



## COURSE OUTLINE

### 1. **Course:** PHYS 369, Acoustics, Optics and Radiation (for students in Engineering) - Fall 2023

Lecture 01 : TR 12:30 - 13:45 in SB 103

<b>Instructor</b>	<b>Email</b>	<b>Phone</b>	<b>Office</b>	<b>Hours</b>
Dr Timothy Andrew	timothy.andrew@ucalgary.ca	please email	SB 603	TBA
<b>Coordinator</b>	<b>Email</b>	<b>Phone</b>	<b>Office</b>	<b>Hours</b>
Dr Shapoor Moradi	moradis@ucalgary.ca	403 220-8073	SB 527B	By appointment

To account for any necessary transition to remote learning for the current semester, courses with in-person lectures, labs, or tutorials may be shifted to remote delivery for a certain period of time. In addition, adjustments may be made to the modality and format of assessments and deadlines, as well as to other course components and/or requirements, so that all coursework tasks are in line with the necessary and evolving health precautions for all involved (students and staff).

#### **In Person Delivery Details:**

This course will have in-person lectures, labs, and exams. Attendance at the lectures is optional but highly recommended as there are in-class activities for credit. Attendance at the labs and exams is compulsory. For information on missed labs and exams, see below. Safety protocols for in-person labs will be discussed during the first week of classes.

#### **Course Site:**

D2L for Lectures: PHYS 369 L01-(Fall 2023)-Acoustics, Optics, and Radiation (for students in Engineering)

D2L for Labs: PHYS 369 B01 - B16 (Fall 2023) - Acoustics, Optics, and Radiation (for students in Engineering)

**Note:** Students must use their U of C account for all course correspondence.

#### **Equity Diversity & Inclusion:**

The University of Calgary is committed to creating an equitable, diverse and inclusive campus, and condemns harm and discrimination of any form. We value all persons regardless of their race, gender, ethnicity, age, LGBTQIA2S+ identity and expression, disability, religion, spirituality, and socioeconomic status. The Faculty of Science strives to extend these values in every aspect of our courses, research, and teachings to better promote academic excellence and foster belonging for all.

The Physics and Astronomy EDI Committee acknowledges there are persistent barriers that prevent such accessibility and hinder our progress towards EDI. Our representatives (faculty, postdocs, graduate and undergraduate students) are committed to addressing any concerns and work towards proactive solutions that may be necessary change within the department. To submit anonymous questions, comments or concerns regarding EDI related issues, please reach out to our Associate Head EDI, Claudia Gomes da Rocha (see section 3.5.C in the Faculty of Science section of the online Calendar. [Claudia.gomesdaRocha@ucalgary.ca](mailto:Claudia.gomesdaRocha@ucalgary.ca))

### 2. **Requisites:**

#### **Prerequisite(s):**

Mathematics 277 and Physics 259 and admission to a program in Engineering.

#### **Antirequisite(s):**

Credit for Physics 369 and 365 will not be allowed. Not open to Electrical Engineering students.

### 3. **Grading:**

The University policy on grading and related matters is described in [F.1](#) and [F.2](#) of the online University Calendar.

In determining the overall grade in the course the following weights will be used:

Course Component	Weight	Due Date (duration for exams)	Modality for exams	Location for exams
Assignments (online) <sup>1</sup>	10%	Ongoing		
Laboratory experiments <sup>2</sup>	20%	Ongoing		
In class activities <sup>3</sup>	5%	Ongoing		
Midterm examination	25%	Nov 07 2023 at 12:30 pm (75 Minutes)	in-person	In class
Registrar Scheduled Final Exam	40%	Will be available when the final exam schedule is released by the Registrar	in person	Will be available when the final exam schedule is released by the Registrar

<sup>1</sup> 10 weekly (Wiley Plus) assignments, each will open on Wednesday at 5:00 PM. For further details, please refer to the assignment schedule.

<sup>2</sup> 5 Labs beginning in the second week of classes.

<sup>3</sup> Questions asked during the lectures.

Each piece of work (reports, assignments, quizzes, midterm exam(s) or final examination) submitted by the student will be assigned a grade. The student's grade for each component listed above will be combined with the indicated weights to produce an overall percentage for the course, which will be used to determine the course letter grade.

The conversion between a percentage grade and letter grade is as follows.

	A+	A	A-	B+	B	B-	C+	C	C-	D+	D
<b>Minimum % Required</b>	95 %	90 %	85 %	80%	75%	70 %	65 %	60%	55%	50 %	45 %

This course will have a Registrar Scheduled Final exam that will be delivered in-person and on campus. [The Final Examination Schedule](#) will be published by the Registrar's Office approximately one month after the start of the term. The final exam for this course will be designed to be completed within 3 hours.

The University of Calgary offers a [flexible grade option](#), Credit Granted (CG) to support student's breadth of learning and student wellness. Faculty units may have additional requirements or restrictions for the use of the CG grade at the faculty, degree or program level. To see the full list of Faculty of Science courses where CG is not eligible, please visit the following website: <https://science.ucalgary.ca/current-students/undergraduate/program-advising/flexible-grading-option-cg-grade>

#### 4. Missed Components Of Term Work:

In the event that a student legitimately fails to submit any online or in-person assessment on time (e.g. due to illness, domestic affliction, etc...), please contact the course coordinator, or the course instructor if this course does not have a coordinator to arrange for a re-adjustment of a submission date, or possible exemption and reweighing of components. Absences not reported within 48 hours will not be accommodated. Students may be asked to provide supporting documentation ([Section M.1](#)) for an excused absence, See [FAQ](#).

If an excused absence is approved, options for how the missed assessment is dealt with is at the discretion of the coordinator or course instructor. Some options such as an exemption and pro-rating among the components of the course may not be a viable option based on the design of this course.

#### Missed Lab

Students are NOT allowed to attend a different lab section than the one in which they are registered. A make-up lab session will be scheduled in the last week of classes. You can make up one lab. Please fill in the *Make-up lab request form* (Excel file, should be saved as an Excel file) posted on D2L to the appropriate Dropbox. Requests submitted more than **2 days** after the date of the missed lab will not be considered.

#### Missed midterm

If a student misses the midterm, they must fill out the *Missed Course Component form* on D2L and submit it to the appropriate Dropbox within **2 days** of the missed midterm. If the request is approved, the weight of the missed midterm will be shifted to the final exam. A missed midterm that does not have an approved accommodation from the course coordinator will result in a zero for that midterm.

#### Missed WileyPlus assignments

The deadline for the online assignments will not be extended, instead, the best 9 grades of the assignments out

of 10 will be counted toward the final grade accommodating for missing one assignment.

### **Missed in-class activities**

There will be no make-up for the missed in-class activities. Instead, the final grade for in-class activities is adjusted at the end of the term in order to accommodate for any questions you might occasionally miss due to different circumstances.

### **5. Scheduled Out-of-Class Activities:**

There are no scheduled out of class activities for this course.

### **6. Course Materials:**

Recommended Textbook(s):

David Halliday, Robert Resnick, and Jearl Walker, *Fundamentals of Physics, 12th Edition*, : Wiley.

- WileyPLUS license (see information about online Assignments below)
- An extensive set of supplemental Extra Notes will be posted on D2L (free of charge).
- Relevant textbook sections from the free Openstax textbook will be included in the topic outline.

In order to successfully engage in their learning experiences at the University of Calgary, students taking online, remote and blended courses are required to have reliable access to the following technology:

- A computer with a supported operating system, as well as the latest security, and malware updates;
- A current and updated web browser;
- Webcam/Camera (built-in or external);
- Microphone and speaker (built-in or external), or headset with microphone;
- Current antivirus and/or firewall software enabled;
- Stable internet connection.

For more information please refer to the UofC [ELearning](#) online website.

### **7. Examination Policy:**

No aids are allowed on tests or examinations.

Students should also read the Calendar, [Section G](#), on Examinations.

### **8. Approved Mandatory And Optional Course Supplemental Fees:**

There are no mandatory or optional course supplemental fees for this course.

### **9. Writing Across The Curriculum Statement:**

For all components of the course, in any written work, the quality of the student's writing (language, spelling, grammar, presentation etc.) can be a factor in the evaluation of the work. See also [Section E.2](#) of the University Calendar.

### **10. Human Studies Statement:**

Students will not participate as subjects or researchers in human studies.

See also [Section E.5](#) of the University Calendar.

### **11. Reappraisal Of Grades:**

A student wishing a reappraisal, should first attempt to review the graded work with the Course coordinator/instructor or department offering the course. Students with sufficient academic grounds may request a reappraisal. Non-academic grounds are not relevant for grade reappraisals. Students should be aware that the grade being reappraised may be raised, lowered or remain the same. See [Section I.3](#) of the University Calendar.

- Term Work:** The student should present their rationale as effectively and as fully as possible to the Course coordinator/instructor within **ten business days** of either being notified about the mark, or of the item's return to the class. If the student is not satisfied with the outcome, the student shall submit the Reappraisal of Graded Term work [form](#) to the department in which the course is offered within 2 business days of receiving the decision from the instructor. The Department will arrange for a reappraisal of the work within the next ten business days. The reappraisal will only be considered if the student provides a detailed rationale that outlines where and for what reason an error is suspected. See sections [I.1](#) and [I.2](#) of the University Calendar

- b. **Final Exam:**The student shall submit the request to Enrolment Services. See [Section 1.3](#) of the University Calendar.

## 12. Other Important Information For Students:

- a. **Mental Health** The University of Calgary recognizes the pivotal role that student mental health plays in physical health, social connectedness and academic success, and aspires to create a caring and supportive campus community where individuals can freely talk about mental health and receive supports when needed. We encourage you to explore the mental health resources available throughout the university community, such as counselling, self-help resources, peer support or skills-building available through the SU Wellness Centre (Room 370, MacEwan Student Centre, [Mental Health Services Website](#)) and the Campus Mental Health Strategy website ([Mental Health](#)).
- b. **SU Wellness Services:** For more information, see their [website](#) or call [403-210-9355](#).
- c. **Sexual Violence:** The Sexual Violence Support Advocate, Carla Bertsch, can provide confidential support and information regarding sexual violence to all members of the university community. Carla can be reached by email ([svsa@ucalgary.ca](mailto:svsa@ucalgary.ca)) or phone at [403-220-2208](#). The complete University of Calgary policy on sexual violence can be viewed [here](#).
- d. **Student Ombuds Office:** A safe place for all students of the University of Calgary to discuss student related issues, interpersonal conflict, academic and non-academic concerns, and many other problems.
- e. **Student Union Information:** [SU contact](#), Email your SU Science Reps: [science1@su.ucalgary.ca](mailto:science1@su.ucalgary.ca), [science2@su.ucalgary.ca](mailto:science2@su.ucalgary.ca), [science3@su.ucalgary.ca](mailto:science3@su.ucalgary.ca),
- f. **Academic Accommodation Policy:**

It is the student's responsibility to request academic accommodations according to the University policies and procedures listed below. The student accommodation policy can be found at: <https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Student-Accommodation-Policy.pdf>

Students needing an accommodation because of a disability or medical condition should communicate this need to Student Accessibility Services in accordance with the Procedure for Accommodations for Students with Disabilities: <https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Accommodation-for-Students-with-Disabilities-Procedure.pdf>.

Students needing an accommodation in relation to their coursework or to fulfil requirements for a graduate degree, based on a Protected Ground other than Disability, should communicate this need, by filling out the [Request for Academic Accommodation Form](#) and sending it to Dr. David Feder by email [phas.ahugrd@ucalgary.ca](mailto:phas.ahugrd@ucalgary.ca) preferably 10 business days before the due date of an assessment or scheduled absence.

- g. **Misconduct:** Academic integrity is the foundation of the development and acquisition of knowledge and is based on values of honesty, trust, responsibility, and respect. We expect members of our community to act with integrity. Research integrity, ethics, and principles of conduct are key to academic integrity. Members of our campus community are required to abide by our institutional [Code of Conduct](#) and promote academic integrity in upholding the University of Calgary's reputation of excellence. Some examples of academic misconduct include but are not limited to: posting course material to online platforms or file sharing without the course instructor's consent; submitting or presenting work as if it were the student's own work; submitting or presenting work in one course which has also been submitted in another course without the instructor's permission; borrowing experimental values from others without the instructor's approval; falsification/fabrication of experimental values in a report. Please read the following to inform yourself more on academic integrity:

[Student Handbook on Academic Integrity](#)  
[Student Academic Misconduct Policy](#) and [Procedure](#)  
[Faculty of Science Academic Misconduct Process](#)  
[Research Integrity Policy](#)

Additional information is available on the [Student Success Centre Academic Integrity page](#)

- h. **Copyright of Course Materials:** All course materials (including those posted on the course D2L site, a course website, or used in any teaching activity such as (but not limited to) examinations, quizzes, assignments, laboratory manuals, lecture slides or lecture materials and other course notes) are protected by law. These materials are for the sole use of students registered in this course and must not be redistributed. Sharing these materials with anyone else would be a breach of the terms and conditions governing student access to D2L, as well as a violation of the copyright in these materials, and may be pursued as a case of

student academic or [non-academic misconduct](#), in addition to any other remedies available at law.

- i. **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPP). Students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page. For more information, see [Legal Services](#) website.
- j. **Surveys:** At the University of Calgary, feedback through the Universal Student Ratings of Instruction ([USRI](#)) survey and the Faculty of Science Teaching Feedback form provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses. Your responses make a difference - please participate in these surveys.

## LABORATORIES

Laboratories begin during the week of September 11; check the timetable below for the dates of your labs. Labs take place in person in **ST 38**. You must attend your lab and contribute to your group's lab write-up in order to receive points for it. TAs offer assistance and guidance and check student understanding periodically throughout the session.

### Lab schedule

Week #	Dates	Even lab section	Odd lab section
1	Sept 05 - Sept 08	No Labs	No Labs
2	Sept 11 - Sept 15	<b>Lab 1</b>	
3	Sept 18 - Sept 22		<b>Lab 1</b>
4	Sept 25 - Sept 29	<b>Lab 2</b>	
5	Oct 02 - Oct 06		<b>Lab 2</b>
6	Oct 10 - Oct 13	<b>Lab 3</b>	
7	Oct 16 - Oct 20		<b>Lab 3</b>
8	Oct 23 - Oct 27	<b>Lab 4</b>	
9	Oct 30 - Nov 03		<b>Lab 4</b>
10	Nov 06 - Nov 10	No Labs	No Labs
11	Nov 13 - Nov 17	No Labs	No Labs
12	Nov 20 - Nov 24		<b>Lab 5</b>
13	Nov 27 - Dec 01	<b>Lab 5</b>	
14	Dec 04 - Dec 06	<b>Make-up Labs</b>	<b>Make-up Labs</b>

**Lab 1** Measurement and Uncertainty

**Lab 2** Simple harmonic oscillations

**Lab 3** Standing waves

**Lab 4** Concave mirrors

**Lab 5** Thin Lenses and Optical Instruments

### Lab Write-ups

Lab write-ups are prepared by the Department of Physics and Astronomy and will be posted on Desire2Learn. Each student should download their own copy of each lab. Before you come to your first lab session (see the schedule, above) make sure you have read the relevant sections of the Manual and completed any Preliminary Work (Pre-lab) required.

### Pre-labs

Pre-lab quizzes will be accessible on D2L every Wednesday at 5:00 PM, one week prior to the lab. Pre-labs should be completed and submitted individually by each lab group member through D2L by 11:59 pm on the Monday of the week in which the lab is scheduled.

### Lab Group work

When you come to the first lab session, your lab section will be organized into groups of 2 or 3 (3 is preferred). Your group will remain the same during the term. The group will work as a team, sharing tasks such as setting up the apparatus, taking measurement data, and keeping a running record of the experiment. No group member should be an idle "third wheel" during the session. The intention is to finish the data taking in the 3-hour period, and also move ahead as much as possible with a single write-up for the group.

### Raw Lab Data and Discussion Points

All the data recorded in the lab should be recorded in the provided Excel file and submitted to the Lab report D2L Dropbox before the lab ends. Please note that all discussion points (especially for Lab 1) should also be recorded in the same file.

### Lab reports

Final Laboratory reports are due at 11:59 pm, one week after the date of lab completion. Group members will meet during that week, perhaps electronically, to accomplish this. (It is possible for students to book group study space in the TFDL or EEEL). Use a word processor to write your lab report and attach a scan of your raw lab notes to your write-up. Save the lab report as a PDF. Your group report saved as a PDF should be submitted to Dropbox (lab report). Your TA will download it and submit the feedback via D2L. Each member of the group will receive the same mark. A caution: Teamwork within a single lab group is expected. However, your group should work independently of other lab groups. Unduly similar reports received from different groups could result in charges of academic misconduct against the students involved.

### WileyPLUS ONLINE ASSIGNMENTS

Your textbook, "Fundamentals of Physics" by Halliday, Resnick, and Walker, is available in the bookstore. If you did purchase the book and WileyPLUS access last term for PHYS 259, you will not need another code as your access is still valid. A new textbook comes bundled with a code, which will give you access to the eBook and assignments. If you would like to purchase just WileyPLUS standalone (without the text), you can do so through the bookstore.

If you choose not to purchase a new book or the WileyPLUS standalone, you will be able to access the homework from an on-campus library computer (with no textbook or resources access). You need to register as directed below. When you click an assignment you will not be prompted to enter an access code if you are accessing from the on-campus library.

To register in WileyPLUS go to: [www.wileyplus.com/go/login](http://www.wileyplus.com/go/login). If you have a WileyPLUS account already, login using the account you used previously. Once you have an account or you have logged into your existing account press "+Add Courses." Once in the course finder, enter the 6-digit Course ID provided by your instructor (find it on D2L) into the space provided. Once you enter your WileyPLUS course, click on one of the content links and you will be asked to verify your purchase using the code provided.

New users: If you are using WileyPLUS for the first time, please click Sign up and complete the form. Once you hit submit, check your email for an email from [Noreply@wileyplus.com](mailto:Noreply@wileyplus.com). The email will include a link titled "Click here." This link will take you to the password screen where you can create and set your WileyPLUS password. Once you create your password you will be taken to the course finder.

### Assignment schedule

Assignment	Available date (Wednesday 5:00 PM)	Due/Closing date (Sunday 11:59 PM)
Assignment 01	September 06	September 17
Assignment 02	September 13	September 24
Assignment 03	September 20	October 01
Assignment 04	September 27	October 08
Assignment 05	October 04	October 15
Assignment 06	October 11	October 22
Assignment 07	October 18	October 29
Assignment 08	November 01	November 19
Assignment 09	November 08	November 26
Assignment 10	November 23	December 03

### COURSE SCHEDULE

Week#	Dates	Topics	Notes	Main textbook reference*	Supp. texts^
1	Sept 05 - Sept 08	Introduction; simple harmonic motion (SHM) of systems obeying Hooke's law; differential equation of SHM; superposition of SHMs of the same frequency.		HR 15.1, 15.4, 16.6	EN1 OSv1 15.1, 16.5
2	Sept 11 - Sept 15	Phasors; phasor addition; phasor diagrams; phasors as complex quantities; traveling wave pulse: mathematical description and particle motion; partial derivatives; harmonic wave equation.		HR 16.1, 16.4, 16.6	EN1, EN2 OSv1 16.2

3	Sept 18 - Sept 22	Principle of wave superposition; harmonic (sinusoidal) waves; mathematical description, particle motion, phase differences; complex representation of a traveling harmonic wave; speed of waves in real media: stretched string; sound waves as longitudinal waves in solids, liquids, and gases; speed of sound waves.		HR 16.2, 16.5,16.6, 17.1-2	EN2, EN3 OSv1 16.5, 17.1, 17.2
4	Sept 25- Sept 29	Energy transport by a harmonic wave; mechanical impedance; power transported by a wave; acoustical impedance.		HR 16.3	EN4 OSv1 15.2, 16.4
5	Oct 02 - Oct 06	Sound intensity and sound intensity level (dB); sound field around point and line sources; inverse square law; acoustical attenuation; reflections at boundaries between two media; boundary conditions; amplitude reflection and transmission coefficients at a junction; energy reflection and transmission coefficients.		HR 17.4, 17.5,16.7	EN4, EN5 OSv1 16.5, 16.6, 17.3, 17.4
6	Oct 10 - Oct 13	Standing waves on a stretched string of fixed length: normal modes; acoustical standing waves: vibrations of air columns, normal modes; standing wave ratio; resonance.		HR 16.7	EN6 OSv1 16.5, 16.6, 17.4, 17.5
7	Oct 16 - Oct 20	Doppler effect; superposition of two harmonic waves of different frequencies: beats; coherent and incoherent sources; two-slit interference.		HR 17.6, 17.7, 33.4, 35.2, 35.3	EN7 OSv1 16.5, 17.6, 17.7 OSv3 3.1
8	Oct 23 - Oct 27	Thin film interference; multiple reflections in a thin film; diffraction pattern of a single slit; circular aperture; resolving power.		HR 35.4, 36.1, 36.2, 36.3	OSv3 3.4, 4.1, 4.5
9	Oct 30 - Nov 03	Nature of light; wavefronts, ray approximation; laws of reflection and refraction, index of refraction; total internal reflection; fiber optics and waveguides; imaging by reflection at a spherical surface.		HR 33.1, 33.5,33.6, 34.1,34.2	OSv3 1.1, 1.2, 1.3, 1.6, 2.2
10	Nov 06 - Nov 10	Graphical methods for spherical mirrors; lateral magnification; imaging by refraction at a spherical interface	Midterm on Tuesday, Nov 07	HR 34.2, 34.3	OSv3 2.2, 2.3
11	Nov 13 - Nov 17		Term Break, no classes		
12	Nov 20 - Nov 24	Multi-surface problems; virtual object; derivation of the thin lens equation; graphical methods for thin lenses; multi-lens systems, cameras, the eye; magnifiers, microscopes, telescopes.		HR 34.4, 34.5, 38.4, 38.5	OSv3 2.2, 2.4, 2.5, 2.6, 2.7, 2.8
13	Nov 27 - Dec 01	Light as a transverse electromagnetic wave; plane and circular polarization; Malus' law; elliptical polarization; polarization by reflection: Brewster's angle; doubly refracting materials; Huygen's principle.		HR 33.4, 35.1	EN9 OSv3 1.6, 1.7
14	Dec 04 - Dec 06	Resolving power, irradiance; radiometric quantities; solid angle; point sources; irradiance due to an extended source; Lambert's law; plane source effects; radiance; absorptance, reflectance; thermal equilibrium; blackbody radiation, Planck's law; Stefan-Boltzmann law; emissivity; heat transfer; Wien displacement law.			EN10 OSv3 6.1, 6.2

\*HR = Halliday Resnick (the course textbook)

^Supplementary texts: EN = Extra notes; OSv1 = Openstax University Physics Vol. 1; OSv3 = Openstax University Physics Vol. 3. Access the Openstax books at <https://openstax.org/details/books/university-physics>

### Course Incomes

- Students coming into PHYS 369 should be able to:
- Use trigonometric functions and identities as well as geometry to solve problems
- Employ algebraic manipulations (including solving the quadratic formula)
- Perform derivatives and integrals of functions as well as calculations using complex numbers
- Demonstrate ability to use vector algebra
- Exploit and use symmetry to simplify physical problems in electricity and magnetism
- Apply the principle of superposition to calculate the electric and magnetic fields of extended objects
- Develop mathematical models of physical situations
- Carry out calculations symbolically (in terms of physical variables) and numerically (using appropriate values and their units)
- Obtain experimental data and relate them to predicted physical laws governing electricity and magnetism

**Course Outcomes:**

- By the end of the course, students will be expected to:
- Exploit and use mathematical representations to predict the behavior of physical systems exhibiting simple harmonic oscillations or containing waves.
- Analyze and describe the effect of a system's physical properties (density, temperature, mechanical impedance, motion) on wave propagation (speed, reflection, transmission, resonance, and interference.)
- Compute properties and effects of electromagnetic radiation emitted and absorbed by physical systems.
- Solve problems in geometric optics, incorporating reflection and refraction from multiple curved surfaces.
- Carry out calculations symbolically (in terms of physical variables) and numerically (using appropriate values and their units).
- Obtain experimental data, estimate uncertainties, and relate the results to predicted physical laws governing wave behavior of oscillating systems and waves.
- Collaborate effectively within a team environment and communicate laboratory results in written scientific format.

Electronically Approved - Aug 31 2023 23:12

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**Department Approval**