SIMON FRASER UNIVERSITY

S.78-151

MEMORANDUM

To: Senate	From: N.R. Reilly, Chairman Senate Committee on Undergraduate Studies
Subject: Changes in Physics Program	Date: 15 November 1978

Action taken by the Senate Committee on Undergraduate Studies at its meetings on October 10 and November 14, 1978 gives rise to the following motion:

MOTION

That Senate approve and recommend approval to the Board of Governors of the proposed changes in the Physics program as outlined below and detailed in S78-151:

(A) **Physics - lower division laboratory changes**

a) PHYS 131-2, change of vector

b) PHYS 233-2, change of prerequisite
PHYS 234-2, change of prerequisite
PHYS 235-2, change of prerequisite

PHYS 231-3, deletion of course
PHYS 232-3, deletion of course
PHYS 236-1, deletion of course

c) **Required lower division laboratory courses for Physics Major and Physics Honours students**

d) **Laboratory prerequisite for third-year Physics laboratories**

(B) **Proposed upper division Physics changes**

a) **PHYS major - revised upper division PHYS requirements**

b) **PHYS honours - revised upper division PHYS requirements**

c) **PHYS honours - revised upper division MATH requirements**

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d) New courses

PHYS 325-3 Relativity and Electromagnetism
PHYS 326-3 Electronics and Instrumentation
PHYS 331-3 Electronics Laboratory
PHYS 344-3 Thermal Physics
PHYS 345-3 Statistical Physics
PHYS 355-3 Optics
PHYS 384-3 Methods of Theoretical Physics I
PHYS 385-3 Quantum Mechanics
PHYS 413-3 Advanced Mechanics
PHYS 415-3 Quantum Mechanics
PHYS 425-3 Electromagnetic Theory
PHYS 465-3 Solid State Physics
PHYS 484-3 Methods of Theoretical Physics II

e) Prerequisite change and title change, PHYS 332-3

f) Change in course description and prerequisite, PHYS 431-4

g) Deletion of courses

PHYS 334-4 Introduction to Electronics

PHYS 341-4 Thermal and Statistical Physics
PHYS 351-4 Optics
PHYS 381-4 Modern Physics
PHYS 382-4 Mathematical Physics
PHYS 411-4 Classical Mechanics
PHYS 412-4 Quantum Mechanics
PHYS 421-4 Electromagnetism
PHYS 461-4 Solid State Physics

FOOTNOTE: It should be noted that in the description of Major and Honors requirements in Physics there is reference to two nuclear science courses. These courses will be dealt with in a separate motion from the Senate Committee on Undergraduate Studies.

Norman R. Reilly

N.R. Reilly

/kb

SIMON FRASER UNIVERSITY SCUS 78-46

MEMORANDUM

To: H.M. Evans, Secretary to SCUS	From: J.M. Webster Dean of Science
Subject: Proposed Lower Division Laboratory Course Changes - Physics	Date: 1978 10 03 adjusted - 26/10/78

The Faculty of Science, at its meeting of 1978 09 28, approved the following changes in the Physics lower division laboratory courses.

1. The restructuring of the lower division physics laboratory offerings will consist of:

   Change of vector: Phys 131-2 General Physics Laboratory changed from 0-0-4 to 0-0-3.

   Prerequisite change: Phys 233-2 Introductory Physics Laboratory A Prerequisite changed to Phys 131-2, from PHYS 121-3 or 102-3

   Prerequisite change: Phys 234-2 Introductory Physics Laboratory B Prerequisite changed to Phys 233-2, from PHYS 121-3 or 102-3

   Prerequisite change: Phys 235-2 Introductory Physics Laboratory C Prerequisite changed to P234-2, from PHYS 121-3 or 102-3

   Courses to be deleted:
   Phys 231-3 Introductory Physics Laboratory I
   Phys 232-3 Introductory Physics Laboratory II
   Phys 236-1 Introductory Physics Laboratory D

2. The required lower division physics laboratory courses for physics major and physics honours students will be:

   Phys 131-2 General Physics Laboratory
   Phys 233-2 Introductory Physics Laboratory A
   Phys 234-2 Introductory Physics Laboratory B

3. The laboratory prerequisite for the 3rd year physics laboratories will be at least 4 semester hours of credit in lower division physics laboratories.

RATIONALE

When the Lower-Level Physics Programme was first set, it was felt that in order to make the physics labs more interesting, the labs would be postponed until students had taken a full year of physics courses.

However, over the years it has been found that there is just too large a jump between High School Physics and the second year physics laboratories. It is therefore recommended that the inclusions of Phys 131-2, a first year laboratory, be a required prerequisite for the second year laboratory. In doing so, it is believed the second year laboratory can remain challenging and interesting. The Phys 131-2 vector has been revised to (0-0-3). It was felt that this was a more reasonable vector for this laboratory than the present (0-0-4) vector.

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The total number of required credits for physics majors and honours students in the lower-level laboratories remains at six although the total number of hours spent in the lower-level laboratories increases from 8 hours to 9 hours.

J.M. Webster

JMW/mgj

SIMON FRASER UNIVERSITY SCUS 78-47

MEMORANDUM

To: H.M. Evans, Secretary S.C.U.S.	From: J.M. Webster, Dean of Science
Subject: Proposed Upper Division Physics Revisions	Date: 1978 10 02

The Faculty of Science, at its meeting of 1978 09 28, approved the following revisions to the PHYS upper division curriculum and asked that these proposed revisions be forwarded to the Senate Committee on Undergraduate Studies for consideration and approval.

The proposed changes are:

PHYS major - revised upper division PHYS requirements
PHYS honours - revised upper division PHYS requirements
PHYS honours - revised upper division MATH requirements

New course	PHYS 325-3	Relativity and Electromagnetism
New course	PHYS 326-3	Electronics and Instrumentation
New course	PHYS 331-3	Electronics Laboratory
Prerequisite change and title change	PHYS 332-3	Intermediate Laboratory
New course	PHYS 344-3	Thermal Physics
New course	PHYS 345-3	Statistical Physics
New course	PHYS 355-3	Optics
New course	PHYS 384-3	Methods of Theoretical Physics I
New course	PHYS 385-3	Quantum Physics
New course	PHYS 413-3	Advanced Mechanics
New course	PHYS 415-3	Quantum Mechanics
New course	PHYS 425-3	Electromagnetic Theory
Change in course description and prerequisite change	PHYS 431-4	Advanced Physics Lab I
New course	PHYS 465-3	Solid State Physics
New course	PHYS 484-3	Methods of Theoretical Physics II

Courses deleted: PHYS 334-4, 341-4, 351-4, 381-4, 382-4, 411-4, 412-4, 421-4, 461-4.

The details of these changes, rationale and course descriptions are attached.

J.M. Webster
Dean of Science

JMW:km
Attach.

SIMON FRASER UNIVERSITY

MEMORANDUM

To: Harry Evans, Secretary SCUS	From: N. Heath Assistant to the Dean of Science
Subject: Proposed Upper Division Physics Revisions	Date: 1978 10 30

With regard to the Proposed Upper Division Physics Revisions which were submitted to you in Dr. Webster's memorandum of 1978 10 02, we have been advised by L. Thomas, Collections Librarian, that the proposed revisions have been examined by the Science Librarian and that they are confident that their present resources are sufficient to support these proposed revisions.

Nick Heath

NH/mgj

cc: Dr. N. Reilly, Chairman
SCUS

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Revised 78-10-05

THE PHYSICS UPPER DIVISION REVISION

For the past year the Physics Undergraduate Curriculum Committee and the Physics Department have been considering the physics upper division course offerings and the requirements for the majors and honors degrees. We have agreed on a number of revisions. Our general conclusions are outlined here.

We agreed that the variety of courses taken by our students is quite restricted and that our majors students, in particular, ought to have a greater selection of courses available to them. There was also a concensus among both students and faculty that our current physics courses offered as four lectures per week is too much, too often and that three lectures per week as done in our lower division is the best form for a physics course. Hence we have revised our upper division offerings from four to three lectures per week; this is the main modification of our programme.

Our revised requirements will allow us to introduce some choice, however modest, into our honors programme and at the same time will give our majors students complete freedom in designing their own programme.

..2

We have introduced a third year course on electromagnetism and relativity. This was specifically done for our majors students. Our current statistical physics course, Phys. 341-4 has been divided into two courses: Thermal Physics (Phys. 344-3) and Statistical Physics (Phys. 345-3). We have also introduced an Electronics and Instrumentation course into third year.

There is one new 400 division course, Phys. 484-3, Methods of Theoretical Physics II, introduced for our more theoretically inclined students. Our laboratory requirement has been reduced for such students.

The total number of semester hours offered remains essentially unchanged and the frequency of course offerings will be such that no increase in the number of Physics faculty is needed to offer the revised programme.

We believe our revision is an improvement, maintains our standards and keeps our physics majors and honors programmes challenging, rewarding and second-to-none in Canada.

Proposed Upper Division Physics Requirements

NOTE: The courses Nuclear Science 442-3 and 485-3 may be counted as upper division PHYS courses in PHYS Minor, Major and Honors Programs.

Physics Major: *Minimum 30 hours upper division Physics, including a minimum 6 hours upper division Physics labs.*

Physics Honors: *Minimum 10 hours upper division labs, i.e. either Physics 331, 332, 431, or 331, 431, 432.*

All 300 lecture courses (i.e., PHYS 325, 326, 344, 345, 355, 384, 385).

4th year: PHYS 413, 415, 425, 431, NUSI 485 or NUSI 442 plus two of PHYS 432, 465, 484 (or all three if 332 is not taken).

Current Upper Division Physics hours are:

Majors: *31 hours upper division physics (University minimum = 28)*

Honors:

300 Division	*23 hours*	
400 Division	*28 hours*	
Total	*51 hours*	*(Faculty minimum for Honors is 48 hours)*

Revised Totals:

Majors: *30 hours*

Honors:

300 Division-	*27 hours*	*(or 24)*
400 Division-	*22, 23 or 26*	
Total	*49 or 50 hours*	

Proposed Upper Division Math Requirements for Honors Physics

Math 312-4, 422-4 and one other mathematics course numbered 316 or greater.

Upper Division Math Requirements for Physics Major: *no change*

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Proposed Course Offerings for Majors and Honors (Draft #4)

Level 1 & 2	Level 3 & 4	Level 5 & 6	Level 7 & 8
(P100-3)	P231-3 Lab	P331-3 Electronics Lab	a b c d P431-4 Advanced Lab I
	P232-3 Lab	P332-3 Optics Lab	a - c d P432-4 Advanced Lab II
(P131-3)		(not progr. "d")	
P120-3	P211-3	P326-3	a b c d P413-3
P121-3	Mechanics	Electronics & Instrumentation	Advanced Mechanics
(Survey)	P221-3	P325-3	a b c d P425-3
	Introd. E & M	Relativity & Electromagnetism	Electromagnetic Theory
		P344-3 Thermal Physics	
		P345-3 Statistical Physics	
		P385-3	a b c d NUSI 485-3 Particle Physics OR NUSI 442-3 Properties of Nuclear Matter
		Quantum Physics	
(9 hrs Math)	(7 hrs Math)		
		P384-3	- b c d P484-3
		Methods of Theoretical Physics I	Methods of Theoretical Physics II
		P355-3	a b c d P415-3
		Optics	Quantum Mechanics
(11 or 12 hours Math			a b - d P465-3
in Upper Levels)		____	____ Solid State Physics
		27 hrs (Honors)	23 22 23 26 hrs
		(24 for program"d")	Honors' choice

(Draft #3)

Proposed Course Calendar Descriptions

(Suggested text in brackets)

Lower Levels: as presently in Calendar.

PHYS 325-3 Relativity and Electromagnetism (3-1-0)

Relativity, electrostatic fields, electric and magnetic fields of moving charges.

Prereq: PHYS 221-3; MATH 312-4 must precede or be taken concurrently.

(Lorrain and Corson or equivalent)

PHYS 326-3 Electronics and Instrumentation (3-1-0)

Circuits and circuit theory, passive and active devices, amplifiers, feedback, modern measurement techniques and instrumentation.

Prereq: PHYS 221-3.

(Brophy)

PHYS 331-3 Electronics Laboratory (0-0-4)

Experiments in electronics, including A.C. circuits, filters, resonance, diodes, transistors, amplifiers, feedback, oscillators, operational amplifiers, integrated circuits, analogue circuits, digital circuits.

Prereq: At least 3 semester hours of credit in 200 division labs; PHYS 326-3 must precede or be taken concurrently.

PHYS 332-3 Intermediate Laboratory (0-0-4)

Experiments in optics and modern physics, including diffraction, interference, spectroscopy, lasers and holography.

Prereq: At least 3 semester hours of credit in 200 division labs; normally PHYS 355-3 must precede or be taken concurrently.

PHYS 344-3 Thermal Physics (3-1-0)

Heat, temperature, kinetic theory of gases, laws of thermodynamics, entropy, heat engines, applications of thermodynamics to special systems, phase transitions.

Prereq: PHYS 121-3; MATH 253-4 must precede or be taken concurrently.

(Zemansky)

PHYS 345-3 Statistical Physics (3-1-0)

Postulates of statistical mechanics, partition functions, application to gases, paramagnetism and equilibrium. Quantum statistics and applications.

Prereq: PHYS 344-3 or CHEM 261-3; PHYS 385-3 is a recommended prerequisite.

(Reif)

PHYS 355-3 Optics (3-1-0)

Geometrical and physical optics, interference, diffraction, coherence, spectra, optical instruments.

Prereq: PHYS 221-3, MATH 253-4 .

(Hecht and Zajac)

PHYS 384-3 Methods of Theoretical Physics I (3-1-0)

Applications of mathematical methods in physics, differential equations of physics, eigenvalue problems.

Prereq: PHYS 221-3; MATH 232-3, 253-4 and either 310-3 or 312-4.

(Enns & Rangnekar or equivalent)

PHYS 385-3 Quantum Physics (3-1-0)

Origins of quantum theory, atomic models, waves and particles, Schroedinger equation, free and bound states, the hydrogen atom, atomic structure and spectra.

Prereq: PHYS 211-3, 221-3. MATH 310-3 must precede or be taken concurrently.

(Richtmeyer et al. or equivalent)

PHYS 413-3 Advanced Mechanics (3-1-0)

Central forces, rigid body motion, small oscillations, Lagrangian and Hamiltonian formulations of mechanics.

Prereq: PHYS 211-3 and 384-3; or PHYS 211-3, MATH 310-3 and 312-4.

(Goldstein or equivalent)

PHYS 415-3 Quantum Mechanics (3-1-0)

Foundations of quantum mechanics, Schroedinger equation, perturbation theory, angular momentum, applications.

Prereq: PHYS 385-3 and either PHYS 384-3 or MATH 420-4

(Wieder)

PHYS 425-3 Electromagnetic Theory (3-1-0)

Magnetic fields, Maxwell's equations, propagation of electromagnetic waves, radiation of electromagnetic waves.

Prereq: PHYS 325-3 and either PHYS 384-3 or MATH 420-4,

(Lorrain and Corson or equivalent)

PHYS 431-4 Advanced Physics Laboratory I (0-0-6)

Advanced experiments in physics. May include special projects.

Prereq: PHYS 331-3

PHYS 432-4 Advanced Physics Laboratory II (0-0-6)

A continuation of PHYS 431-4

Prereq: PHYS 431-4

PHYS 465-3 Solid State Physics (3-1-0)

Crystal structure, lattice vibrations and thermal properties of solids, free electron model, band theory, applications.

Prereq: PHYS 385-3

(Kittel or equivalent)

PHYS 484-3 Methods of Theoretical Physics II (3-1-0)

Advanced topics in theoretical physics which may include integral equations in physics, calculus of variations, nonlinear problems, perturbation theory and approximation techniques, elements of group theory.

Prereq: PHYS 384-3, MATH 310-3, 312-4.

(Enns & Rangnekar or equivalent)

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

NEW COURSE PROPOSAL FORM

1. Calendar Information

Department: Physics

Abbreviation Code: PHYS Course Number: 325 Credit Hours: 3 Vector: 3-1-0

Title of Course: Relativity and Electromagnetism

Calendar Description of Course:

Relativity, electrostatic fields, electric and magnetic fields of moving charges.

Nature of Course Lecture/tutorial

Prerequisites (or special instructions):

PHYS 221-3; MATH 312-4 must precede or be taken concurrently.

What course (courses), if any, is being dropped from the calendar if this course is approved: Part of PHYS 421-4, Electromagnetism
Part of PHYS 381-4, Modern Physics

2. Scheduling

How frequently will the course be offered? Once or twice per year.

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible? All

3. Objectives of the Course

Replaces part of PHYS 421-4 and the relativity currently offered in PHYS 381-4.

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty

Staff NONE

Library

Audio Visual

Space

Equipment

5. Approval

Date: August 31 1978 2/10/78 15 Nov 1978

Department Chairman Dean Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

PHYSICS 325-3

RELATIVITY AND ELECTROMAGNETISM

Text: P. Lorrain and D. Corson, "*Electromagnetic Fields and Waves*", 2nd Edition.

Topics: Electrostatic fields in a vacuum: Coulomb's Law, potential, conductors and insulators, Gauss' Law and its applications, electric dipoles and multipoles, energy and mechanical forces in an electric field.

Dielectric Materials: Polarization, external and internal electric fields, electric displacement, susceptibility and dielectric constant. Simple boundary value problems involving dielectrics.

Solutions to electrostatic problems: continuity at an interface, images, problems with rectangular, spherical and cylindrical co-ordinates.

Basic concepts of special relativity, the Lorentz transformation, transformation of velocity, acceleration, mass, four-vectors, the four-momentum, transformation of an electric charge density and of an electric current, the four-current density.

Electric and magnetic fields of moving charges, field of a charge with constant velocity, transformation of electric and magnetic fields and potentials, Maxwell's equations.

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

NEW COURSE PROPOSAL FORM

1. Calendar Information

Department: Physics

Abbreviation Code: PHYS Course Number: 326 Credit Hours: 3 Vector: 3-1-0

Title of Course: Electronics and Instrumentation

Calendar Description of Course:

Circuits and circuit theory, passive and active devices, amplifiers, feedback, modern measurement techniques and instrumentation.

Nature of Course Lecture/tutorial

Prerequisites (or special instructions):

PHYS 221-3

What course (courses), if any, is being dropped from the calendar if this course is approved: The lecture associated with PHYS 334-4.

2. Scheduling

How frequently will the course be offered? Once or twice per year.

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible? All

3. Objectives of the Course

To provide science students with a basic understanding of electronic devices, circuits and modern measurement techniques and instrumentation.

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library

Audio Visual NONE

Space

Equipment

5. Approval

Date: August 31 1978 2/10/78 15 Nov 78

Department Chairman Dean Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

PHYSICS 326-3 - ELECTRONICS AND INSTRUMENTATION

Text: Brophy - *"Basic Electronics for Scientists"*, Third Edition.

Topics:

Circuit analysis, equivalent circuits, impedance, maximum power transfer , resonance, differentiating and integrating circuits, transients, bridge circuits, transformers.

Diode circuits: nonlinear components, rectifier circuits, filters.

Semiconductor devices: junction diodes and transistors, field-effect transistors, integrated circuits.

Amplifiers: voltage, power, tuned, pulse and D.C. amplifiers.

Operational amplifiers, negative feedback, operational feedback, analog computers.

Oscillators and waveform generators.

Analog measurement and instrumentation: oscilloscope, waveform analyzer, electrometer, photocells and photomultipliers, bolometers, radiation detectors, mechanical transducers, magnetic recorders.

Thermal noise, current noise, noise in transistors, shielding and grounding, phase-sensitive detection.

Digital logic, logic circuits, flip-flops, counters, registers, displays, memories.

Digital measurements: time-interval meter, frequency meter, digital voltmeter, A-D and D-A conversion.

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

NEW COURSE PROPOSAL FORM

1. Calendar Information — Department: Physics

Abbreviation Code: PHYS Course Number: 331 Credit Hours: 3 Vector: 0-0-4

Title of Course: Electronics Laboratory

Calendar Description of Course:

Experiments in electronics, including A.C. circuits, filters, resonance, diodes, transistors, amplifiers, feedback, oscillators, operational amplifiers, integrated circuits, analogue circuits, digital circuits.

Nature of Course Laboratory

Prerequisites (or special instructions):

At least 3 semester hours of credit in 200 division labs; PHYS 326-3 must precede or be taken concurrently.

What course (courses), if any, is being dropped from the calendar if this course is approved:

PHYS 334-4, Introduction to Electronics

2. Scheduling

How frequently will the course be offered? Once or twice per year

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible? All experimentalists

3. Objectives of the Course

This course replaces the laboratory part of PHYS 334-4.

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library

Audio Visual NONE

Space

Equipment

5. Approval

Date: August 3/78 2/10/78 15 Nov 78

Department Chairman Dean Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

NEW COURSE TITLE and revised prerequisite

1. Calendar information

Department: Physics

Abbreviation Code: PHYS Course Number: 332 Credit Hours: 3 Vector: 0-0-4

Title of Course: Intermediate Laboratory

Calendar Description of Course:

Experiments in optics and modern physics, including diffraction, interference, spectroscopy, lasers and holography.

Nature of Course

Prerequisites (or special instructions):

At least 3 semester hours of credit in 200 division labs; normally PHYS 355-3 must precede or be taken concurrently.

What course (courses), if any, is being dropped from the calendar if this course is approved: Title change from Intermediate Laboratory II.

2. Scheduling

How frequently will the course be offered?

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible?

3. Objectives of the Course

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library

Audio Visual

Space

Equipment

5. Approval

Date: August 31 1978 2/10/78 15 Nov 78

Department Chairman Dean Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

NEW COURSE PROPOSAL FORM

1. **Calendar Information** Department: Physics

Abbreviation Code: PHYS **Course Number:** 344 **Credit Hours:** 3 **Vector:** 3-1-0

Title of Course: Thermal Physics

Calendar Description of Course:

Heat, temperature, kinetic theory, laws of thermodynamics, entropy, heat engines, applications of thermodynamics to special systems, phase transitions.

Nature of Course Lecture /tutorial/

Prerequisites (or special instructions):

PHYS 121-3; MATH 253-4 must precede or be taken concurrently.

What course (courses), if any, is being dropped from the calendar if this course is approved: PHYS 341-4.

2. **Scheduling**

How frequently will the course be offered? Once or twice per year.

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible? All

3. **Objectives of the Course**

An introduction to heat and thermodynamics with physical applications. This is an expansion of the hour currently associated with these topics in Phys 341-4. The course will provide a better background for the new subsequent course PHYS 345-3, Statistical Physics.

4. **Budgetary and Space Requirements (for information only)**

What additional resources will be required in the following areas:

Faculty

Staff

Library NONE

Audio Visual

Space

Equipment

5. **Approval**

Date: August 31 1978 2/10/78 15 Nov 78

Department Chairman Dean Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

PHYSICS 344-3: THERMAL PHYSICS

TEXT: M.W. Zemansky, "Heat and Thermodynamics", 5th Edition.

CORE CONTENT: Chapters 1 to 9, 11, 12.

1. Temperature and thermometric properties, gas thermometers, ideal gas temperature, measurement of temperature.

2. Simple thermodynamic systems: thermodynamic equilibrium, PVT diagrams for a pure substance, equatiors of state, simple physical systems.

3. Work: quasi-static process, work of a hydrostatic system, PV diagrams, work in quasi-static processes, simple physical examples.

4. Heat and the First Law: Work and heat, adiabatic work, internal energy, differential formulation of First Law, heat capacity, heat conduction, convection and radiation, Stefan-Boltzmann Law.

5. Ideal Gases: equation of state and internal energy of a gas, ideal gas, heat capacity of ideal gas, adiabatic process, measurement of γ, speed of a longitudinal wave.

6. Kinetic theory of an ideal gas: equation of state, distribution of molecular velocities, equipartition of energy.

7. Engines, refrigerators and the Second Law: Conversion of work into heat and vice versa. The Stirling engine, steam and internal combustion engines, the Second Law, the refrigerator.

8. Reversibility and the Kelvin temperature scale: reversibility and irreversibility, conditions for reversibility, Kelvin temperature and equality with ideal gas temperature.

9. Entropy: entropy, entropy of an ideal gas, carnot cycle, entropy and reversibility, irreversibility and non-equilibrium states, entropy and unavailable energy, disorder and direction.

11. Pure substances: enthalpy, Helmholtz and Gibbs Functions, Maxwell's equations, heat capacity at constant volume and constant pressure, thermal expansion, compressibility.

12. Phase transitions; Liquid and Solid Helium: Joule-Kelvin effect and liquifaction of gases, first order transitions, Clapeyron's equation, vaporization, fusion, higher order transitions, liquid and solid helium.

13. Special physical topics, such as: the stretched wire, dielectric in a parallel plate capacitor, piezoelectric effect, thermoelectric refrigeration, blackbody radiation.

It is anticipated that the core content will require 11 to 12 weeks to complete. The remaining time would be devoted to applications to physical systems, such as noted in Chapter 13 above. The topics of Chapter 10 (statistical mechanics) are deferred to the succeeding course Phys 345-3.

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

NEW COURSE PROPOSAL FORM

1. Calendar Information — Department: Physics

Abbreviation Code: PHYS Course Number: 345 Credit Hours: 3 Vector: 3-1-0

Title of Course: Statistical Physics

Calendar Description of Course:

Postulates of statistical mechanics: partition functions: applications to gases, paramagnetism and equilibrium. Quantum statistics and applications.

Nature of Course Lecture/tutorial

Prerequisites (or special instructions):

PHYS 344-3 or CHEM 261-3; PHYS 385-3 is a recommended prerequisite.

What course (courses), if any, is being dropped from the calendar if this course is approved: PHYS 341-4

2. Scheduling

How frequently will the course be offered? Once per year.

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible? All

3. Objectives of the Course

Approx. 3/4 of PHYS 341-4.

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library NONE

Audio Visual

Space

Equipment

5. Approval

Date: August 31 1978 2/10/78 15 Nov 78

Department Chairman — Dean — Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

PHYSICS 345-3

STATISTICAL PHYSICS

Text: F. Reif, "*Fundamentals of Statistical and Thermal Physics*", McGraw-Hill (1965)

Topics: Introduction to statistical methods.

Statistical description of systems of particles. Statistical ensembles. Basic postulates of statistical mechanics.

Statistical thermodynamics, irreversibility and the attainment of equilibrium, thermal interaction between macroscopic systems, approach to equilibrium, temperature and heat reservoirs.

Thermodynamical laws and basic statistical relations, statistical calculation of thermodynamic quantities.

Basic results of statistical mechanics, microcanonical and grand canonical ensembles. Connection with thermodynamics.

Applications of statistical mechanics, partition function for ideal monatomic gas. Equipartition theorem, paramagnetism, kinetic theory of dilute gases in equilibrium, equilibrium between phases.

Elements of quantum statistics, ideal gas in classical limit, polyatomic gases. Black body radiation, free electron gas.

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

NEW COURSE PROPOSAL FORM

1. Calendar Information — Department: Physics

Abbreviation Code: PHYS Course Number: 355 Credit Hours: 3 Vector: 3-1-0

Title of Course: Optics

Calendar Description of Course:

Geometrical and physical optics, interference, diffraction, polarization, coherence, spectra, optical instruments.

Nature of Course Lecture/tutorial

Prerequisites (or special instructions):

PHYS 221-3, MATH 253-4

What course (courses), if any, is being dropped from the calendar if this course is approved: PHYS 351-4, Optics

2. Scheduling

How frequently will the course be offered? Once per year.

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible? All

3. Objectives of the Course

Replaces 3/4 of PHYS 351-4.

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library

Audio Visual NONE

Space

Equipment

5. Approval

Date: August 31/1978 2/10/78 15 Mar 78

Department Chairman — Dean — Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

PHYSICS 355-3

OPTICS

Text: "Optics" by E. Hecht and A. Zajac

References: "Optics" by M.V. Klein

"Fundamentals of Optics" by R.A. Jenkins and H.E. White

"Geometrical and Physical Optics" by R.S. Longhurst

Content: Propagation of light, reflection, refraction.

Geometric optics, paraxial theory, thick lenses, optical instruments.

Waves, superposition of waves, wave packets, coherence.

Two beam and multiple-beam interference, interferometers, thin films, filters.

Fraunhofer and Fresnel diffraction, Kirchoff's scalar diffraction theory.

Polarized light, circular and elliptical polarization, polarizers, birefringence, wave plates.

Fourier methods and imagery, spatial filtering, phase contrast.

Lasers, holography.

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

NEW COURSE PROPOSAL FORM

1. Calendar Information — Department: Physics

Abbreviation Code: PHYS Course Number: 384 Credit Hours: 3 Vector: 3-1-0

Title of Course: Methods of Theoretical Physics I

Calendar Description of Course:

Applications of mathematical methods in physics, differential equations of physics, eigenvalue problems.

Nature of Course Lecture /tutorial/

Prerequisites (or special instructions):

PHYS 221-3, MATH 232-3, 253-4 and either 310-3 or 312-4

What course (courses), if any, is being dropped from the calendar if this course is approved: Phys 382-4

2. Scheduling

How frequently will the course be offered? Once or twice per year.

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible? Physics theoreticians plus other physics faculty.

3. Objectives of the Course

This course is the first 3/4 of the current PHYS 382-4.

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library

Audio Visual — NONE

Space

Equipment

5. Approval

Date: August 31/1978 — 2/10/78 — 15 Mar 78

Department Chairman — Dean — Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

PHYSICS 384-3

METHODS OF THEORETICAL PHYSICS I

TEXT: Enns and Rangnekar, *"An Introduction to the Methods and Tools of Theoretical Physics"* - (or equivalent)

1) One dimensional scalar fields, initial and boundary value problems, vibrating strings, wires and bars, infinite strings, energy flow, damped and forced oscillations, Dirac δ function and Hilbert spaces.

2) Two dimensional scalar fields, rectangular, circular and wedge-shaped membranes, normal modes, temperature distributions in a circular annulus, introduction to Bessel functions, vibrating plates.

3) Three dimensional scalar and vector fields of physics, propagation of electromagnetic and sound waves, heat flow, neutron diffusion, temperature distribution in a solid sphere, spherical Bessel functions and spherical harmonics, expansion of plane waves, Green's function techniques in three dimensions.

4) Problems of mathematical physics with continuous spectra, integral transform techniques, wave packets, retarded and advanced electromagnetic potentials, vibrations of infinite and semi-infinite membranes.

5) Applications of complex variables, contour integrals, dispersion relations, steepest descent.

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

NEW COURSE PROPOSAL FORM

1. Calendar Information

Department: Physics

Abbreviation Code: PHYS Course Number: 385 Credit Hours: 3 Vector: 3-1-0

Title of Course: Quantum Physics

Calendar Description of Course:

Origins of quantum theory, atomic models, waves and particles, Schroedinger equation, free and bound states, the hydrogen atom, atomic structure and spectra.

Nature of Course Lecture/tutorial

Prerequisites (or special instructions):

PHYS 211-3, 221-3. MATH 310-3 must precede or be taken concurrently.

What course (courses), if any, is being dropped from the calendar if this course is approved: PHYS 381-4, Modern Physics

2. Scheduling

How frequently will the course be offered? Once or twice per year.

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible? All

3. Objectives of the Course

Replaces 3/4 of PHYS 381-4.

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library NONE

Audio Visual

Space

Equipment

5. Approval

Date: August 31 1978 2/10/78 15 Nov 78

Department Chairman Dean Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34, Attach course outline).

PHYSICS 385-3

QUANTUM PHYSICS

TEXT: "Introduction to Modern Physics", 6th Ed., by Richtmeyer, Kennard and Cooper.

REFERENCES: "Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles" by R. Eisberg and R. Resnick.

COURSE CONTENT: The following topics treated at a level equivalent to the indicated chapters in the text:

Origins of quantum physics - Chapters 4 to 11.

Elementary wave mechanics - Chapters 12 and 13.

Hydrogen atom, atomic spectra - Chapters 14 to 18.

Physics of molecules - Chapter 19.

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

NEW COURSE PROPOSAL FORM

1. Calendar Information — Department: Physics

Abbreviation Code: PHYS Course Number: 413 Credit Hours: 3 Vector: 3-1-0

Title of Course: Advanced Mechanics

Calendar Description of Course:

Central forces, rigid body motion, small oscillations, Lagrangian and Hamiltonian formulations of mechanics.

Nature of Course Lecture /tutorial/

Prerequisites (or special instructions):

PHYS 211-3 and 384-3; or PHYS 211-3, MATH 310-3 and 312-4.

What course (courses), if any, is being dropped from the calendar if this course is approved: PHYS 411-4, Classical Mechanics

2. Scheduling

How frequently will the course be offered? Once per year.

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible? Theoreticians in physics, plus other Physics faculty.

3. Objectives of the Course

Replaces 3/4 of PHYS 411-4.

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library NONE

Audio Visual

Space

Equipment

5. Approval

Date: Nov 31 1978 — 2/16/78 — 15 Nov 1978

Department Chairman — Dean — Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

PHYSICS 413-3: ADVANCED MECHANICS

TEXT: H. Goldstein, "Classical Mechanics", Addison-Wesley (1950)

1. Fundamentals of Newtonian Mechanics.

2. Hamilton's principle and Lagrange's equations, some techniques of the calculus of variations.

3. Conservation laws in physics.

4. Two body central force problem: general properties, inverse square forces, stability of circular orbits, repulsive forces, scattering, the Virial Theorem, transformation to laboratory conditions.

5. Motion of a rigid body:

   Rigid body motion, moments and products of inertia, principal axes, Euler's equations of motion, Euler angles, motion of a torque free system, motion of a top under gravity, the Coriolis force.

6. Oscillatory motion:

   Formulation of the problem. The eigenvalue equation and the principal axis transformation. Frequencies of free vibration and normal co-ordinates, vibration of a linear triatomic molecule.

7. Canonical equations: Hamilton's equations of motion, Poisson brackets, Canonical transformations.

8. Hamilton-Jacobi equations, separation of variables in spherical co-ordinates, action-angle variables, Hamilton-Jacobi theory, geometrical optics and wave mechanics.

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

NEW COURSE PROPOSAL FORM

1. Calendar Information — Department: Physics

Abbreviation Code: PHYS Course Number: 415 Credit Hours: 3 Vector: 3-1-0

Title of Course: Quantum Mechanics

Calendar Description of Course:

Foundations of quantum mechanics, Schroedinger equation, perturbation theory, angular momentum, applications.

Nature of Course Lecture /tutorial/

Prerequisites (or special instructions):

PHYS 385-3 and either PHYS 384-3 or MATH 420-4.

What course (courses), if any, is being dropped from the calendar if this course is approved: PHYS 412-4, Quantum Mechanics

2. Scheduling

How frequently will the course be offered? Once per year.

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible? Theoreticians in physics plus other Physics faculty.

3. Objectives of the Course

Replaces 3/4 of PHYS 412-4.

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library NONE

Audio Visual

Space

Equipment

5. Approval

Date: August 31/1978 — 2/10/78 — 15 Nov 1978

Department Chairman — Dean — Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

PHYSICS 415-3 - QUANTUM MECHANICS

Review of the fundamental experiments.

Outline of Classical Mechanics.

Formulations of Quantum Mechanics: vectors, operators, eigenvalues, postulates relating to observables, states and probability distributions, position and momentum operators, Schroedinger wave equation, probability flux.

One dimensional problems: confined particle, barrier reflection, square well, harmonic oscillator.

Commuting and non-commuting operators: theorems on simultaneous eigenvectors, Uncertainty Principle.

Three dimensional problems, including angular momentum and central forces.

Two-body problem: separation of variables with and without interaction, hydrogen atom, Zeeman effect.

Spin: Pauli matrices, direct product vectors, Stern-Gerlach experiment, hyperfine interaction in hydrogen, spin precession and spin resonance.

Perturbation theory: stationary case (degenerate and non-degenerate) with examples, time-dependent case. Applications.

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

NEW COURSE PROPOSAL FORM

1. Calendar Information — Department: Physics

Abbreviation Code: PHYS Course Number: 425 Credit Hours: 3 Vector: 3-1-0

Title of Course: Electromagnetic Theory

Calendar Description of Course:

Magnetic fields, Maxwell's equations, propagation of electromagnetic waves, radiation of electromagnetic waves.

Nature of Course Lecture/tutorial/

Prerequisites (or special instructions):

PHYS 325-3, and either PHYS 384-3 or MATH 420-4.

What course (courses), if any, is being dropped from the calendar if this course is approved: PHYS 421-4, Electromagnetic Theory

2. Scheduling

How frequently will the course be offered? Once per year.

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible? All

3. Objectives of the Course

Replaces 3/4 of Phys 421-4

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library

Audio Visual NONE

Space

Equipment

5. Approval

Date: August 31/1978 2/10/78 15 Nov 1978

Department Chairman — Dean — Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a.

PHYSICS 425-3 - ELECTROMAGNETIC THEORY

Text: P. Lorrain and D. Corson, *"Electromagnetic Fields and Waves"*, 2nd Edition.

Topics:

Magnetic field of steady currents, Ampere's law, magnetic vector potential and scalar potential, Magnetic flux, magnetic properties of matter, sources of the magnetic field, magnetic intensity, field equations, boundary conditions on the field vectors, current circuits containing magnetic media, magnetic circuits, boundary value problems involving magnetic materials, magnetic energy.

Maxwell's Equations and the wave equations.

Propagation of electromagnetic waves: plane waves in the free space, in non-conductors, in conductors, in ionized gases.

Reflection and Refraction: at dielectric interface, at the surface of a good conductor, reflection by an ionized gas.

Guided waves: parallel conducting plates, the coaxial line, rectangular wave guide, cavity resonators.

Electric dipole radiation, half-wave antenna, antenna arrays.

Special topics:

May include topics such as klystron amplifiers and oscillators, Gunn effect, optical properties of metals, elements of plasma theory.

CHANGE IN DESCRIPTION

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

~~NEW~~ COURSE DESCRIPTION

1. Calendar Information — Department: Physics

Abbreviation Code: PHYS Course Number: 431 Credit Hours: 4 Vector: 0-0-6

Title of Course: Advanced Physics Laboratory I

Calendar Description of Course:

Advanced experiments in Physics. May include special projects.

Nature of Course

Prerequisites (or special instructions):

What course (courses), if any, is being dropped from the calendar if this course is approved:

2. Scheduling

How frequently will the course be offered?

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible?

3. Objectives of the Course

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library

Audio Visual

Space

Equipment

5. Approval

Date: August 31 1978 — 2/16/78 — 15 Nov 1978

Department Chairman — Dean — Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a.

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

NEW COURSE PROPOSAL FORM

1. Calendar Information

Department: Physics

Abbreviation Code: PHYS Course Number: 465 Credit Hours: 3 Vector: 3-1-0

Title of Course: Solid State Physics

Calendar Description of Course:

Crystal structure, lattice vibrations and thermal properties of solids, free electron model, band theory, applications.

Nature of Course Lecture

Prerequisites (or special instructions):

PHYS 385-3

What course (courses), if any, is being dropped from the calendar if this course is approved: PHYS 461-4, Solid State Physics

2. Scheduling

How frequently will the course be offered? Once per year.

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible? All

3. Objectives of the Course

Replaces 3/4 of PHYS 461-4.

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library

Audio Visual NONE

Space

Equipment

5. Approval

Date: August 31 1978 2/10/78 15 Mar 1978

Department Chairman Dean Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

PHYSICS 465-3

SOLID STATE PHYSICS

TEXT: "Introduction to Solid State Physics" by Charles Kittel. (5th Edition)

REFERENCE TEXTS:

Solid State Physics - Dekker

Solid State Physics - Ashcroft & Mermin

COURSE CONTENT: The level of the course and the material covered both parallel the first 12 chapters of the text-book.

TOPICS:

Crystal structure
Crystal diffraction and the reciprocal lattice
Crystal binding
Elastic constants and elastic waves
Phonons and lattice vibrations
Thermal properties of insulators
Free electron Fermi gas
Energy bands
Semiconductor crystals
Superconductivity
Dielectrics

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

NEW COURSE PROPOSAL FORM

1. Calendar Information

Department: Physics

Abbreviation Code: PHYS Course Number: 484 Credit Hours: 3 Vector: 3-1-0

Title of Course: Methods of Theoretical Physics II

Calendar Description of Course:

Advanced topics in theoretical physics which may include integral equations in physics, calculus of variations, nonlinear problems, perturbation theory and approximation techniques, elements of group theory.

Nature of Course Lecture/tutorial

Prerequisites (or special instructions):

PHYS 384-3, MATH 310-3, 312-4

What course (courses), if any, are being dropped from the calendar if this course is approved:

PHYS 382-4

2. Scheduling

How frequently will the course be offered? Once per year.

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible? Physics theoreticians plus other Physics faculty

3. Objectives of the Course

This course contains last quarter of the current Phys 382-4, plus more advanced topics. This course is intended for theoretically inclined students.

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library

Audio Visual

Space NONE

Equipment

5. Approval

Date: August 31 1978 2/10/78 15 Mar 1978

Department Chairman

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Dean

Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

PHYSICS 484-3

METHODS OF THEORETICAL PHYSICS II

TEXT: Enns and Rangnekar, *"An Introduction to the Methods and Tools of Theoretical Physics"* - or equivalent.

Advanced topics in Mathematical Physics:

1) Integral equations, conversion of differential equations with boundary conditions to integral equations; Fredholm and Volterra integral equations; solution by iteration, series, or integral transform techniques, application to scattering theory in quantum mechanics.

2) Nonlinear physical problems; applications to nonlinear dynamics, competition phenomena; solitons. Methods of solution; approximation techniques.

3) Variational methods of physics; Euler-Lagrange equations; method of Lagrange multipliers, application to classical field theory, conservation laws and symmetries, Rayleigh-Ritz procedure and applications.

4) Elements of group theory. Applications to quantum mechanics and solid state physics.

5) Applications of modern mathematical methods such as functional analysis and differential forms.