QF01/0408-4.0E	Course Plan for Bachelor program - Study Plan Development and Updating Procedures/ Mathematics Department

Study plan No.	**2021/2022**		**University Specialization**	**Bachelor of Mathematics**	
Course No.	**0101112**		**Course name**	**Foundations of Mathematics**	
Credit Hours	**3**		**Prerequisite/ Co-requisite**	.....	
Course type	☐ MANDATORY UNIVERSITY REQUIREMENT	☐ UNIVERSITY ELECTIVE REQUIREMENTS	☐ FACULTY MANDATORY REQUIREMENT	☐ Support course family requirements	✓ **Mandatory requirements**	☐ Elective requirements
Teaching style	☐ Full online learning		☐ Blended learning		✓ **Traditional learning**	
Teaching model	☐ 1 Synchronous: 1 asynchronous		☐ 1 face to face : 1 asynchronous		✓ **2 Traditional**	

Faculty member and study divisions' information (to be filled in each semester by the subject instructor)

Name	Academic rank	Office No.	Phone No.	E-mail	
Division number	**Time**	**Place**	**Number of students**	**Teaching style**	**Approved model**

Brief description

Introduction to logical symbols, Connectives, Tautologies and contradictions, Quantifiers, Methods of proof, Operations on sets, Indexed families, Proof by induction, Relations, Cartesian graphs and direct graphs, Equivalence relations, Partitions, Functions, Operations on functions, Inverse functions, Finite sets and infinite sets, Countable sets.

Learning resources

Course book information (Title, author, date of issue, publisher ... etc)	P. Fletcher and C.W. Patty, Foundations of Higher Mathematics, PWS-KENT, Boston, 1988			
Supportive learning resources (Books, databases, periodicals, software, applications, others)	1.- Set Theory, C. Pinter, Addison-Wesley, London, 1971 2.- A Transition to Advanced Mathematics, D. Smith, M. Eggen, and R. Andre, Wadsworth, California, 1986. 3.- The Elements of Set Theory, Deepak, 2008			
Supporting websites	1- Discrete Mathematics Notes. Stanford University. 2- Vladlen Koltun, Discrete Structures lecture notes. 3- http://www.ugrad.math.ubc.ca/coursedoc/math100/index.html 4- Online tutorials and quizzes			
The physical environment for teaching	✓ **Class room**	☐ labs	☐ Virtual educational platform	☐ Others
Necessary equipment and software				
Supporting people with special needs				
For technical support				

Course learning outcomes (S= *Skills, C= Competences K= Knowledge,)*

No.	Course learning outcomes	The associated program learning output code
	Knowledge	
K1	Define the basic concepts in propositional logic, sets, relations and functions.	MK1
K2	State some important logical implications and equivalences.	MK2
K3	Interpret the principles of mathematical induction.	MK1
K4	Identify suitable methods of proof.	MK2
K5	Define the Countable and uncountable sets, cardinal numbers	MK2
	Skills	
S1	Construct truth tables of compound statements.	MS1
S2	Evaluate the truth value of a statement using the principles of logic	MS2
S3	Analyse the logical structure of statements symbolically, including the proper use of logical connectives, predicates and quantifiers.	MS4
S4	Prove some statements by the direct method or the method of proof by contradiction.	MS4
S5	Disprove a hypothesis by giving counter examples.	MS5
	Competences	
C1	Cooperate to work effectively in the group assignments.	MC1
C2	Develop the individual's ability to communicate and interact with other mathematical courses	MC2

Mechanisms for direct evaluation of learning outcomes

Type of assessment / learning style	Fully electronic learning	Blended learning	Traditional Learning (Theory Learning)	Traditional Learning (Practical Learning)
First/Second exam	30%	30%	**30%**	30%
Participation / practical applications	0	0	**20%**	30%
Asynchronous interactive activities	30%	30%	**0**	0
Final exam	40%	40%	**50%**	40%

Schedule of simultaneous / face-to-face encounters and their topics

Week	Subject	learning style	Reference
1	**I. <u>Logic and Language of Proof</u>** Propositions(Statements); truth value, sentential connectives, negation, disjunction, conjunction, conditional and biconditional statements, tautologies and contradictions, equivalent statements.	Lecture	1-11
2	The converse and the contrapositive of a conditional, the universal and the existential quantifiers, negation of quantified statements	Lecture	12-17

3	Techniques of proof the direct method, the contrapositive method, the contradiction method, proof by cases, counterexamples	Lecture	18-29
4	**II. Sets** Definition, set-builder notation, subset, equal sets, proper subset, the empty set , the power set.	Lecture	31-34
5	Union and intersection of sets, disjoint sets, universal set, complements, properties of unions, intersections and complements	Lecture	34-41
6	Indexed families of sets, proving or giving counterexamples to various statements involving sets.	Lecture	41-46
7	**III. Mathematical Induction** The well-ordering property of N, the principle of mathematical induction (PMI), equivalent forms of PMI.	Lecture	51-65
8	**IV. Relations and Order** Ordered pairs, Cartesian product, relation ,the domain and the range of a relation, the inverse of a relation. **Midterm Exam**	Lecture	80-90
9	Reflexive, symmetric and transitive relations, equivalence relations, composition of relations,	Lecture	92-97 107-109
10	Equivalence classes, partitions, congruence relations, congruence classes, orders, partial order, well order.	Lecture	97-106
11	**V. Functions** Functions as relations, composition of functions, injective (one-to one) functions, the inverse function.	Lecture	115-120
12	Surjective (onto) functions, bijections, composition of functions.	Lecture	120-125
13	Real-valued functions, images and inverse images of sets, proving more theorems involving the previous concepts concerning functions.	Lecture	131-143
14	**VI. Countability and Cardinality of Sets** Euqinumerous sets, finite and infinite sets, denumerable sets.	Lecture	175-194
15	Countable and uncountable sets, cardinal numbers.	Lecture	175-194
16	**Final Exam**		