. Acrylic resins and other embedding media. 1 h
Lab 4. Cutting ultra-thin sections. 3 h

Theory and application-oriented theory session 5. Principles of ultramicrotomy and glass knife preparation. 1 h
Lab 5. Post staining of ultra-thin sections and examination in TEM. 3 h

Theory and application-oriented theory session 6. Staining: En bloc and post staining of sections: theory and practice. 1 h
Lab 6. Continuation of Labs 4 and 5. 3 h

Theory and application-oriented theory session 7. Producing data from sections: Calibration and basic morphometry. 1 h
Lab 7. Continuation of Labs 4 and 5. 3 h

Theory and application-oriented theory session 8. Alternative procedures for special applications: microwave preparations, rapid freezing and freeze substitution, (immuno)cystochemical localization, replica techniques. 1 h
Lab 8. Continuation of Labs 4 and 5. 3 hr

Theory and application-oriented theory session 9. Trouble shooting: Questions and answers. 1 h
Lab 9. Continuation of Labs 4 and 5. 3 h
Theory 10. Written exam.
Weeks 5-10

Continuation of lab sessions 2 x 3 h per week fostering students’ own project work.

Lecture and Laboratory Schedule for TEM II (Material Sciences)

Weeks 1-5

**Theory and application-oriented theory session 1.** Sample preparation. Overview of TEM sample preparation techniques for diverse materials. 1 h

**Lab 1.** Practice of sample preparation: cutting, grinding, polishing, dimpling and ion milling. 3 h

**Theory and application-oriented theory session 2.** Electron diffraction I. Formation and indexing of selected-area electron diffraction patterns, poly-ring patterns. 1 h

**Lab 2.** Practice of electron diffraction in TEM and indexing using dedicated software. 3 h

**Theory and application-oriented theory session 3.** Electron diffraction II. Kikuchi patterns, convergent-beam electron diffraction (CBED). 1 h

**Lab 3.** Practice of Kikuchi line acquisition and analysis and CBED. 3 h

**Theory and application-oriented theory session 4.** Embedding and staining for materials. Epoxy and acrylic resin components and formulations: staining theory and practice. 1 h (AE)

**Lab 4.** Making glass knifes; cutting semi-thin sections; practice in embedding and staining. 3 h

**Theory and application-oriented theory session 5.** Principles of ultramicrotomy and glass knife preparation. 1 h (AE)

**Lab 5.** Cutting ultra-thin materials sections. 3 h

**Theory and application-oriented theory session 6.** Imaging I. Imaging contrast, bright-field (BF) and dark-field (DF) imaging; weak-beam dark-field (WBDF) imaging; two-beam condition and crystal defect identification. 1 h

**Lab 6.** Practice of BF, DF and WBDF imaging in the TEM, identification of dislocation Burgers vector. 3 h

**Theory and application-oriented theory session 7.** Imaging II. Principles of high-resolution electron microscopy (HREM); HREM data processing and interpretation. 1 h

**Lab 7.** Two-beam and WBDF operations and dislocation Burgers vector identification. 3 h

**Theory and application-oriented theory session 8.** Compositional analysis and related techniques. Energy dispersive spectroscopy (EDS), electron energy-loss spectroscopy (EELS), electron spectroscopic imaging (ESI), semi-STEM and STEM. 1 h

**Lab 8.** EDS data collection and elemental identification. 3 h

**Theory and application-oriented theory session 9.** Troubleshooting: questions and answers. 1 h
Lab 9. Continuation of Lab 8. 3h

Theory 10. Written exam.

Weeks 5-10

Continuation of lab sessions 2 x 3 h per week fostering students’ own project work.