New Course Outline

- The PharmD Approval Process for New Course Outlines document provides for more information on next steps and approval timelines.
- The Course Outline Submission Overview document provides more detailed guidelines on course learning objectives, topic outlines/scheduling requirements, and assessment methods.
- The AFPC Educational Outcomes for Professional Programs document provides complete information on roles and key competencies for Pharmacy Degree Programs.

Course Number: PHM130H

Course Title: Pharmaceutical Calculations

Outline Version Code:

Course Description:

As pharmacists, you are expected to integrate your knowledge and skills gained throughout the pharmacy curriculum to provide direct patient care. Pharmacy practice is calculations intensive and accuracy is critically important to safe and effective patient care. As medication therapy experts, patients and other health care providers value and depend on pharmacists' expertise and accuracy in pharmaceutical calculations. Throughout the course, students will be required to complete pharmaceutical calculations with a focus on accuracy. A case based approach will be taken to familiarize students with real life examples of common calculations required to practice in community and hospital settings. The objective of this course is to prepare the student to apply knowledge and skills gained to other courses in the program, such as the early practice experience (EPE 1).

Semester: ☒ Fall ☐ Winter ☐ Summer

Course Type: ☐ Elective ☐ Selective ☒ Mandatory

1. Course Learning Objectives:
Upon completion of this course, students will have achieved the following level of learning objectives:
Introductory = knowledge and comprehension of concepts, definitions
Intermediate = application of concepts to simple situations
Advanced = application of concepts to more complex situations with ability to synthesize and evaluate
**Knowledge**
Introductory Level:

Intermediate Level:
- Describe the role pharmaceutical calculations play in the provision of patient care and medication therapy management.

Advanced Level:

**Skills**
Introductory Level:

Intermediate Level:
- Interpret abbreviations and professional nomenclature in prescriptions

Advanced Level:
- Perform pharmaceutical calculations with accuracy
2. **Attitudes/Values:**

*Introductory Level:*

- Accept responsibility to understand and thoughtfully consider the practice problem prior to engaging in pharmaceutical calculations. Perform the necessary calculations in a focused and responsible manner. Complete a double check of his/her calculations/answer and consider the reasonableness of the answer

*Intermediate Level:*

*Advanced Level:*

2. **Rationale for Inclusion in the Curriculum:**

The ability to accurately perform pharmaceutical calculations is essential in the provision of patient care in all pharmacy practice settings. In general, some basic science and chemistry knowledge is required; however, simple mathematical skills are used in carrying out most pharmaceutical calculation problems. Challenges in this area are not linked to complex mathematical computations, but to the correct interpretation of the practice problems. Therefore, it is critical for students to learn and practice approaches to minimize the potential for error in performing pharmaceutical calculation

3. **Pre-requisites:**

4. **Co-requisites:**
5. Course Contact Hours and Teaching Methodologies:

<table>
<thead>
<tr>
<th>Methodology</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Didactic (lecture)</td>
<td>11</td>
</tr>
<tr>
<td>Large group problem-based/ case-based learning (group size: 240)</td>
<td>2</td>
</tr>
<tr>
<td>Laboratory or Simulation</td>
<td></td>
</tr>
<tr>
<td>Tutorial/Seminar/Workshop/Small Group (group size: )</td>
<td></td>
</tr>
<tr>
<td>Experiential</td>
<td></td>
</tr>
<tr>
<td>On-line</td>
<td></td>
</tr>
<tr>
<td>Other (please specify):</td>
<td></td>
</tr>
<tr>
<td><strong>Total Course Contact Hours</strong></td>
<td><strong>13</strong></td>
</tr>
</tbody>
</table>

6. Estimate and description of student's weekly out-of-class preparation time excluding exam preparation:

7. Topics Covered and Lecture Specific Learning Objectives

**Week 1**

**Lecture Topic:** International System of Units and Pharmaceutical Measurement

Lecture Learning Objectives:

- Convert common fractions, decimal fractions and percentages
- Utilize exponential notations in calculations
- Apply the method of ratios and proportion in problem solving
- Recognize the method of dimensional analysis in problem solving
- Demonstrate and understanding of significant figures and rules for rounding

Skills

- Perform pharmaceutical calculations with accuracy

**Week 2**

**Lecture Topic:** International System of Units and Pharmaceutical Measurement

Lecture Learning Objectives:

- Demonstrate and understanding of the International System of Units (SI)
- Recognize other systems of measurement: avoirdupois and apothecaries’ systems
- Convert measures within the International System of Units (SI)
- Convert measures between the International System of Units (SI) and other systems of measurement used commonly in pharmacy practice

Skills

- Apply the International System of Units correctly in pharmaceutical calculation
**Week 3**  
**Lecture Topic:** Interpretation of Prescriptions and Medication Orders

**Lecture Learning Objectives:**

- Correctly interpret standard abbreviations and symbols used on prescription and medication orders
- Roman numerals commonly used on prescriptions Skills
- Demonstrate an understanding of the format and components of a typical prescription and medication orders through the correct interpretation of an order and the appropriate and accurate use of pharmaceutical calculations.

**Skills**

- Demonstrate an understanding of the format and components of a typical prescription and medication orders through the correct interpretation of an order and the appropriate and accurate use of pharmaceutical calculations.

Preparation/Readings: Read Chapter 4 and complete assigned exercises from required textbook.

**Week 4**  
**Lecture Topic:** Percentage, Ratio Strength, and Expressions of Concentration

**Lecture Learning Objectives:**

- Percent (w/v, v/v, w/w)
- Ratio strength
- Milligrams percent
- Parts per million (ppm) and parts per billion (ppb) Skills
- Perform pharmaceutical calculations with accuracy

**Week 5**  
**Lecture Topic:** Calculation of Doses: General Considerations

**Lecture Learning Objectives:**

**Dose definitions**

- Routes of drug/dose administration and dosage forms
- Dose measurement
- General dose calculations
- Dose calculations based on patient parameters

**Skills**

- Perform pharmaceutical calculations with accuracy
Week 6
Lecture Topic: Isotonic and Buffer Solutions

Lecture Learning Objectives:

- Defining tonicity
- Buffers and buffer solutions

Skills

- Pharmaceutical calculations with accuracy.

Week 7
Lecture Topic: Electrolyte Solutions

Lecture Learning Objectives:

- Milliequivalents
- Millimoles
- Milliosmoles
- Osmolarity

Skills

- Pharmaceutical calculations with accuracy.

Week 8
Lecture Topic: Intravenous Infusion, Parenteral Admixtures, Infusion Calculations

Lecture Learning Objectives:

- Rates-of-flow calculations
- Common IV infusions
- IV admixtures

Skills

- Pharmaceutical calculations with accuracy

Week 9
Lecture Topic: Altering Product Strength, Use of Stock Solutions, and Alligation Alternate

Lecture Learning Objectives:

- Dilution and concentration of liquids
- Stock solutions
- Alligation alternate
Skills

- Pharmaceutical calculations with accuracy

Week 10
Lecture Topic: Reducing and Enlarging Formulas

Lecture Learning Objectives:

- Dilution and concentration of liquids
- Stock solutions
- Allegation alternate

Week 11
Lecture Topic: Final Exam Review

Lecture Learning Objectives:

- Review of case examples in preparation for Final Exam

Week 12
Lecture Topic:

Lecture Learning Objectives:

Week 13
Lecture Topic:

Lecture Learning Objectives:
8. Assessment Methodologies Used:

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Course Learning Objectives Addressed</th>
<th>Assessment Method Used</th>
<th>Percent of Course Grade</th>
<th>For Group Work: Individualized or same mark for all group members</th>
</tr>
</thead>
<tbody>
<tr>
<td>☒ Assignment</td>
<td></td>
<td>Covered by materials from lectures 1 – 5</td>
<td>MCQ (Term Test #1)</td>
<td>Pass/Fail: Average grade of 85% on Assessment 1 and Assessment 3</td>
</tr>
<tr>
<td>☐ Presentation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ Participation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ Mid-term</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ Final Exam</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>☒ Assignment</td>
<td></td>
<td>Assessment 2a, 2b, 2c: Covered by materials from lectures 1 – 7</td>
<td>MCQ (Term Test #2)</td>
<td>Pass/Fail: The final grade of the course will be a PASS/FAIL. In order to PASS the course, students must achieve the following: 100% on Assessment 2a, 2b, or 2c, and</td>
</tr>
<tr>
<td>☐ Presentation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ Participation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ Mid-term</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ Final Exam</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ Assignment</td>
<td></td>
<td>Cumulative Exam</td>
<td>MCQ (Final)</td>
<td>Pass/Fail: Average grade of 85% on Assessment 1 and Assessment 3</td>
</tr>
<tr>
<td>☐ Presentation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ Participation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ Mid-term</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ Final Exam</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Expectation for pass grades for all Pharmacy courses is 60%*

9. Policy and procedure regarding late assignments/examinations/laboratories:

10. Policy and procedure regarding missed assignments/examinations/laboratories:

Students who miss an examination or a test and who have a valid petition filed with the Registrar's office will be eligible to complete a make-up examination or test. The format of this examination or test will be at the discretion of the course coordinator.
11. AFPC Education Outcomes addressed (check all those that apply):
- Refer to AFPC Educational Outcomes for Professional Programs for further information about the role and key competencies.

As Care Providers, pharmacy graduates:

**CP1 – Practice within the pharmacist scope of practice and expertise**

☐ CP1.1 Apply knowledge from the foundational sciences to make decisions relevant to the contemporary and evolving scope of pharmacist practice;

☒ CP1.2 Integrate AFPC Communicator, Collaborator, Leader-Manager, Health Advocate, Scholar, and Professional roles in their practice of pharmacy;

☒ CP1.3 Recognize and respond to the complexity, uncertainty and ambiguity inherent in pharmacy practice;

☐ CP1.4 Explain the benefits, risks and rationale associated with pharmacist-provided care as an important step in obtaining and documenting consent to pharmacist care;

☐ CP1.5 Recognize and take appropriate action when signs, symptoms and risk factors that relate to medical or health problems that fall into the scope of practice of other health professionals are encountered.

**CP2 – Provide patient-centred care**

☒ CP2.1 Collect, interpret, and assess relevant, necessary information about a patient’s health-related care needs;

☐ CP2.2 Formulate assessments of actual and potential issues and in collaboration with the patient and other health team members as appropriate, prioritize issues to be addressed in a given patient encounter;

☐ CP2.3 Create and document plans in collaboration with the patient and other health team members as appropriate, and make recommendations to prevent, improve or resolve issues;

☒ CP2.4 Implement plans in collaboration with the patient and other health team members as appropriate, including:

  - CP2.4.1 obtaining consent
  - CP2.4.2 making a referral or consulting others
  - CP2.4.3 adapting, initiating, renewing/continuing, discontinuing or administering medication as authorized
  - CP2.4.4a dispensing and/or
  - CP2.4.4b compounding and/or
  - CP2.4.4c delegating/authorizing such tasks to others appropriately
CP2.4.5 engaging the patient or care-giver through education, empowerment and self-management, and
CP2.4.6 negotiating the role of pharmacy and non-pharmacy team members in continuity and transitions of care.

☐ CP2.5 Follow-up by monitoring, evaluating progress toward achievement of the patient’s goals of therapy, adjusting plans in collaboration with the patient and health team members across the care continuum.

CP3 – Actively contribute, as an individual and as a member of a team providing care, to the continuous improvement of health care quality and patient safety

☐ CP3.1 Recognize and respond to harm and potential harm from health care delivery, including patient safety incidents;
☒ CP3.2 Adopt strategies that promote patient safety and address human and system factors;

As Communicators, pharmacy graduates:

CM1 – Communicate in a responsible and responsive manner that encourages trust and confidence

☐ CM1.1 Select and use oral, non-verbal and written communication strategies (tools, techniques, technologies, etc.) effectively so that the patient’s best interests are foremost;
☐ CM1.2 Provide timely, clear responses that are tailored to the context and audience;
☐ CM1.3 Express facts, evidence, opinions and positions accurately and effectively, with clarity and confidence;
☐ CM1.4 Listen, actively solicit and respond appropriately to ideas, opinions and feedback from others;
☐ CM1.5 Use language, pace, tone, and non-verbal communication that is suitable for:
   a) the intended outcomes of the communication, and
   b) the complexity, ambiguity, urgency and/or difficulty of a situation, conversation or conflict
☐ CM1.6 Seek and synthesize relevant information from others in a manner that ensures common understanding and where applicable, clarifies and secures agreement and/or consent;
☒ CM1.7 Compose and share oral, written, and electronic information in a manner that optimizes patient safety, dignity, confidentiality, and privacy.

CM2 – Communicate in a manner that supports a team approach to health promotion and health care

☐ CM2.1 Engage in respectful, empathetic, compassionate, non-judgmental, culturally safe, tactful conversations with patients, communities, populations, and health team members;
CM2.2 Demonstrate awareness of the impact of one’s own experience level, professional culture, biases and power and hierarchy within the health team on effective working relationships, communication and conflict resolution with health team members and adapt the approach to the situation appropriately;

CM2.3 Demonstrate accuracy and appropriateness of communication as well as respect for the role of other health team members when disclosing information about harmful or potentially harmful situations;

CM2.4 In word and in action, convey the importance of teamwork in patient-centred care, patient safety, health care quality improvement and health program delivery.

As Collaborators, pharmacy graduates:

CL1 – Work effectively with members of the health team including patients, pharmacy colleagues and individuals from other professions

CL1.1 Establish and maintain positive relationships;

CL1.2 Recognize, respect and negotiate the roles and shared/overlapping responsibilities of team members;

CL1.3 Join with others in respectful, effective shared decision-making.

CL2 – Hand over the care of the patient to other pharmacy team members and non-pharmacy team members to facilitate continuity of safe patient care

CL2.1 Determine when and how care should be handed over to another team member;

CL2.2 Recognize, respect and honour the negotiate shared and overlapping responsibilities of patients, pharmacy team members and other health members when handovers occur;

CL2.3 Demonstrate safe handover of care, using oral, written, and electronic communication, during a patient transition to a different care provider or setting.

As Leader-Managers, pharmacy graduates:

LM1 – Contribute to optimizing health care delivery and pharmacy services

LM1.1 Work with others to apply quality improvement strategies and techniques to optimize pharmacy care;

LM1.2 Contribute to a culture of patient safety;

LM1.3 Confirm the quality, safety, and integrity of products;

LM1.4 Use health informatics to improve the quality of care, manage resources and optimize patient safety.
LM2 – Contribute to the stewardship of resources in health care systems

☐ LM2.1 Apply evidence and management processes to achieve cost appropriate care;
☐ LM2.2 Allocate health care resources for optimal patient care;
☐ LM2.3 Contribute to the management of finances and health human resources in pharmacy practice settings;

LM3 – Demonstrate leadership skills

☐ LM3.1 Demonstrate leadership skills to enhance pharmacy practice and health care.

LM4 – Demonstrate management skills

☐ LM4.1 Work with others to apply the principles of effective management and supervision of health human resources and medication use systems;
☐ LM4.2 Use effective strategies to manage and improve their own practice of pharmacy.

As Health Advocates, pharmacy graduates:

HA1 – Respond to an individual patient’s health needs by advocating with the patient within and beyond the patient care environment

☐ HA1.1 Work with patients to address determinants of health that affect them and their access to needed health services or resources;
☐ HA1.2 Work with patients to increase opportunities to adopt healthy behaviours;
☐ HA1.3 Incorporate disease prevention, health promotion and health surveillance into interactions with individual patients.

HA2 – Respond to needs of communities or populations they serve by advocating with them for system-level change in a socially accountable manner

☐ HA2.1 Work with community or population to identify the determinants of health that affect them;
☐ HA2.2 Participate in health promotion and disease prevention programs.

As Scholars, pharmacy graduates:

SC1 – Apply medication therapy expertise to optimize pharmacy care, pharmacy services and health care delivery
☐ SC1.1 Use knowledge and problem-solving to arrive at recommendations and decisions that are appropriate, accurate, and practical;

☐ SC1.2 Use professional experience to solve routine, previously encountered problems;

☐ SC1.3 Use established decision-making frameworks and apply learning required to manage new situations and problems.

SC2 – Integrate best available evidence into pharmacy practice

☐ SC2.1 Generate focused questions related to needs for information, recommendations and decisions in practice;

☐ SC2.2 Use systematic approaches in the search for best available evidence;

☐ SC2.3 Critically appraise health-related research and literature;

☐ SC2.4 Incorporate best available evidence in the decision-making process.

SC3 – Contribute to the creation of knowledge or practices in the field of pharmacy

☐ SC3.1 Apply scientific principles of research and scholarly inquiry;

☐ SC3.2 Apply ethical principles that underlie research and scholarly inquiry.

SC4 – Teach other pharmacy team members, the public and other health care professionals including students

☐ SC4.1 Provide effective education to others;

☐ SC4.2 Employ appropriate teaching roles when teaching others;

☐ SC4.3 Deliver effective feedback in teaching and learning situations;

☐ SC4.4 Use appropriate learning assessment and evaluation strategies when working with patients, team members, students and teachers.

As Professionals, pharmacy graduates:

PR1 – Committed to apply best practices and adhere to high ethical standards in the delivery of pharmacy care

☐ PR1.1 Exhibit professional behaviour whether face-to-face, in writing, or via technology-enabled communication. Professional; behaviour includes, but is not limited to:

    a) demonstrating honesty, integrity, humility, commitment, altruism, compassion, respect for diversity and patient autonomy;

    b) being accessible, diligent, timely and reliable in service to others;

    c) abiding by the principle of non-abandonment;
d) maintaining appropriate interpersonal boundaries;

e) maintaining professional composure, demeanor, and language even in difficult situations, and;

f) maintaining privacy and confidentiality;

☐ PR1.2 Use ethical frameworks as one component of professional judgment;

☐ PR1.3 Recognize and respond to situations presenting ethical dilemmas, including conflicts of interest;

☐ PR1.4 Engage in activities that:

   a) protect the public, and;

   b) advance the practice of pharmacy.

PR2 – Able to recognize and respond to societal expectations of regulated health care professionals

☐ PR2.1 Take responsibility and accountability for actions and inactions;

☒ PR2.2 Demonstrate a commitment to patient safety and quality improvement;

☐ PR2.3 Honour the laws, ethical codes, and regulatory requirements (by-laws, standards, policies) that govern the self-regulated profession of pharmacy;

☐ PR2.4 Demonstrate an understanding of federal, provincial/territorial, and municipal laws, policies and standards that apply to pharmacy workplaces;

☐ PR2.5 Demonstrate an ability to maintain competence to practice through evaluating areas for improvement and planning, undertaking learning activities to address limitations in competence and/or performance and incorporating learning into practice;

☐ PR2.6 Identify and respond to unprofessional, unethical, and illegal behaviours in pharmacists, other pharmacy team members, and other health professionals.

PR3 – Committed to self-awareness in the management of personal and professional well being

☐ PR3.1 Set professional and personal goals, priorities, and manage their time to balance patient care, workflow, and practice requirements;

☐ PR3.2 Examine, reflect upon, and manage personal attributes (knowledge, skills, beliefs, biases, motivations, emotions, etc.) that could influence self-development and professional performance;

☐ PR3.3 Adapt their practice of pharmacy to fulfill evolving professional roles;

☐ PR3.4 Recognize and respond to self and colleagues in need.