Far Western University
Faculty of Education
B. Ed. in Mathematics Education

Course Title: Professional Development of Mathematics Teachers
Course No.: Math. Ed. 485 | **Nature of the Course: Theoretical**
Level: Undergraduate | **Credit hours: 3**
Semester: Eighth | **Teaching Hours: 48**
Time per Period: 1 Hour

1. Course Description

This course is designed with the purpose of developing knowledge and skills needed for the mathematics teachers. It deals with the ideas concerning professional development of mathematics teachers. It consists three areas: Developing pedagogical skills, developing research skills, and developing knowledge of philosophy of mathematics education. The prerequisites of the course are basic knowledge of nature of mathematical knowledge, pedagogies in mathematics, and different terminologies associated with teaching mathematics. It is expected that the course helps perspective mathematics teachers in developing their knowledge and skills needed for the professional development.

2. General Objectives

By engaging in the learning of the content of this course, students will be able to

- Demonstrate knowledge and skills of making mathematics classroom effective.
- Show the knowledge and skills of engaging students behaviorally, emotionally, and cognitively in mathematics classrooms.
- Demonstrate knowledge of conferences, seminars, and workshops concerning mathematics education.
- Show knowledge and skills on conducting action research to improve approach of teaching mathematics.
- Demonstrate in-depth knowledge of philosophy of mathematics and mathematics education.

3. Specific objectives and contents.

Specific Objectives	Contents
• To describe techniques of using mathematics textbook effectively. • To describe techniques of using learning resources effectively. • To explain how to assign and evaluate homework. • To list out classroom questioning strategies. • To describe how to diagnose and resolve learning difficulties. • To explain technique of maintaining discipline in classroom.	**Unit I: Making Mathematics Classrooms Effective (6 hours)** 1.1 Using mathematics textbook effectively 1.2 Using teaching learning resources 1.3 Assigning and evaluating homework 1.4 Classroom questioning strategies 1.5 Diagnosing and resolving learning difficulties 1.6 Maintaining discipline in the classroom
• To explain concept and importance of cognitive, behavioral, and emotional engagement in mathematics teaching.	**Unit II: Students' Engagement in Mathematics Classrooms (10 hours)** 2.1 Introduction of students' engagement

• To discuss various ways to engage students through these three dimensions. • To explain how project works, art integration, contextual teaching, hands-on activities, and scaffolding of optimal level engages students cognitively, behaviorally, or/and emotionally. • To envision techniques to engage students through one or more of dimensions.	2.2 Types of student engagement: Cognitive, behavioral, and emotional 2.3 Ways to engaging students behaviorally, emotionally and cognitively 2.4 Hands-on activities on mathematics 2.5 ZPD, optimal level of task, and optimal level of scaffolding 2.6 Project works in Mathematics 2.7 Integrating arts in teaching mathematics 2.8 Creating contextual problems form real life
• To explain the concept, purpose, and importance of workshops, seminars, and conferences in mathematics education. • To conduct workshops for particular topics in mathematics education. • To write seminar papers and present it in the seminars. • To discus the types of conferences with examples. • To describe roles of participants, presenters, chairs, panelist, key note speakers, and organizers in the conferences.	**Unit III: Workshop, Seminar, and Conference in Mathematics Education (10 hours)** 3.1 Workshop in mathematics education 3.1.1 Concept, purpose and importance 3.1.2 Conducting workshops for mathematics 3.2. Seminar in Mathematics Education 3.2.1 Concept, purpose and importance 3.2.2 Types and scopes of seminars 3.2.3 Writing a seminar paper 3.2.4 Presenting in the seminars 3.3 Conferences in mathematics education 3.3.1 Concept, purpose, and importance 3.3.2 Types of conferences 3.3.3 Roles in the conferences
• To describe action research and its characteristics. • To write procedure for conducting action research. • To discuss various tools and procedure for fata collection. • To discuss the ways to maintain quality standards in AR. • To develop proposal for action research and conduct AR. • To conduct an action research and prepare a report (Assignment).	**Unit IV: Action Research in Mathematics Education (10 hours)** 4.1 Introduction of Action Research 4.2 Characteristics of AR 4.3 Procedure for AR: Steps and cycles 4.4 Tools for data collection in AR 4.5 Data collection and analysis procedure in AR 4.6 Maintaining quality standards in AR 4.7 Writing proposal for AR 4.8 Conducting AR and reporting results
• To explain briefly the concept of mathematics and mathematics education. • To describe the relationship between mathematics and mathematics education. • To elucidate the concept of philosophy of mathematics and mathematics education. • To differentiate absolutist and fallibilist view on nature of mathematical knowledge. • To argue on the objective and subjective mathematical knowledge from social constructivist point of view. • To discuss the domain of philosophy of mathematics education.	**Unit V: Philosophy of Mathematics and Mathematics Education (12 hours)** 5.1 Introduction of Mathematics and Mathematics Education 5.2 Interrelation between mathematics and mathematics education 5.3 Philosophy of Mathematics 5.3.1 Introduction of philosophy of mathematics 5.3.2 Absolutist view of mathematical knowledge and its criticism 5.3.3 Fallibilist view of mathematical knowledge 5.3.4 Social constructivism as a philosophy of mathematics: Objective and subjective

• To explain philosophy of mathematics education in terms of aims, values, equal opportunity, investigation, problem solving, and pedagogy. • To discuss the philosophy of teaching, learning, and doing mathematics.	mathematical knowledge 5.4 Philosophy of Mathematics Education 5.4.1 Domain of philosophy of mathematics education. 5.4.2 Aims of mathematics education 5.4.3 Mathematics, values, and equal opportunities 5.4.4 Investigation, problem solving and pedagogy 5.4.5 Philosophy of teaching, learning, and doing mathematics

4. Methodology and Techniques

- **For unit I,** discus on each content area. Teachers are advised to create some case scenario and ask some questions concerning use of textbook, assigning homework, classroom questioning, and discipline. Then, help students in drawing conclusion on how to make mathematics classroom effective. It is suggested to use inductive method of teaching.
- **For unit II,** give emphasis on practical activities. Start class with brief discussion on theoretical part of the content and then assign students task for each topic. Let the students give opportunity of learning by doing. Give special focus on engaging from all three dimensions.
- **For unit III,** use inductive approach of teaching. Let them provide some reading materials concerning conferences, seminars, and workshops that had already happened. Then discuss on the concept, main events, activities, and roles.
- **For unit IV**, start from brief introduction of action research and procedure of doing action research. Then, engage students in selecting problem and conducting a small-time action research and facilitate them to prepare report of their research work.
- **For unit V,** assign the topics groupwise and let them to present in the classroom. Then, discuss in detail on each of the topics.

5. Evaluation Scheme

5.1 Internal Evaluation (40%)

Internal Evaluation will be conducted by the course facilitator based on the following activities.

a) **Attendance and Participation in class activities**: **10 marks**

b) **Assignment I [**Preparing a AR report and its viva**]** **5+5=10 marks**
(Ask students individually to do action research and prepare its report. Then conduct viva voce based on the report)

c) **Assignment II**: [Knowledge covering whole course] **5+5=10 marks**
(Assign two highly comprehensive questions covering large part of the course, same questions to all, and let them submit the answer sheets. Ask them questions individually based on their responses).

d) **Mid-term exam:** **10 marks**

5.2 External Evaluation (Final Examination) 60%

The Controller of Examination office will conduct the final examination at the end of the semester.

End Semester Examination Model

Nature of question	Total questions to be asked	Total questions to be answered	Total marks
Group A: Multiple choice	10 questions	10 × 1 mark	10
Group B: Short answer type question	6 with 2 'or' questions	6 × 5 marks	30

Group C: Long answer type question/case studies	2 with 1 'or' questions	2 × 10 marks	20
Total			**60**

References

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Far Western University
Faculty of Education
B. Ed. in Mathematics Education

Course Title: Integrated Approaches in Mathematics Education
Course No.: Math. Ed. 486 | **Nature of the Course: Theoretical**
Level: Undergraduate | **Credit hours: 3**
Semester: Eighth | **Teaching hours: 48**
Time per Period: 1 Hour

1. Course Description

This course deals with integrated approaches in curriculum, pedagogy, and assessment concerning mathematics education. The aim of the course is to make perspective mathematics teachers familiar with knowledge and skills of integrated education in relation to mathematics education. It starts with two widely used approaches STEM Education and STEAM Education. Then integration in curriculum, in pedagogical approaches, and in assessment approaches are discussed. The prerequisites of this course are concept of curriculum, pedagogy, and assessment.

2. General Objectives

After completing the course, the students will be able to

- Demonstrate understanding of STEM/STEAM education and its philosophy.
- Show knowledge and skills in different approaches of curriculum integration.
- Develop knowledge and skills of different integrated pedagogical approaches in relation to school mathematics.
- Demonstrate knowledge of various integrated assessment approaches and develop assessment tools.

3. Specific objectives and contents

Specific Objectives	Content
• To explain the concept of STEM and STEAM education. • To describe how 21st century skills are addressed in STEAM education. • To elucidate role of art and technology in STEAM education. • To give argument on nature of curriculum, pedagogy and assessment in STEAM education. • To explain benefits, implication, and philosophy of STEAM education. • To describe implications of STEAM approaches in teaching mathematics at school level.	**Unit I: STEM/STEAM Education (12 hours)** 1.1 Introduction of STEM education 1.2 Concept of STEAM education 1.3 21st century skills and STEAM education 1.4 Role of Art and Technology in STEAM education 1.5 Curriculum, pedagogy, and assessment in STEAM Education 1.6 Philosophy of STEAM education 1.7 Benefits and implication of STEAM education 1.8 Implementing STEAM approaches in teaching mathematics
• To depict the meaning, need, and challenges curriculum integration. • To explain what constitutes knowledge in integrated curriculum. • To explain ways of curriculum integration, particularly, within disciplines, across disciplines, and within and across learners. • To illustrate multidisciplinary, interdisciplinary, and transdisciplinary approach of curriculum integration.	**Unit II: Curriculum Integration (12 hours)** 2.1 Meaning and need of curriculum integration 2.2 Knowledge in integrated curriculum 2.3 Ways of curriculum integration: Within disciplines, across disciplines, and within and across learners 2.4. Multidisciplinary, interdisciplinary, and transdisciplinary approach of curriculum integration 2.5 Integrated curriculum practiced in Nepal: Integration of mathematics with other subjects 2.6 Challenges of implementing integrated curriculum

• To explore integrated curriculum practiced in Nepal, in particular, integration of mathematics with other subjects.	
• To describe the constructivism as a foundation of integrated pedagogical approaches. • To explain the concept, steps (if any), role of teacher, role of students, and conditions for application of pedagogical approaches: Inquiry-based learning, problem-based learning, project-based learning, art-based learning, ICT integrated teaching, and STEAM pedagogy. • To develop lesson plan for each of these methods and implement on the classroom. • To develop integrated projects and design real life problems associated with at least two components of STEAM.	**Unit III: Integrated Pedagogical Approaches (16 hours)** 3.1 Constructivism as a foundation of pedagogical approaches 3.2 Inquiry-based learning: 5E instructional approach 3.3 Project-based Learning: Integrated projects 3.4 Problem-based learning: Real life problems 3.5 ICT integrated teaching: Integrating ICT in Mathematics 3.6 Art-based teaching: Integrating arts in teaching mathematics 3.7 STEAM pedagogical approach to teach mathematics 3.8 Collaborative teaching approach
• To explain the meaning of portfolio and procedure of its use as an approach of assessment. • To describe the way of assessing projects. • To explain the way of using self/peer assessment technique to evaluate collaborative works. • To assess students' cognitive, emotional, and behavioral engagement students' performance on these aspects. • To describe the way of using students' reflection as a way of assessment technique. • To develop assessment tasks (particularly authentic) that measures 21st century skills. • To use rubric in above type of assessment techniques. • To apply these approaches in evaluating students' performance.	**Unit IV: Assessment Techniques in Integrated Education (8 hours)** 4.1 Portfolio-based assessment 4.2 Assessing projects or integrated projects 4.3 Self/peer assessment on collaborative works 4.4 Assessing engagement through observation 4.5 Assessment of knowledge of each component of STEAM 4.6 Assessment through observing students' reflection 4.7 Assessing cognitive, affective, and psychomotor aspects 4.8 Use of rubric in assessment 4.9 Assessing through authentic tasks 4.10 Assessing 21st century skills

4. Methodology and Techniques

- **For unit I,** use flipped pedagogy. For, teachers need to provide the reading materials on STEM Education and STEAM Education and ask students to share their understanding on the classroom. Then, facilitate students to develop clear concepts of the topics mentioned in this unit.
- **For unit II,** start a class by discussing on the concept of integrated curriculum. Then, divide the class into three groups and assign the group work to read the reading materials concerning three approaches of integration. Ask each group to present in the classroom and facilitate students to develop clear concept. Then, assigning group work, discuss on the integrated curriculum of grade 1-3 in Nepal. Finally, discuss on challenges of curriculum integration.
- **For unit III,** start with the discussion on theoretical aspects of the pedagogical approaches, covering the main concept and steps. Then, engage students in writing the classroom activities that need to be done for each type of approaches. Give sufficient time in Art-based approach and project-based learning. Engage students in developing integrated project works.

- **For unit IV**, discuss how each assessment technique can be used and help students in creating assessment tools for basic-level courses. In this unit, emphasize students participation on developing assessment tools.

5. Evaluation Scheme

5.1 Internal Evaluation (40%)

Internal Evaluation will be conducted by the course facilitator based on the following activities.

a) **Attendance and Participation in class activities**: **10 marks**

b) **Assignment I [Theoretical knowledge]** **5+5=10 marks**
(Give two comprehensive questions, one from each of the first two units, and ask students to write answer them in at least 1000 words. Then ask them to present in the classroom)

c) **Assignment II**: **5+5=10 marks**
(Divide students in four groups and assign them topics for integrated project works. Then ask students to prepare group reports and present them in a classroom)

d) **Mid-term exam:** **10 marks**

5.2 External Evaluation (Final Examination) 60%

The Controller of Examination office will conduct the final examination at the end of the semester.

End Semester Examination Model

Nature of question	Total questions to be asked	Total questions to be answered	Total marks
Group A: Multiple choice	10 questions	10 × 1 mark	10
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Total			**60**

References

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