University of Maryland
Department of Physics

PHYS420 Principles of Modern Physics (Spring 2002)
Course Syllabus

This syllabus was last modified on 26 April 2002 and succeeds all previously dated versions.

Class description

A survey of atomic and nuclear phenomena and the main trends in modern physics. Appropriate for students in engineering and other physical sciences (3 credits).

Meeting times: MWF 12:00 – 12:50 pm in room PHY 4220.
Class website: http://riq.umd.edu *(during semester only)*

Instructor

Enrique 'Riq' Parra

Office: Computer and Space Sciences building (CSS), Room B0205 (in the basement)
Phone: (301) 405-0052
Email: riq@wam.umd.edu

No formal office hours are scheduled. You are encouraged to stop by my office any time for help. Call ahead to make sure that I'm there. You can also call or email me with questions.

Teaching Assistant

Haihong Che

Office: Physics building, Room 1322
Phone: (301) 405-6185
Email: hche@Glue.umd.edu
Office hours: Tuesday 12:30 – 1:30 pm
Thursday 12:30 – 1:30 pm

Required text

Modern Physics (2nd ed.) by R.A. Serway, C.J. Moses and C.A. Moyer

Examination / grading policy

Homework: Assignments will be assigned weekly. Late homework will not be accepted.
Note: Physics problems are often best solved through discussions with others and

students ARE encouraged to work in groups. However, copying someone else's work is cheating and will not be tolerated.

Closed book quizzes may occasionally be given during lectures. They will be announced.

There will be two 50-minute, in-class exams and a final exam.
The final exam will be on the last day of classes, **May 13th**.

Grading breakdown:	Homework and quizzes	40%
	Exam 1	20%
	Exam 2	20%
	Final Exam	20%

Tentative Lecture Schedule

The following is a tentative schedule of the material to be covered in this class. This schedule is meant to provide a rough outline of the course and may change somewhat as the semester progresses.

Week 1

Lecture 1 (January 28)

Introductions, syllabus, website, survey, pretest, etc…

Lecture 2 (January 30)

1. Physics in the 19th century: Mechanics, gravity, thermodynamics
2. Maxwell's equations (1860's), the ether, Hertz's experiments

Lecture 3 (February 1)

3. Inertial reference frames, Galilean transformations

Week 2

Lecture 4 (February 4)

4. Galilean invariance

Lecture 5 (February 6)

5. Michelson – Morley experiment (1887)

Lecture 6 (February 8)

6. Albert Einstein's (1879 – 1955) Special Relativity
7. Postulates, synchronicity, time dilation

Week 3

Lecture 7 (February 11)

8. Length contraction
9. Lorentz Coordinate Transformations

Lecture 8 (February 13)

10. Lorentz velocity transformations

Lecture 9 (February 15)

11. Relativistic Doppler effect
12. Relativistic mechanics: momentum, force

Week 4

Lecture 10 (February 18)

13. Relativistic mechanics: kinetic energy
14. Mass energy conservation
15. Samples of papers verifying Special Relativity

Lecture 11 (February 20)

16. Twin Paradox – *optional lecture*

Lecture 12 (February 22)

17. Continuous spectra, visible wavelength regime
18. Blackbodies, Kirchhoff's law, Stefan's law, Displacement law

Week 5

Lecture 13 (February 25)

19. Wein's law, Rayleigh – Jeans law
20. Planck's law intro to the quantum

Lecture 14 (February 27)

21. Exam review

Lecture 15 (March 1)

22. Exam # 1

Week 6

Lecture 16 (March 4)

23. Line spectra (Bunsen, Kirchhoff)

Lecture 17 (March 6)

24. Vacuum discharges, Balmer, Rydberg, Cathode rays

Lecture 18 (March 8)

25. Cathode rays

Week 7

Lecture 19 (March 11)

26. J.J. Thomson

Lecture 20 (March 13)

27. Phenomenology of the photoelectric effect, Lenard.

Lecture 21 (March 15)

28. Einstein's solution to the photoelectric effect

Week 8

Lecture 22 (March 18)

29. Natural radioactivity, Becquerel, Curies

Lecture 23 (March 20)

30. Rutherford / Soddy, Isotopes, Half-life

Lecture 24 (March 22)

31. Rutherford atomic model, Moseley's x-rays

SPRING BREAK (3/25 – 3/29)

Week 9

Lecture 25 (April 1)

32. The Bohr atom

Lecture 26 (April 3)

33. Correspondence Principle, Franck–Hertz, Artificial transmutation

Lecture 27 (April 5)

34. de Broglie, Heisenberg, Schrödinger, Born

Week 10

Lecture 28 (April 8)

35. History epilogue (1930's – 1940's): Fission, chain reactions & the bomb

Lecture 29 (April 10)

36. Exam review

Lecture 30 (April 12)

37. Exam # 2

Week 11

Lecture 31 (April 15)

38. de Broglie Matter waves, Heisenberg's Uncertainty Principle

Lecture 32 (April 17)

39. Wavegroup formalism

Lecture 33 (April 19)

40. Double Slit thought experiment

Week 12

Lecture 34 (April 22)

41. Schrödinger's equation

Lecture 35 (April 24)

42. Particle in box potential

Lecture 36 (April 26)

43. Finite square well & harmonic oscillator potential

Week 13

Lecture 37 (April 29)

44. Qualitative plots & periodic potentials

Lecture 38 (May 1)

45. Observables, operators & expectation values

Lecture 39 (May 3)

46. Tunneling phenomena

Week 14

Lecture 40 (May 6)

47. QM in 3D

Lecture 41 (May 8)

48. Periodic table & quantum statistics

Lecture 42 (May 10)

49. Exam review

Week 15

Lecture 43 (May 13)

50. Exam # 3

** May 14 Campus - Last day of classes

** May 15 Campus - Exam study day

** May 22 **No final exam on this date, moved to 5/13/02**