The University of Arizona

GUIDELINES
FOR
GRADUATE CERTIFICATE APPROVAL

Directions:
1. Provide information regarding the proposed graduate certificate in the format requested on the attached pages. Respond to each item individually using “not applicable” where appropriate.
2. Obtain signatures of the proposed unit administrator and department or committee head and college dean or Director of GIDPs.* Signature verifies that the proposal has received faculty approval through appropriate procedures and that the unit has the resources to support the certificate.
3. Forward the original and one copy to the college office for the dean’s signature and retain a copy for departmental files.
4. The dean should forward the original to Academic Programs, Attn: Sandra Gonzales, CCIT 337, and retain the remaining copy for college files. An electronic version of the documents with appropriate signatures is preferred but not required.
5. Documents must be submitted in a timely manner to move through the campus approval process. UA campus protocols include review of the appropriate Graduate Council; Provost Management Group; and Academic Council (deans) review; Instruction and Curriculum Policy Committee of the Faculty Senate; and the Faculty Senate for final formal approval.

Initiating college, department, or committee:

Graduate Interdisciplinary Program (GIDP) in Statistics

Title of this proposal: Graduate Certificate in Statistics

Unit Administrator: (name and title) J. Bruce Walsh, GIDP Head

Signature: ___________________________ Date: ___________________________

College Dean: ___________________________ Date: ___________________________
(Signature)

*In some situations signatures of more than one dean or department head may be required. If the program changes have a commitment of resources from other than the initiating unit, the signature of the collaborating department/committee head and collaborating college dean is also required. If you have any questions, please contact Sandra Gonzales, CCIT 337, 621-1847.
I. Certificate Name and Description:

- Name of the certificate.
  Graduate Certificate in Statistics

- Managing department college, department, and oversight committee membership.
  Graduate Interdisciplinary Program (GIDP) in Statistics

- Specify whether the certificate is affiliated with an existing degree program or is a stand-alone certificate.

II. Certificate Requirements – Any changes to the originally approved certificate must be approved by the Graduate College.

- List the certificate requirements, including number of credit hours required and any special requirements for completion.
  Minimum 12 units of graduate-level courses, including 3 units of MATH 566--Theory of Statistics and a minimum of 9 units from a set list of elective courses (below).

- List current and new courses needed to meet certificate requirements. New courses should be designated as such and include a proposed catalog description. No less than 50% must be taken for a regular letter grade.

  Required: 3 units of MATH 566 -- Theory of Statistics

  Required: a minimum of 9 units taken for a letter grade from any of the following 23 areas:
  1. ANS 513/EPID 513/GENE 513 -- Statistical Genetics for Quantitative Measures
  2. AREC 517/ECON 517 -- Introductory Mathematical Statistics for Economists, or SIE 500A -- Introduction to SIE Methods: Probability and Statistics
  3. AREC 549/ECON 549 -- Applied Econometric Analysis
  4. CHP 676/EPID 676 -- Advanced Topics in Biostatistics
  5. CHP 684A/EPID 684A -- Theory of Linear Models
     New course. Proposed catalog description: This course serves as an introduction to estimation and hypothesis testing for general linear statistical models. Emphasis is placed on both the underlying theory and practical problems that are encountered in using these models. Beginning with a review of matrix algebra, the course continues with a discussion of the general linear univariate model, and the general linear multivariate model. Distribution theory, estimation and hypothesis testing are addressed, along with sample size determination. Prerequisites: CPH 576A, CPH 576B.
  6. CHP 684B/EPID 684B -- General Linear and Mixed Effects Models
     New course. Proposed catalog description: This course introduces basic concepts of linear algebra that are essential for understanding more advanced statistical modeling methodology. This knowledge is used to understand the General Linear Model (GLM) which includes ordinary linear regression, ANOVA, and other special applications and modern methods for the analysis of repeated measures, correlated outcomes and longitudinal data, including the unbalanced and
incomplete data sets characteristic of biomedical research. Topics include an introduction to matrices for statistics, general linear models, analysis of correlated data, random effects models, and generalized linear mixed models. Prerequisites: CPH 684A.

7. CHP 684C/EPID 684C -- Generalized Linear Modeling
New course. Proposed catalog description: This course serves as an introduction to Generalized Linear Models (GLMs) and Generalized Linear Mixed Models (GLMMs). GLMs introduces a unifying theory that combines the areas of linear models used for non-Gaussian data types including binary, count, and ordinal data. GLMMs extend the GLMs by the addition of random effects, thus increasing their usage to include analysis of correlated data. Applications include analysis of prospective or longitudinal data sets, which can have incomplete data or data collected at unequal time intervals. Prerequisites: CPH 684A and CPH 684B.

8. CHP 685/EPID 685 -- Statistical Consulting

9. CHP 686/EPID 686 -- Survival Analysis

10. ECOL 518 -- Spatio-temporal Ecology, or
    RNR 613 -- Applied Biostatistics

11. EDP 647 -- Techniques in Dimensionality Analysis: Principal Components and Factor Analysis

12. EDP 658B -- Theory of Measurement

13. GEOS 585A -- Applied Time Series Analysis, or
    MATH 562 -- Time Series Analysis, or
    SIE 533 -- Time Series Modeling, Analysis, and Applications

14. MATH 563 -- Probability Theory

15. MATH 564 -- Theory of Probability

16. MATH 567A -- Theoretical Statistics

17. MATH 567B -- Theoretical Statistics

18. MATH 570 -- Categorical Data Analysis

19. MATH 571A -- Advanced Statistical Regression Analysis
New course. Proposed catalog description: Regression analysis including simple linear regression and multiple linear regression. Matrix formulation and analysis of variance for regression models. Residual analysis, transformations, regression diagnostics, multicollinearity, variable selection techniques, and response surfaces. Students will be expected to utilize standard statistical software packages for computational purposes. Prerequisite(s): MATH 410 or MATH 413, or equivalent; and MATH 461 or MATH 466, or equivalent.

20. MATH 571B -- Design of Experiments, or
    PSYC 507C -- Research Design & Analysis of Variance, or
    SIE 536 -- Experiment Design and Regression
MATH 571B is a new course. Proposed catalog description: Principles of designing experiments. Randomization, block designs, factorial experiments, analysis of contrasts, multiple comparisons,
analysis of variance and covariance, repeated measures, variance components analysis. Students will be expected to utilize standard statistical software packages for computational purposes.

Prerequisite(s): MATH 223, or equivalent; and MATH 571A.

21. MATH 574/GEOG 574 -- Introduction to Geostatistics

22. SIE 522 -- Engineering Decision Making Under Uncertainty

23. SIE 531 -- Simulation Modeling and Analysis

- Describe any courses that will be offered via distance learning or other distributed methods? None currently, although courses on the required or elective list that are in the future offered through distance education will be accepted for credit towards the Certificate.

- Student Learning Outcomes
Students will obtain a firm foundation in the theory of statistical inference (via MATH 566) and also be allowed to design or select a concomitant curriculum pertinent to their own research or professional interests from a list of advanced, statistically-rigorous courses taken from across the campus' offerings.

III. Student Admittance/Advising/Completion – Student must have no less than a bachelor’s degree for a post-baccalaureate, a master’s degree for a Post-Master’s certificate or be currently enrolled in a graduate level program.

- Are there prerequisites or standardized tests required for admission? Students must have earned at least a bachelor’s degree from an accredited institution of higher learning. No standardized tests are required.

- Is concurrent enrollment in a degree program allowed, required? Concurrent enrollment is allowed, but not required.

- Is there a University credit requirement? University credit is the term used to identify all credit offered by The University of Arizona with the exception of correspondence and Special Examination for Credit. None for admission.

- Will transfer credit from other institutions be accepted? How many credit hours maximum? (May not exceed 6) No transfer of credit will be allowed; however, coursework taken previously at another institution may be used to satisfy prerequisites for any of the courses in the Graduate Certificate, at the discretion of the course instructor or department.

- What provisions are included for student advising? Students seeking advise for course selection and curriculum development may contact the Head of the GIDP in Statistics.

- May a student change from a certificate to a degree program? What are the provisions? Yes, as desired. Students desiring admission the M.S. or Ph.D. program in Statistics must meet all existing requirements for admission to those programs at the time admission is requested.
IV. Certificate and Student Outcomes

- Provide a plan and frequency for assessing the intended certificate outcomes both for students and the certificate.

Students earning the Certificate will be surveyed at the conclusion of their graduate studies to determine if the courses they selected to complete the Certificate served as important components of their Statistics education and training. One- and three-year follow-up assessments will be conducted. These will be web-based, but with active contact from the GIDP staff to target 90% return on the one-year and upwards of 80% on the three-year response. Feedback from these surveys will be forwarded to the GIDP curriculum committee for appropriate action.

V. Student Demand - Is there sufficient student demand for the certificate?

- What is the anticipated student enrollment for this certificate?
  Anticipated enrollment is 5-20 students over the next 3-5 years.

- Will there be any collaboration with other departments or universities to maximize resources?
  Yes. Due to the interdisciplinary nature of the Certificate and of the larger GIDP, up to 13 departments from 8 different colleges will collaborate in providing courses for the Certificate.

- Program demand/need. Will the certificate serve a community need, preparation for professional certification exams, degree program recruitment, employability enhancement, or other.
  The Certificate will serve to provide necessary training for graduate students in other graduate programs who require more than superficial knowledge in statistical theory and applications, and also offer the opportunity for supplementary training for students in areas where statistics plays a key role. Although approximately fifty graduate courses may be found from among the listings of over a dozen departments in many different Colleges, these various courses operate at highly disparate levels; the Certificate will help define a curriculum of study that ensures a substantive learning experience in the field of Statistics has been accomplished, and should be recognized/certified as such. The GIDP provides the appropriate venue to coordinate, rationalize, and utilize pertinent courses towards this goal and, at the same time, provide a focus of interest for current faculty interested in statistically oriented teaching and training.

VI. Expected Faculty and Resource Requirements

- List the name, rank, highest degree and estimate of level of involvement of all current faculty who will participate in the program.
  J. Bruce Walsh, GIDP Head, Ph.D., or his successor as GIDP Head, will provides the majority of effort/involvement for managing the Certificate. Other faculty associated with the Certificate are restricted to those who will teach the required and elective courses through the auspices of their home departments.

- Describe additional faculty needed for the first three years of the certificate.
  No additional faculty are required to begin offering the Certificate. Certain courses selected for inclusion in the Certificate's elective list are under development; any needs the sponsoring department has for offering these courses are the responsibility of that department.
Give the present numbers of FTE students and FTE faculty in the department or unit in which the certificate is offered. No students are currently enrolled in the Statistics GIDP, since the GIDP was only organized in 2006. We anticipate enrolling between 5-20 students over the next 3 years, admitting the first cohort in Fall 2007. Also, since the unit is a GIDP, it has no FTE faculty lines. However, over 30 full-time faculty members currently list affiliation with the GIDP.

Give the proposed numbers of FTE students and FTE faculty for the next three years in the department or unit in which the certificate is offered. Since the GIDP was only organized in 2006, we anticipate enrolling between 5-20 students (not including students applying for the proposed Graduate Certificate) over the next 3 years, admitting the first cohort in Fall 2007. Also, since the unit is a GIDP, it has no FTE faculty lines. However, we expect the over 30 full-time faculty members currently listing affiliation with the GIDP to continue their membership for the next 3 years and beyond.

Provide a copy of the current department budget and note any impact the approval of the certificate could have on department resources. The GIDP does not currently operate under its own budget, past the limited administrative supplement received from the Office of Graduate Interdisciplinary Programs. The new Certificate will have essentially no additional budgetary impact on the GIDP.

NOTE: Implementation of any graduate certificate requires approval by the appropriate university committees prior to announcement and implementation.

Effective: 4/2006