**Application Form For Opening Graduate Courses**

School (Department/Institute)：

Course Type: New Open  Reopen □ Rename □**（**Please tick in □, the same below）

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| --- | --- | --- |
| Course Name | Chinese | 检测与估计 |
| English | Detection and Estimation |
| Course Number |  | Type of Degree  | Ph. D | √ | Master |  |
| Total Credit Hours | 36 | In Class Credit Hours | 36 | Credit |  2 | Practice |  | Computer-using Hours |  |
| Course Type | □Public Fundamental □Major Fundamental □Major Compulsory Major Elective |
| School (Department) | School of Information Science and Engineering | Term | Spring term |
| Examination | A. □Paper（□ Open-book □ Closed-book） B. □Oral C. □Paper-oral Combination D.  Others Homework-based  |
| ChiefLecturer | Name | Nan Liu | Professional Title | Professor |
| E-mail | nanliu@seu.edu.cn | Website | Ncrl.seu.edu.cn/liunan |
| Teaching Language used in Course | Chinese-English | Teaching Material Website |  |
| Applicable Range of Discipline | First-class discipline | Name of First-Class Discipline | Information and Commmunications Engineering |
| Number of Experiment |  | Preliminary Courses | Random Processes |
| Teaching Books | Textbook Title | Author | Publisher | Year of Publication | Edition Number |
| Main Textbook | An Introduction to Signal Detection and Estimation | H. V. Poor | Springer-Verlag | 1997 | 1 |
| Main Reference Books | Mathematical Statistics: A Decision Theoretic Approach | T. S. Ferguson | AcademicPress | 1967 | 1 |
| Fundamentals of Statistical Signal Processing: Estimation Theory | S. M. Key | Prentice-Hall | 1993 | 1 |
| Fundamentals of Statistical Signal Processing: Detection Theory | S. M. Key | Prentice-Hall | 1993 | 1 |

1. **Course Introduction (including teaching goals and requirements) within 300 words:**

The class introduces the basic theory of detection and estimation. Students are required to learn the basic methods for detection and estimation of parameters. Basic methods for detection include Bayesian hypothesis testing, Neyman-Pearson tests; composite tests etc. Methods of parameter estimation include Bayesian parameter estimation, linear LS estimation, minimum variance unbiased estimation, maximum likelihood estimation, Cramer-Rao bound and nonlinear estimation. The focus of this course is not on the applications of estimation and detection, but rather the common problem solving framework that they all share. It is hoped that after this class, students can use the theory learnt and apply them successfully to all kinds of applications in the area of statistical signal processing, communications and control.

1. **Teaching Syllabus (including the content of chapters and sections. A sheet can be attached):**
	1. Review of probability: probability notation, random vectors, covariance matrices, abstract vector space
	2. Bayesian hypothesis testing; likelihood ration tests;
	3. Neyman-Pearson tests; receiver operating characteristics
	4. Composite hypothesis testing; uniformly most powerful tests
	5. Randomized tests
	6. M-ary hypothesis testing
	7. Performance evaluation; bounds
	8. Bayesian parameter estimation
	9. Linear least-squares estimation; orthogonality; normal equations
	10. Nonrandom parameter estimation
	11. Sufficiency, minimality, completeness
	12. Minimum variance unbiased estimation
	13. Cramer-Rao bound; efficiency
	14. Maximum likelihood estimation; properties
	15. Nonlinear estimation
2. **Teaching Schedule:**

|  |  |  |
| --- | --- | --- |
| Week | Course Content | Teaching Method |
| 1 | Review of probability: probability notation | Lecture |
| 2 | Review of probability: random vectors, covariance matrices | Lecture |
| 3 | Review of probability: abstract vector spaces | Lecture |
| 4 | Bayesian hypothesis testing; likelihood ration tests | Lecture |
| 5 | ROCs; LRT/ROC properties | Lecture |
| 6 | Neyman-Pearson tests; composite tests, UMPs | Lecture |
| 7 | Randomized tests | Lecture |
| 8 | M-ary hypothesis testing; performance evaluation and bounds | Lecture |
| 9 | Examples; Gaussian case; matched filter | Lecture |
| 10 | Bayesian parameter estimation: MAE, MAP | Lecture |
| 11 | Bayesian parameter estimation: LS; properties | Lecture |
| 12 | Linear LS estimation; orthogonality; properties | Lecture |
| 13 | Nonrandom parameter estimation; minimum variance unbiased estimation | Lecture |
| 14 | Sufficient statistics, minimality, complete sufficient statistics | Lecture |
| 15 | Cramer-Rao bound; efficiency | Lecture |
| 16 | Maximum likelihood estimation | Lecture |
| 17 | Properties of maximum likelihood estimation; examples | Lecture |
| 18 | Nonlinear estimation | Lecture |

Note: 1.Above one, two, and three items are used as teaching Syllabus in Chinese and announced on the Chinese website of Graduate School. The four and five items are preserved in Graduate School.

2. Course terms: Spring, Autumn , and Spring-Autumn term.

3. The teaching languages for courses: Chinese, English or Chinese-English.

4. Applicable range of discipline: public, first-class discipline, second-class discipline, and third-class discipline.

5. Practice includes: experiment, investigation, research report, etc.

6. Teaching methods: lecture, seminar, practice, etc.

7. Examination for degree courses must be in paper.

8. Teaching material websites are those which have already been announced.

9. Brief introduction of chief lecturer should include: personal information (date of birth, gender, degree achieved, professional title), research direction, teaching and research achievements. (within 100-500 words)

1. **Brief Introduction of Chief lecturer:**

Nan Liu: female, born in December, 1978. Ph.D., professor in Southeast University. She received the B.Eng. degree in electrical engineering from Beijing University of Posts and Telecommunications, Beijing, P. R. China in 2001, and the Ph.D. degree in electrical and computer engineering from University of Maryland, College Park, MD, USA in 2007. From 2007-2008, she was a postdoctoral scholar in the Wireless Systems Lab, Department of Electrical Engineering, Stanford University. In 2009, she became a faculty member in the School of Information Science and Engineering in Southeast University, Nanjing, China. Her research interests are in network information theory for wireless networks. She has published nearly 40 papers including 7 journal papers in the IEEE Transactions.

1. **Lecturer Information (include chief lecturer)**

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| --- | --- | --- | --- | --- |
| Lecturer | Discipline (major) | Email | Address | Postcode |
| Nan Liu | Wireless Communications | nanliu@seu.edu.cn | School of Information Science and Engineering, Southeast University | 210096 |