Course Changes
Texas A&M University
Departmental Request for a Change in Course
Undergraduate ♦ Graduate ♦ Professional
♦ Submit original form and attachments ♦

1. Request submitted by (Department or Program Name): Physics and Astronomy

2. Course prefix, number and complete title of course: PHYS 606 Quantum Mechanics

3. Change requested
   a. Prerequisite(s): From: ______________________________ To: ______________________________
   b. Withdrawal (reason): ______________________________
   c. Cross-list with: ______________________________
      Cross-listed courses require the signature of both department heads.
   d. Change in course title and description. Enter complete current course title and current course description in item 5; enter proposed course title and proposed course description in item 6. Complete item 7 for change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 7. Attach a course syllabus.

4. For informational purposes only, please indicate course number if this course will be stacked:

5. Complete current course title and current catalog course description:

6. Complete proposed course title and proposed catalog course description (not to exceed 50 words):

7. a. As currently in course inventory:

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   Approval recommended by:

   George R. Welch
   Department Head or Program Chair (Type Name & Sign) Date 11-21-12
   Chair, College Review Committee Date 12-10-12
   Dean of College Date 1-9-13
   Chair, GC or CCC Date 2-7-13

   Submitted to Coordinating Board by:

   Associate Director, Curricular Services Date
   Effective Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra.williams@tamu.edu. Curricular Services – 02/11
PHYS 606: Quantum Mechanics I
spring 2013

Instructor
Dr. Aleksei Zheltikov
zheltikov@physics.tamu.edu
MPHY 542
979.458.7934

Course meetings
TR 12:45-2:00pm in MPHY 107

Final exam
Wednesday, May 8, 2013; 8:00-10:00am

Course (catalog) description
Schrödinger wave equation, bound states of simple systems, collision theory, representation and expansion theory, matrix formulation, perturbation theory.

Prerequisites
MATH 601, PHYS 412 or equivalents

Texts
required
Quantum Mechanics, 3rd ed.; Dec 1997
by Eugen Merzbacher
publisher: Wiley
ISBN-10: 0471887021

recommended
Quantum Mechanics Non-Relativistic Theory, 3rd ed., vol. 3; 2000
by L. D. Landau and E. M. Lifshitz
publisher: Butterworth-Heinemann
ISBN-10: 0750635398

recommended
Modern Quantum Mechanics, 2nd ed.; Jul 2010
by J. J. Sakurai and Jim J. Napolitano
publisher: Addison Wesley
ISBN-10: 0805382917

Grading
50% homework assignments
50% two (2) exams
A = 90% or higher
B = 80%-90%
C = 60%-80%
See http://student-rules.tamu.edu/rule07 for information on University-excused absences.

Topics
Basic principles of quantum mechanics
Wave packets
Wave mechanics
Schrödinger equation, both time dependent and time independent
Operators, probabilities, and expectation values for physical observables
Eigenvalues and eigenfunctions of operators
Commutators
Uncertainty relations
Transformations between bases
Matrix mechanics
Exactly solvable 1-D problems
Sectionally-constant potentials
Harmonic oscillator, in both wave and matrix mechanics
Approximation methods in quantum mechanics
Variational method
Time-independent perturbation theory
Angular momentum in quantum mechanics
Basic principles
Allowed eigenvalues and eigenfunctions
Spin $\frac{1}{2}$
Spherically symmetric potentials
Free particle
Finite square well
Hydrogen atom

ADA statement
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academic integrity
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Texas A&M University
Departmental Request for a Change in Course
Undergraduate • Graduate • Professional
• Submit original form and attachments •

1. Request submitted by (Department or Program Name): Physics and Astronomy

2. Course prefix, number and complete title of course: PHYS 607 Statistical Mechanics

3. Change requested
   a. Prerequisite(s): From: ____________________________ To: ____________________________
   b. Withdrawal (reason): ____________________________
   c. Cross-list with: ____________________________

   Cross-listed courses require the signature of both department heads.

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   Approval recommended by:

   George R. Welch
   Department Head or Program Chair (Type Name & Sign)
   Date 11.21.2012

   Chair, College Review Committee
   Date 12-10-12

   Dean of College
   Date 1-9-13

   Chair, GC or UCE
   Date 2-7-13

   Submitted to Coordinating Board by:

   Associate Director, Curricular Services
   Date

   Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra.williams@tamu.edu.
PHYS 607 — Statistical Mechanics

PHYS 607: Statistical Mechanics
spring 2013

Instructor
Dr. Artem Abanov
abanov@physics.tamu.edu
MPHY 415
404.981.7799

Course meetings
MWF 10:20-11:10am in MPHY 107

Final exam
Tuesday, May 7, 2013; 8:00-10:00am

Course (catalog) description
Classical statistical mechanics, Maxwell-Boltzmann distribution, and equipartition theorem quantum statistical mechanics, Bose-Einstein distribution and Fermi-Dirac distribution applications such as polyatomic gases, blackbody radiation, free electron model for metals, Debye model of vibrations in solids, ideal quantum mechanical gases and Bose-Einstein condensation, and if time permits, phase transitions and nonequilibrium statistical mechanics.

Prerequisites
PHYS 408 and 412 or equivalents

Texts
required
by L. D. Landau and E. M. Lifshitz
publisher: Butterworth-Heinemann
ISBN-10: 0750633727

recommended
Statistical Mechanics, May 1990
by R. Kubo, H. Ichimura, T. Usui, and N. Hashitsume
publisher: North Holland
ISBN-10: 0444871039

Grading
50% weekly homework assignments
30% two (2) exams at 15% each
20% final exam
No late work is accepted without appropriate excuse. Attendance is required. Make-up exams will be provided to those with a University-excused absence. See http://student-rules.tamu.edu/rule07 for information on University-excused absences.

Topics
Thermodynamics
First law of thermodynamics — conservation of energy
Entropy
Definition of intensive parameters, $T$, $P$, and $\mu$, equations of state
Second law of thermodynamics — maximum work theorem
Legendre transformations and alternative formulation of thermodynamics — thermodynamic potentials
Reduction of thermodynamics derivatives — measurable physical properties
Thermodynamic inequalities and stability
Nernst’s theorem
Phase transitions — discontinuities, level rule, Clausius-Clapeyron
Mixtures — Gibbs phase rule, osmotic pressure

Statistical mechanics
Microcanonical formalism
Classical statistical mechanics — phase space, distribution functions
Canonical formalism
Classical ideal gas (internal degrees of freedom, translation, vibration, rotation, electronic)
Density of states — Debye model of crystals
Mean field theory — Ising model
Grand canonical formalism
Fermi and Bose statistics
Ideal Fermi gas
Photon gas
Ideal Bose gas — Bose Einstein condensation
Interacting classical gas
Fluctuations
Density matrices

Optional topics
Simple transport theory based on Maxwell distribution
Second order phase transitions

ADA statement
The Americans 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 that 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 Disability Services, in Cain Hall, Room B118, or call 979-845-1637. For additional information visit http://disability.tamu.edu.

academic integrity
1. Request submitted by (Department or Program Name): Physics and Astronomy

2. Course prefix, number and complete title of course: PHYS 611 Electromagnetic Theory

3. Change requested
   a. Prerequisite(s): From: _______________________________ To: _______________________________
   b. Withdrawal (reason): _______________________________
   c. Cross-list with: _______________________________

   Cross-listed courses require the signature of both department heads.

   d. Change in course title and description. Enter complete current course title and current course description in item 5; enter proposed course title and proposed course description in item 6. Complete item 7 for change in title.

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   Approval recommended by:

   George R. Welch
   Department Head or Program Chair (Type Name & Sign) Date: 11-21-2012
   Chair, College Review Committee Date: 12-10-12

   Department Head of Program Chair (Type Name & Sign) Date: 1-9-13
   Dean of College Date: 2-7-13

   Submitted to Coordinating Board by:

   George R. Welch
   Associate Director, Curricular Services Date: 02/11
   Effective Date:
PHYS 611 — Electromagnetic Theory II

PHYS 611: Electromagnetic Theory II
fall 2012

Instructor
Dr. Christopher Pope
pope@physics.tamu.edu
MIST M520
979.845.7793

Course meetings
MWF 9:10-10:00am in MPHY 213

Final exam
Monday, December 10, 2012; 8:00-10:00am

Course (catalog) description
Continuation of PHYS 603. Propagation, reflection and refraction of electromagnetic waves; wave guides and cavities; interference and diffraction; simple radiating systems; dynamics of relativistic particles and fields; radiation by moving charges.

Prerequisites
PHYS 603

Texts
recommended
The Classical Theory of Fields, 4th ed., vol. 2(Course of Theoretical Physics Series); Jan 1980
by L. D. Landau and E. M. Lifshitz
publisher: Butterworth-Heinemann
ISBN-10: 0750627689

recommended
by John David Jackson
publisher: Wiley
ISBN-10: 047130932X

Grading
20% homework assignments
25% midterm 1
25% midterm 2
30% final exam
See http://student-rules.tamu.edu/rule07 for information on University-excused absences.

Topics
Electrodynamics and special relativity/ Minkowski spacetime, Lorentz transformations, suffix notation for 4-vectors and tensors, proper time, 4-velocity

Maxwell's equations in 4-tensor notation; gauge potentials and gauge invariance, Lorentz transformations of E and B, Lorentz force

Action principle for charged particle, canonical momentum and Hamiltonian, relativistic particle motion in E and B fields, relativistic orbits in Coulomb potential

Action principle for electrodynamics; energy density and flux, energy-momentum tensor
Electromagnetic waves, polarization, waveguides, resonant cavities

Fields due to moving charges; retarded potentials, Lienard-Wiechert potentials, Larmor formula, angular and frequency distributions of radiated power, Cerenkov radiation, Thompson scattering

Multipole expansion, dipole radiation, higher multipoles, antennae

Electromagnetism and quantum mechanics; gauge transformations, covariant derivative, magnetic monopoles, Dirac quantisation

ADA statement
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academic integrity
Texas A&M University
Departmental Request for a Change in Course
Undergraduate • Graduate • Professional
Submit original form and attachments •

1. Request submitted by (Department or Program Name): Physics and Astronomy

2. Course prefix, number and complete title of course: PHYS 615 Methods of Theoretical Physics I

3. Change requested
   a. Prerequisite(s): From: __________________________ To: __________________________
   b. Withdrawal (reason): __________________________
   c. Cross-list with: __________________________
   d. Change in course title and description. Enter complete current course title and current course description in item 5; enter proposed course title and proposed course description in item 6. Complete item 7 for change in title.
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   Approval recommended by:

   George P. Welch
   Department Head or Program Chair (Type Name & Sign) Date 11.21.2012

   Chair, College of Physics
   Date 12-10-12

   Department Head of Program Chair (Type Name & Sign)
   (if cross-listed course)

   Dean of College
   Date 1-9-13

   Submitted to Coordinating Board by:

   Associate Director, Curricular Services
   Date

   Effective Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandrawilliams@tamu.edu.
Instructor
Dr. Ergin Sezgin
sezgin@physics.tamu.edu
MIST MS21
979.845.7795

Course meetings
TR 2:20-3:35pm in MPHY 107

Final exam
Wednesday, May 8, 2013; 1:00-3:00pm

Course (catalog) description
Orthogonal eigenfunctions—with operator and matrix methods applied to solutions of the differential and integral equations of mathematical physics; contour integration, asymptotic expansions of Fourier transforms, the method of stationary phase and generalized functions applied to problems in quantum mechanics.

Prerequisites
MATH 311, 407, and 412 or equivalents

Texts
recommended
Mathematical Methods of Physics, 2nd ed.; 1970
by Jon Mathews and Robert L. Walker
publisher: W. A. Benjamin
ISBN-10: 0805370021

Grading
50% homework assignments, plus class participation
25% two midterms
25% final exam
See http://student-rules.tamu.edu/rule07 for information on University-excused absences.

examinations
The first midterm will be administered approximately six weeks into the semester; the second midterm will follow approximately six weeks after the first exam. No books or notes will be permitted during examinations. The final exam will cover all topics discussed in class.

homework
Weekly problem sets will be required. There will be a total of twelve sets during the semester. Students may work together on the problem assignments, but each student must turn in solutions written entirely in his/her own handwriting. Active participation in class by asking or answering questions will also count towards grades. An extension of the deadline to turn in homework may be approved in special situations, but homework will not be accepted after the solutions have been posted.

Topics
Differential equations of physics; first-order equations, separation of variables
Legendre equation, properties of Legendre polynomials, generating function, Rodrigues’ formula, Associated Legendre functions, spherical harmonics
Singular points of second-order ODEs, Wronskian, series solutions, Green-function methods, Sturm-
Liouville theory

Functions of a complex variable; complex numbers, analytic functions, contour integration, classification of singularities, calculus of residues, evaluation of real integrals, summation of series, analytic continuation

Gamma function, Riemann zeta function, asymptotic expansions, method of steepest descent

Cartesian vectors and tensors, rotation group, tensor calculus

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Texas A&M University
Departmental Request for a Change in Course
Undergraduate • Graduate • Professional
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1. Request submitted by (Department or Program Name): Physics and Astronomy

2. Course prefix, number and complete title of course: PHYS 619 Modern Computational Physics

3. Change requested
   a. Prerequisite(s): From: ___________________________ To: ___________________________
   b. Withdrawal (reason): ___________________________
   c. Cross-list with: ___________________________

   Cross-listed courses require the signature of each department head.

   d. Change in course title and description. Enter complete current course title and current course description in item 5; enter proposed course title and proposed course description in item 6. Complete item 7 for change in title.

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   Department Head or Program Chair (Type Name & Sign) Date 11-27-12

   Chair, College Review Committee Date 12-10-12

   Dean of College Date 1-9-13

   Chair, GC or MCC Date 2-7-13

   Submitted to Coordinating Board by:

   Associate Director, Curricular Services Date

   Effective Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra.williams@tamu.edu.
Curricular Services - 02/11
PHYS 619 – Computational Physics (Spring 2014)

Meeting times
- Lecture: Monday and Wednesday 12:40 – 13:30 (MPHYS 213)
- Lab: Monday 15:00 – 16:40 (MPHYS 330A)

Course description: Introduction to computational and simulative techniques widely used in physics applications and research, including trajectory integration, wave motion analysis, molecular dynamics, (quantum) Monte Carlo methods, statistical mechanics of spin systems, phase transitions, quantum evolution, bound state problems, and variational methods. Introduction to computer architectures, GPU and HPC programming for physicists. 3 credits.

Prerequisites
- PHYS 408 (or equivalent)
- PHYS 412 (or equivalent)
- knowledge of a high-level language such as C (via CSCE 206 or equivalent) and a scripting language

Course website: http://katzgraber.org/teaching/SS14-401-619 (all information posted online)

Instructor
Helmut G. Katzgraber
MPHYS 409
hkg@tamu.edu
979 845 8532

Office Hours
by appointment

TA
Ross McDonald

Grading Policies
- Lab: 20%
- Homework: 20%
- Semester-long project: 40%
- Written report: 10%
- End-of-semester Presentation: 10%

Note that there will be no midterms or a final exam. If you score 70% or lower in the lab, you fail the course. The projects will be distributed in the first week.
Textbook

The lecture notes will serve as cliff notes to multiple textbooks that will be introduced in the first lecture.

Syllabus

1. Introduction to programming techniques and computer architectures via numerical solutions of ODEs (e.g., Euler, Runge-Kutta).

2. Harmonic oscillators (Verlet and symplectic methods), transition to chaos (Lyapunov exponents, logistic map, ...), Duffing equation.


5. Fractals (Newton-Raphson, Mandelbrot, Sierpinsky).


7. Statistical mechanics and phase transitions (Ising model, Monte Carlo methods, first vs second-order phase transitions).

8. Statistical data analysis (fitting, plotting, ...)

9. Molecular dynamics

10. Quantum mechanics (shooting and matching methods, matrix methods, exact diagonalization, variational approaches and quantum Monte Carlo methods).
Lab component

1. Development of proper coding techniques and provenance. Use of common tools such as version control systems, debuggers, profilers. Code optimization to illustrate different computer hardware components.

2. Introduction to symbolic programming with Mathematica by applying the concepts learned in class to chaotic systems (Duffing equation and damping).

3. Kepler problem, programming anharmonic oscillators with high-level languages.

4. Numerical determination of electric field distributions (Introduction to GPU computing).

5. Using symbolic languages to efficiently study fractal systems (emphasis on graphical display of the results).

6. Good vs bad random number generators, tests, efficient implementations. Introduction to MPI and parallel programming illustrated via the computation of π using random sampling on multi-core systems.

7. Importance vs simple sampling, Markov chains, simulation of the one-dimensional Ising model (in class from scratch).

8. Hands-on statistical data analysis lab, computing error bars via bootstrap and jackknife methods. Fitting and plotting with gnuplot.

9. Solidification and melting transition, jamming of granular systems.

10. Solving of time-independent Schrödinger equations, variational methods (harmonic oscillator), matrix methods (anharmonic oscillator), shooting, quantum Monte Carlo.

11. Introduction to the LaTeX typesetting language. Presentation skills.
Semester-long projects

These shall be tackled by teams of 2 – 3 students. Topics include: two-dimensional Ising model with cluster algorithms, hysteresis in magnetic materials with randomness, computing electric field distributions of complex geometries with GPUs, parallel molecular dynamics simulations, etc.

ADA Policy Statement

The Americans 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 that 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 Disability Services, in Cain Hall, Room B118, or call 845-1637. For additional information visit http://disability.tamu.edu.

Academic Integrity Statement

"An Aggie does not lie, cheat or steal, or tolerate those who do." See http://aggiehonor.tamu.edu.
Texas A&M University
Departmental Request for a Change in Course
Undergraduate • Graduate • Professional
• Submit original form and attachments •

1. Request submitted by (Department or Program Name): Physics and Astronomy
2. Course prefix, number and complete title of course: PHYS 624 Quantum Mechanics

3. Change requested
   a. Prerequisite(s): From: __________________________ To: __________________________
   b. Withdrawal (reason): __________________________
   c. Cross-list with: __________________________
   d. Change in course title and description. Enter complete current course title and current course description in item 5; enter proposed course title and proposed course description in item 6. Complete item 7 for change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 7. Attach a course syllabus.

4. For informational purposes only, please indicate course number if this course will be stacked: __________________________

5. Complete current course title and current catalog course description: __________________________

6. Complete proposed course title and proposed catalog course description (not to exceed 50 words):

7. a. As currently in course inventory:

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Approval recommended by:

George R. Welch 11.21.2013
Department Head or Program Chair (Type Name & Sign) Date

Chair, College Review Committee 12.7.12
Date

Dean of College 1-9-13
Date

Chair, GC or GCC 2-7-13
Date

Questions regarding this form should be directed to Sandra Williams at 845-8251 or sandra.williams@tamu.edu
Curricular Services – 02/11
PHYS 624: Quantum Mechanics II
fall 2012

Instructor
Dr. Valery Pokrovsky
valery@physics.tamu.edu
MPHY 457
979.845.1175

Course meetings
MW 4:10-5:25pm in MPHY 213

Final exam
Monday, May 6, 2013; 3:30-5:30pm

Course (catalog) description
Continuation of PHYS 606. Scattering theory, second quantization, angular momentum theory, approximation methods, application to atomic and nuclear systems, semiclassical radiation theory.

Prerequisites
MATH 601, PHYS 412 or equivalents

Texts
required
Quantum Mechanics, 3rd ed.; Dec 1997
by Eugen Merzbacher
publisher: Wiley
ISBN-10: 0471887021

recommended
Quantum Mechanics Non-Relativistic Theory, 3rd ed., vol. 3; 2000
by L. D. Landau and E. M. Lifshitz
publisher: Butterworth-Heinemann
ISBN-10: 0750635398

recommended
Modern Quantum Mechanics, 2nd ed.; Jul 2010
by J. J. Sakurai and Jim J. Napolitano
publisher: Addison Wesley
ISBN-10: 0805382917

Grading
50% homework assignments
50% two (2) exams
A = 90% or higher
B = 80%-90%
C = 60%-80%
See http://student-rules.tamu.edu/rule07 for information on University-excused absences.

Topics
- Elementary scattering theory; phase shifts and scattering; low and high-energy scattering; Lippmann-Schwinger formalism; Higher Born approximations; resonance scattering.
- Spin; SO(3) group and its irreducible representations; spin-orbit coupling; spin in magnetic field.
- Addition of angular momenta.
- Discrete symmetries: P, CP, CPT; time reversal invariance; Kramers degeneration.
- Propagators and path integrals; quantum interference phenomena: gravitational interference, Aharonov-Bohm effect.
- Adiabatic approximation; Berry's phase; Landau-Zener theory.
- Many-body quantum mechanics; second quantization; spin and statistics; atoms and molecules; Bose-Einstein condensation.

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Texas A&M University
Departmental Request for a Change in Course
Undergraduate • Graduate • Professional
* Submit original form and attachments *

1. Request submitted by (Department or Program Name): Department of Veterinary Large Animal Clinical Sciences

2. Course prefix, number and complete title of course: VLCS 422/622 Equine Disease and Epidemiology

3. Change requested
   a. Prerequisite(s): From: ___________________________ To: ___________________________
   b. Withdrawal (reason):
   c. Cross-list with: _______________________________________________________________

   Cross-listed courses require the signature of both department heads.
   d. Change in course title and description. Enter complete current course title and current course description in item 5; enter proposed course title and proposed course description in item 6. Complete item 7 for change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 7. Attach a course syllabus.

4. For informational purposes only, please indicate course number if this course will be stacked: VLCS 622

5. Complete current course title and current catalog course description:
   Equine Disease and Epidemiology

6. Complete proposed course title and proposed catalog course description (not to exceed 50 words):
   Equine Epidemiology and Infectious Diseases

7. a. As currently in course inventory:
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   Approval recommended by:
   Dr. Allen J. Roussel, Jr. Date: 1/8/13
   Department Head or Program Chair (Type Name & Sign)

   Dr. Jane Welsh Date: 1/9/13
   Chair, College Review Committee

   Dean of College Date: 1-10-13
   Dr. Eleanor Green

   Chair, GC or UCC Date: 2-4-13
   Submitted to Coordinating Board by:

   Associate Director, Curricular Services Date

   Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
   Curricular Services — 02/11