# 電信所博士生資格考核—考試科目參考書籍&範圍 GICE Doctoral Qualifying Exam – Reference Books and Range of Topics

• 筆試科目，考生可選依各組規定應考。每門考試時間均為**100**分鐘，試卷採彌封方式。 The written exams are separated into three categories; students will have 100 minutes to complete each subject within the test category. The test will be sealed.

• 筆試成績送學術委員會認定是否通過，未通過者必須重考，**筆試成績須委員會審定通過者，可申請撤銷免考**。重考得於一學期後提出申請，以一次為限。重考權仍未通過者，即取消公告退學。全部考試必須於進入博士班後**五**個學期以內通過（不包含休學期間），但經各組及所長認定須補修大學部學分超過九學分（含）者得延長資格考試年限為三年。After the tests are scored, the academic committee will determine if the student has passed the entire examination; students who fail to pass the exam will have ONE opportunity to apply for reexamination after one semester. You can obtain exemptions for the subjects you pass the first time from the reexamination. Failure to pass the reexamination will be subject to expulsion from the school. All subjects of the examination need to be passed within 5 semesters since the acceptance into the PhD program (The term(s) and year(s) of an approved leave of absence will not be counted). However, students who are required to take more than 9 college-level course credits will have three years to pass the qualifying exam. Waiver to the written qualifying examination will be given if the student has passed the required courses.

| 組別 Group | 考試科目 Exam Subjects | | 參考書籍 Reference Books | 參考範圍 Range of Topics | 參考網址 Reference Websites |
|---|---|---|---|---|---|
| 電波 EM | 微分方程 Differential Equations | 100% | 1. "Advanced Engineering Mathematics," 3rd ed., by Peter V. O'Neil , I.T.P. ( 4th ed. is available now )<br>2."Differential Equations with Boundary-Value Problems," 4th ed., by Dennis G. Zill and Michael R. Cullen. | • First order differential equations<br>• Differential equations of higher order<br>• Laplace transform<br>• Series solutions of linear differential equations<br>• Systems of differential equations<br>• Fourier series and integral<br>• Boundary-value problems - rectangular coordinate | |
| | 電磁學(一)、(二) Electromagnetics I & II | 100% | 1. "Field and Wave Electromagnetics," by David K. Cheng, 2nd ed., Addison-Wesley, 1989.<br>2."Elements of Engineering Electromagnetics," by N. N. Rao, 5th ed., Prentice-Hall, 2000. | • Vector analysis<br>• Static electric fields<br>• Solutions of electrostatic problems<br>• Steady electric currents<br>• Static magnetic fields<br>• Time-varying fields and Maxwell's equations<br>• Plane electromagnetic waves<br>• Theory and applications of transmission lines<br>• Waveguides and cavity resonators<br>• Antennas and radiating systems | |
| | 微波電路 Theory of Microwave Circuits and Devices | 100% | 1. "Microwave Engineering", David M. Pozar, 2nd ed., John-Wiely, 1998.<br>Chapter 2: 2.1, 2.3, 2.4, 2.5, 2.6, 2.7<br>Chapter 3: 3.1, 3.5, 3.7, 3.8<br>Chapter 4: 4.1, 4.2, 4.3, 4.4, 4.5, 4.6 (point of interest)<br>Chapter 5: 5.1-5.9<br>Chapter 6: 6.1, 6.2, 6.5, 6.7<br>Chapter 7: 7.1, 7.2, 7.3, 7.5, 7.6, 7.7, 7.8, 7.9<br>Chapter 8: 8.3-8.9<br>Chapter 10: 10.1-10.4<br>Chapter 11: 11.1-11.5<br>Chapter 12: 12.2-12.4 | • Transmission line theory<br>• Transmission lines and microwave network analysis<br>• Impedance and tuning<br>• Passive microwave circuits: resonator, power divider, directional coupler, filter<br>• Active microwave circuits: detector, mixer, PIN diode switch, amplifier, oscillator<br>• Basics of microwave systems | |
| | 天線 Antenna | 100% | 1. "Antenna Theory and Design," by Robert S. Elliott. | • Far-field integrals, reciprocity, directivity<br>• Radiation patterns of dipoles, loops, and helices<br>• Radiation patterns of horns, slots, and patch antennas<br>• Linear arrays: analysis<br>• Linear arrays: synthesis (Sec.5.1 to Sec.5.7 only)<br>• Self impedance and mutual impedance of antenna elements (Sec.7.1 to Sec.7.7 only) | |
| | 電磁理論 Electromagnetics Theory | 100% | 1. "Time-Harmonic Electromagnetic Fields," by R. F. Harrington, Ch.1 to Ch.6. | • Fundamental concepts ( Maxwell equations, energy and power, boundary conditions…)<br>• Introduction to waves ( Waves in lossy matter, reflection of waves, transmission lines, waveguides, resonators, antennas…)<br>• Some theorems and concepts ( Duality, uniqueness, image theory, equivalence principle, induction theorem, reciprocity, Green's functions, tensor Green's functions, integral equations, far-field approximation…)<br>• Plane wave functions and applications<br>• Cylindrical wave functions and applications<br>• Spherical wave functions and applications | |
| 通信 CSP | 線性代數 Linear Algebra | 50% | Linear Algebra: A Matrix Approach 2e by Spence, Insel, Friedberg | systems of linear equations, Gaussian elimination, reduced row echelon form, span, linear dependence/independence, invertibility and elementary matrices, inverse, linear transformations, determinants, subspaces, basis, coordinate, matrix representation of linear operator, eigenvalues, eigenvectors and diagonalization, orthogonality, Gram-Schmidt process, orthogonal projection, least-squares method, orthogonal matrices and operators, symmetric matrices, vector spaces and subspaces, linear transformations, basis, matrix representation of linear operators, inner product spaces | |
| | 機率與隨機程序 Probability and Random Process | 50% | 1. A. Papoulis and S.U. Pillai, Probability, Random Variables, and Stochastic Processes, fourth edition, McGraw-Hill, 2002.<br>2. H. Larson and B. Shubert, Probabilistic Models in Engineering Sciences, vols. 1 and 2, Wiley, 1979. | 1. Review of Random Variables (Papoulis, Chaps. 1-7, and class note)<br>2. Introduction to Random Processes: General Concepts and Spectral Analysis (Papoulis, Chap. 9, and class note)<br>3. Real-Valued Gaussian Random Vectors and Real-Valued Gaussian Random Processes (Larson & Shubert, class note)<br>4. Karhunen-Love Representation (Papoulis, Chap. 11, and class note) | http://homepage.ntu.edu.tw/~r04042121/stsu105.htm |
| | 數位通信 Digital Communications | 100% | | | |
| | 電腦通信網路 Computer Communication Networks | 100% | | | |
| | 數位訊號處理 Digital Signal Processing | 100% | A. V. Oppenheim and R. W. Schafer, Discrete-Time Signal Processing, Pearson | Chap 2 Discrete-Time Signals and Systems<br>Chap 3 The z-Transform<br>Chap 4 Sampling of Continuous-Time Signals<br>Chap 7 Filter Design Techniques<br>Chap 8 The Discrete Fourier Transform<br>Chap 9 Computation of the Discrete Fourier Transform | |
| 資網 DS | 線性代數 Linear Algebra | 50% | Linear Algebra: A Matrix Approach 2e by Spence, Insel, Friedberg | systems of linear equations, Gaussian elimination, reduced row echelon form, span, linear dependence/independence, invertibility and elementary matrices, inverse, linear transformations, determinants, subspaces, basis, coordinate, matrix representation of linear operator, eigenvalues, eigenvectors and diagonalization, orthogonality, Gram-Schmidt process, orthogonal projection, least-squares method, orthogonal matrices and operators, symmetric matrices, vector spaces and subspaces, linear transformations, basis, matrix representation of linear operators, inner product spaces | |
| | 機率與統計 Probability and Statistics | 50% | 1. R. Yates and D. Goodman, "Probability and Stochastic Processes," 2e, Wiley, 2005.<br>2. Bertsekas and J. Tsitsiklis, "Introduction to Probability," 2e, Athena Scientific, 2008.<br>3. Ghahramani, "Fundamentals of Probability with Stochastic Processes," 3e, Prentice Hall, 2005. | 1. Experiments, Models, and Probabilities<br>2. Random Variables (Discrete and Continuous)<br>3. Multi-variate Random Variables (Random Vectors)<br>4. Probability Models of Derived Random Variables<br>5. Conditional Probability Models<br>6. Sum of Random Variables<br>7. Parameter Estimation<br>8. Hypothesis Testing<br>9. Central limit theorem<br>10. Confidence Interval<br>11. and Law of large number | |
| | 離散數學 Discrete Mathematics | 50% | Discrete Mathematics and Its Applications 7th Edition | 1. Mathematical Reasoning :Logic, Proof methods, Inductive Proofs<br>2. Combinatorial Analysis : Summations, Countability, Probability, Combinatorics, Recurrences, Boolean Algebra<br>3. Discrete Structures : Sets, Functions, Sequences, Permutations, Relations, Graphs, Trees, Finite-state Machines<br>4. Algorithms : Orders of Growth, Complexity, Specification, Program verification<br>5. Application and modeling | |
| | 機器學習 Machine Learning | 100% | 1. Introduction to Machine Learning, second edition, Ethem Alpaydin<br>2. Pattern Recognition and Machine Learning, Christopher M. Bishop<br>3. Learning from Data, Yaser S. Abu-Mostafa , Malik Magdon-Ismail, Hsuan-Tien Lin | 1. Deep Neural Network<br>2. Convolutional Neural Network<br>3. Unsupervised Learning: Linear Models<br>4. Unsupervised Learning: Auto-encoder<br>5. Unsupervised Learning: Generative Model<br>6. Semisupervised Learning<br>7. Transfer Learning<br>8. Beyond Classification: Recurrent Neural Network<br>9. Beyond Classification: Structured Learning<br>10. Learning in the Real World: Reinforcement Learning | |
| | 資料科學 Data Science | 100% | Data Mining:<br>Concepts and Techniques, J. Han and M. Kamber, Morgan Kaufmann , 2000 | 1. Mining Association Rules<br>2. FPTree<br>3. Classification<br>4. Data, GPGPU<br>5. Data Classification<br>6. KNN, Bayes Theorem, Neural Net and Concept of SVM<br>7. SVM and Clustering<br>8. More on Clustering<br>9. Sequential Pattern Mining<br>10. Cloud Computing, Web Mining, and Social Networks | |
| | 電腦通信網路 Computer Communication Networks | 100% | Andrew S.Tanenbaum "Computer Networks" Third Edition 1996 Prentice-Hall International Inc. | 1. The Physical Layer<br>2. The Data Link Layer<br>3. The Medium Access<br>4. Network Layer<br>5. The Transport Layer<br>6. The Appication Layer | |

電波 EM：三科選考一科 Choose one subject out of three
通信 CSP：三科選考一科 Choose one subject out of three
資網 DS：三科選考二科 Choose two subjects out of three；三科選考一科 Choose one subject out of three