APSC 248 (3) Engineering Analysis III (2020W)

Contact Information

- Instructor: **Dr. Yang Cao**
  Office: EME4235; **Phone**: 807-9643; **Email**: yang.cao@ubc.ca
  Office hours: Tuesday and Thursday, 1:30-2:30. Individual appointments can be arranged.
  However, advance notice of at least 24 hours will be appreciated.
  Zoom link for Office Hour
  Response Time: Given the UBC work-at-home policy, all communication and contact will be conducted through email, Zoom meetings and the discussion forum on Canvas. For any course related inquiries, I will attempt to respond within 24 hours, or I will post, on Canvas, answers to commonly asked questions rather than give individual replies.

- Tutorial TAs
  TA name and email
  TA name and email

- Meeting Times and Location
  Lecture Section 101: **Mon, Wed, 10:30 – 11:30**; **Fri, 11:00 – 12:00**
  Lecture Location: Zoom. See Canvas for the Zoom link for each lecture. Join any particular lecture by clicking "Join".

  Tutorial Section T1A: Mon, 13:00-14:00 (TA Name)
  Tutorial Section T1B: Wed, 11:30-12:30 (TA Name)
  Tutorial Section T1C: Mon, 13:00-14:00 (TA Name)
  Tutorial Section T1D: Thu, 8:00-9:00 (TA Name)
  Tutorial Section T1E: Thu, 12:00-13:00 (TA Name)

  Tutorial Location: Zoom. See Canvas for the Zoom link for each tutorial. Join any particular tutorial session (for your tutorial section) by clicking "Join". Please only attend the tutorial section in which you are registered.

  Tutorials start Sept. 14, 2020.

A student who has registered in APSC 248 should register in one of above tutorial sections.

Academic Calendar Entry

Multivariable functions, Lagrange multipliers; line integrals, surface integrals, volume integrals; divergence, curl, gradient; divergence and Stokes' theorems; engineering applications of vector field theory. Fourier series and transform; solutions to partial differential equations. (3-0-1)

Pre-req: APSC 173

Course Format

- Three lecture hours and one tutorial hour each week

Both lectures and tutorials will be synchronous – they will occur at their scheduled times. Please join the appropriate Zoom meeting (in Canvas) at the scheduled times. Lectures and tutorials will be recorded and videos will be available for access through Canvas and/or YouTube.

– Student performance will be assessed on quizzes, one midterm and one final exam.
– Canvas will be used to distribute information such as course syllabus, assignment problems & solutions, lecture and tutorial notes, and announcements related to APSC 248. To log in, please visit the webpage https://canvas.ubc.ca using your CWL Login ID and Password.
– Video tutorials will be posted on YouTube as a supplement to lecture materials. The channel is https://www.youtube.com/c/yangcaoubc .

Course Overview

This course covers differential, integral and vector calculus for functions of more than one variable. Applications of those mathematical methods and concepts can be found in numerical analysis, fluid mechanics, engineering optimization, and engineering electromagnetics. The major topics of the course include:

– Review of vector concepts and their operations
– Lines and planes in 3D
– Vector functions and their derivatives and integrations
– Functions of multi-variables and partial derivatives
– Integration of multivariable functions, in particular, double integrals, triple integrals and surface integrals
– Introduction to finding min/max for multivariable functions based on Lagrange multiplier
– Divergence, curl and gradient of multivariable functions
– Divergence and Stokes' theorems

Learning Outcomes

After completing this course, students will demonstrate comprehension of and apply following mathematical concepts as relevant to the field of engineering:

• Illustrate multivariable functions through level curves and level surfaces;
• Complete partial derivative of functions of multiple variables;
• Construct parametric equations of lines, planes and curves, and find arc length using parametric equation;
• Evaluate double and triple integrals in different coordinate systems including Cartesian, Polar, Cylindrical and Spherical;
• Evaluate surface integral and understand the flux through a surface;
• Apply the concepts of gradient, divergence and curl to engineering applications;
• Employ Divergence theorem and Stokes' theorem to simplify certain multiple integrals;
• Apply vector field theory to solve some practical engineering problems related to fluid mechanics and electromagnetics;

Engineering Accreditation

The Canadian Engineering Accreditation Board requires students to have achieved competency in a twelve main areas by graduation. To ensure that our program provides sufficient instruction in these 12 graduate attributes, course learning outcomes have been mapped to the graduate attributes for each course. The relevant graduate attributes for this course are identified below.

Course Learning Outcomes	**Graduate Attributes** (as defined below)											
	1	2	3	4	5	6	7	8	9	10	11	12
Demonstrate comprehension of and apply mathematical concepts to the field of engineering	D											

CEAB Graduate Attributes

1. **A knowledge base for engineering:** Demonstrated competence in university level mathematics, natural sciences, engineering fundamentals, and specialized engineering knowledge appropriate to the program.
2. **Problem analysis:** An ability to use appropriate knowledge and skills to identify, formulate, analyze, and solve complex engineering problems in order to reach substantiated conclusions.
3. **Investigation:** An ability to conduct investigations of complex problems by methods that include appropriate experiments, analysis and interpretation of data, and synthesis of information in order to reach valid conclusions.
4. **Design:** An ability to design solutions for complex, open-ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural and societal considerations.
5. **Use of engineering tools:** An ability to create, select, apply, adapt, and extend appropriate techniques, resources, and modern engineering tools to a range of engineering activities, from simple to complex, with an understanding of the associated limitations.
6. **Individual and team work:** An ability to work effectively as a member and leader in teams, preferably in a multi-disciplinary setting.
7. **Communication skills:** An ability to communicate complex engineering concepts within the profession and with society at large. Such ability includes reading, writing, speaking and listening, and the ability to comprehend and write effective reports and design documentation, and to give and effectively respond to clear instructions.
8. **Professionalism:** An understanding of the roles and responsibilities of the professional engineer in society, especially the primary role of protection of the public and the public interest.
9. **Impact of engineering on society and the environment:** An ability to analyze social and environmental aspects of engineering activities. Such ability includes an understanding of the interactions that engineering has with the economic, social, health, safety, legal, and cultural aspects of society, the uncertainties in the prediction of such interactions; and the concepts of sustainable design and development and environmental stewardship.
10. **Ethics and equity:** An ability to apply professional ethics, accountability, and equity.

11. **Economics and project management:** An ability to appropriately incorporate economics and business practices including project, risk, and change management into the practice of engineering and to understand their limitations.
12. **Life-long learning:** An ability to identify and to address their own educational needs in a changing world in ways sufficient to maintain their competence and to allow them to contribute to the advancement of knowledge.

Evaluation Criteria and Grading

- Quizzes   15%
- Midterm   30%
- Final Exam   55%

(1).   **Quizzes** (15%)
Five (5) Quizzes will be given throughout the term. All quizzes will be open-book and open-notes. All quizzes will be conducted during tutorials using Canvas.

(2).   **Midterm Tests** (30%):
The **midterm exam will be given on Thursday Oct. 15, 2020 18:30-20:00**. Please ensure that your schedule is clear on that date/time. It will be closed-book and closed-notes. No calculators will be allowed. No make-up for the midterm exam will be offered. If a student misses the midterm exam for a legitimate and documented reason, his/her midterm exam weight will be added to the final examination weight.

The midterm exam will be conducted using Zoom and Canvas. The format of the midterm exam is still under development, but will likely include Multiple Choice Questions (MCQs) and short answers. Students will likely need to scan (or take a photo) of any written work and upload such work to Canvas. More details are forthcoming.

(3).   **Final Examination** (55%):
A three-hour **comprehensive** final examination will be given during the final exam period in December 2020. The exact date for the final examination will be determined and announced by the UBC. The final examination will be closed-book and closed-notes. No calculators will be allowed. A formula sheet will be provided by the instructor. Detailed information on the final examination will be given to the students on the last day of class.

The final exam will be conducted using Canvas. The format of the final exam is still under development, but will likely include Multiple Choice Questions (MCQs) and short answers. Students will likely need to scan (or take a photo) of any written work and upload such work to Canvas. More details are forthcoming.

Note: One must achieve a minimum final examination grade of 40% in order to pass the course. If a student receives a score below 40% in their final examination, the maximum grade they can receive for the course is 47%.

Exam Invigilation Format:

Both the midterm and final exams will be invigilated using Zoom. To maintain privacy, students can log in using only their first name or a nickname. If student choose to log in with only their first name or a nickname, they should register this name with their instructor in advance.

Students will be required to keep their camera on, but the instructor will not record the invigilation session.

At some point during the exam, students will be invited to a Zoom breakout room where they will be asked to hold up their Student ID card, covering the first four digits of their student number, so that the instructor can record the student's presence at the exam. Alternatively, the instructor can set up extra breakout rooms for ID checks with students to ensure privacy.

Required Materials

- Lecture Notes.
- Thomas' Calculus, Calculus: Multivariable, 12th - 14th edition, Pearson.
- Technology requirements for online learning and assessment: a webcam, microphone, and ability to scan or photograph documents. Please refer to the "Document Scanning Solutions" file (posted on Canvas) for your choice of scanning tool and samples of acceptable scans.

Course Schedule
The material to be covered in the lectures is given in the following table (subject to change). Information given during lecture regarding due dates and assignments supersedes the information on this page.

	Date		Lectures	Reading	Homework
Week 1 Sept 7 – 11	7-Sept-20		**No Class**		
	9-Sept-20	1.	Syllabus and Review on vectors	PowerPoint	
	11-Sept-20	2.	Review on vectors	Notes	
Week 2 Sept. 14 – 18	14-Sept-20	3.	Equation of Planes in 3D	Notes	
	16-Sept-20	4.	Equation of Lines in 3D	Notes	
	18-Sept-20	5.	Equation of Lines in 3D	Notes	
Week 3 Sept. 21 – 25	21-Sept-20	6.	Parametric equation of curves	Notes	
	23-Sept-20	7.	Parametric equation of curves	Notes	
	25-Sept-20	8.	Derivative of vector function, tangent vector, Arc length	Notes	
Week 4 Sept. 28 – Oct. 2	28-Sept-20	9.	Line Integral	Notes	
	30-Sept-20	10.	Line Integral	Notes	
	2-Oct-20	11.	Function of Multi-variables, Contour plot, Partial Derivative	Notes	
Week 5 Oct. 5 – 9	5-Oct-20	12.	Chain Rule, Total Differential	Notes	

	7-Oct-20	13.	Gradient Vector, tangent plane	Notes	
	9-Oct-20	14.	Gradient Vector, tangent plane	Notes	
Week 6 Oct. 12 – 16	12-Oct-20		**No Class-Thanksgiving**		
	14-Oct-20	15.	Min/max, Lagrange Multiplier		
	16-Oct-20		**No Lecture due to Midterm Exam**		
Week 7 Oct. 19 – 23	19-Oct-20	16.	Directional Derivatives		
	21-Oct-20	17.	Double Integral		
	23-Oct-20	18.	Double Integral		
Week 8 Oct. 26 – 30	26-Oct-20	19.	Applications of Double Integrals	Notes	
	28-Oct-20	20.	Applications of Double Integrals		
	30-Oct-20	21.	Triple Integral		
Week 9 Nov. 2 – 6	2-Nov-20	22.	Triple Integral		
	4-Nov-20	23.	Triple Integral		
	6-Nov-20	24.	Vector Field and vector Line integrals		
Week 10 Nov. 9 – 13	9-Nov-20	25.	Vector Field and vector Line integrals	Notes	
	11-Nov-20		**No Class-Remembrance Day**		
	13-Nov-20		**No Class – Midterm Break**		
Week 11 Nov. 16 – 20	16-Nov-20	26.	Curl, Green's Theorem		
	18-Nov-20	27.	Curl, Green's Theorem		
	20-Nov-20	28.	Divergence and Surface Integral		
Week 12 Nov. 23 – 27	23-Nov-20	29.	Divergence and Surface Integral		
	25-Nov-20	30.	Surface Integral		
	27-Nov-20	31.	Surface Integral		
Week 13 Nov.30 – Dec. 4	30-Nov-20	32.	Divergence and Stokes' theorem		
	2-Dec-20	33.	Stokes' theorem		
	4-Dec-20	34.	Final Review		

Final Examinations

The examination period for **Term 1 of Winter 2020 is December 7 to 22**. Except in the case of examination clashes and hardships (three or more formal examinations scheduled within a 24-hour period) or unforeseen events, students will be permitted to apply for out-of-time final examinations only if they are representing the University, the province, or the country in a competition or performance; serving in the Canadian military; observing a religious rite; working to support themselves or their family; or caring for a family member. Unforeseen events include (but may not be limited to) the following: ill health or other personal challenges that arise during a term and changes in the requirements of an ongoing job.

Further information on Academic Concession can be found under Policies and Regulation in the *Okanagan Academic Calendar* http://www.calendar.ubc.ca/okanagan/index.cfm?tree=3,48,0,0 .

Academic Integrity

Laura will provide sample language for this section.

Grading Practices

Faculties, departments, and schools reserve the right to scale grades in order to maintain equity among sections and conformity to University, faculty, department, or school norms. Students should therefore note that an unofficial grade given by an instructor might be changed by the faculty, department, or school. Grades are not official until they appear on a student's academic record.
http://www.calendar.ubc.ca/okanagan/index.cfm?tree=3,41,90,1014

Online Etiquette

- In synchronous meetings (lectures and tutorials)
    - **ARRIVE EARLY** Join the session a few minutes before the start time to ensure that your Internet connection, webcam, and microphone are functioning properly.
    - **MUTE YOUR MIC** If you are not speaking, please mute your microphone as it may pick up background noise which can distract other participants.
    - **USE THE "RAISE HAND" FEATURE** If you would like to speak or ask a question, you can make your intentions known to the instructor/moderator without having to unmute your mic. For Zoom: click on the 'Participants' button located at the bottom of the screen, where you will find a blue hand icon. For Collaborate Ultra: click on the raise hand icon located at the bottom on the screen. In both cases, remember to "lower hand" once you have spoken.

- On discussion boards
    - **NO PROFANITY or DEROGATORY TERMS** Everyone in the class and your instructional team can see course discussion boards. Please be polite and professional in your messaging.

o **RESPECTFUL ENVIRONMENT** As per the UBC statement on Respectful Environment, disrespectful behaviour will not be tolerated. Do your part to ensure that everyone feels comfortable using the discussion board as a resource.

Academic Honesty and Integrity Pledge
School of Engineering | Faculty of Applied Science
UBC Okanagan

Academic honesty and integrity are essential principles of the University of British Columbia and engineering as a profession. All UBC students are expected to behave as honest and responsible members of an academic community. Engineering students have an even greater responsibility to maintain the highest level of academic honesty and integrity as they prepare to enter a profession with those principles as a cornerstone.

Cheating on exams or projects, plagiarizing or any other form of academic dishonesty are clear violations of these principles.

As a student of the School of Engineering at UBC Okanagan, I solemnly pledge to follow the policies, principles, rules, and guidelines of the University with respect to academic honesty. In particular, as an engineering student, I commit to upholding academic integrity and professionalism.

By signing this pledge, I promise to adhere to exam requirements and maintain the highest level of ethical principles during the exam period.

_____   _____
Signature   Name

_____   _____
Student Number   Date

Student Service Resources

UBC Okanagan Disability Resource Centre
The Disability Resource Centre ensures educational equity for students with disabilities and chronic medical conditions. If you are disabled, have an injury or illness and require academic accommodations to meet the course objectives, please contact Earllene Roberts, the Diversity Advisor for the Disability Resource Centre located in the University Centre building (UNC 214).

UNC 214   250.807.9263

email: earllene.roberts@ubc.ca
Web: www.students.ok.ubc.ca/drc

UBC Okanagan Equity and Inclusion Office
Through leadership, vision, and collaborative action, the Equity & Inclusion Office (EIO) develops action strategies in support of efforts to embed equity and inclusion in the daily operations across the campus. The EIO provides education and training from cultivating respectful, inclusive spaces and communities to understanding unconscious/implicit bias and its operation within in campus environments. UBC Policy 3 prohibits discrimination and harassment on the basis of BC's Human Rights Code. If you require assistance related to an issue of equity, educational programs, discrimination or harassment please contact the EIO.

UNC 216   250.807.9291

email:equity.ubco@ubc.ca
Web: www.equity.ok.ubc.ca

Health & Wellness
At UBC Okanagan health services to students are provided by Health and Wellness. Nurses, physicians and counsellors provide health care and counselling related to physical health, emotional/mental health and sexual/reproductive health concerns. As well, health promotion, education and research activities are provided to the campus community. If you require assistance with your health, please contact Health and Wellness for more information or to book an appointment.

UNC 337   250.807.9270

email:healthwellness.okanagan@ubc.ca
Web: www.students.ok.ubc.ca/health-wellness

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SAFEWALK

Don't want to walk alone at night? Not too sure how to get somewhere on campus? Call Safewalk at
250-807-8076.
For more information, see: www.security.ok.ubc.ca

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