DEPARTMENT OF MATHEMATICS

LAHORE COLLEGE FOR WOMEN UNIVERSITY, LAHORE

SELF-ASSESSMENT REPORT

<u>BS MATHEMATICS</u>

Submitted to

Quality Enhancement Cell,

Lahore College for Women University, Lahore

Dated: _____

Program Team Members:

1. Dr. Uzma Bashir
2. Mrs. Shabana Zain
3. Dr. Saima Nazeer

Head of the Department: Dr. Imrana Kousar

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INTRODUCTION

Mathematics is an interdisciplinary tool and language. It is used as an essential element in many fields, including social and natural sciences, engineering and medicine. For this reason, mathematics is called mother of all sciences and considered as a building block for everything in our daily lives. Consequently, all research and technical abilities in almost all the applied sciences are based on proficiency and excellence in mathematical skills.

Mathematics as a subject at Lahore College was first taught during the pre-partition days. When the college was shifted to the present building in 1951, Miss Ali Muhammad was the Head of the Department. In 1958, the subject was offered at ungraduated level. Later in 1996, to meet the needs of the time, it was offered at graduate level. The current four year degree BS mathematics program was started in 2005. This program has been basically designed for laying down a firm footing foundation to carry out advanced level research projects in mathematics. This program is intended to produce graduates with excellence in the skills given as follows:

- Reasoning and thinking skills leading to systematic and creative approach.
- Develop critical and logical thinking enabling individual to acquire skill such as interpretation analysis, synthesis, application, evaluation, inference and reflection.

- Effective communication skills in writing, reading, speaking and listening.
- Effective team work abilities, interpersonal skills, appreciation for diversity.
- Strong conceptual and computational talent so that student will have a solid background to pursue higher educational program and they will be able to take up assignments in industry and other related practical fields.

CRITERION 1: PROGRAM MISSION, OBJECTIVES AND OUTCOMES

Standard 1-1: The program must have documented measurable objectives that support college and institution mission statements.

Quality Policy of Department of Mathematics:

The core values of the department are:

- Credibility and Merit
- integrity and character building
- Moral Values
- Task Oriented

- Respect and care
- Commitment
- Accountability
- Fairness
- Transparency

Mission Statement of BS Program

The mission of Department of Mathematics is:

- to contribute to the development of students who think critically, have abilities to reason logically and provide new solutions to the mathematical problems.
- to produce a considerable and qualified group of graduates in the areas of general and applied mathematics.
- to prepare graduates who can contribute their innovative research ideas to industry and in educational field.
- to offer the students with variety of courses to meet the challenges of the era.
- to develop the students with adequate knowledge of mathematics to pursue higher studies in mathematics.
- to generate an understanding that mathematics is a constantly developing field which is corelated to other sciences and human nature.
- to impart the students with enough mathematical knowledge and skills using appropriate technology necessary for success in their program and future careers.
- to train the students to become active citizens who can effectively participate in nation building. The aim is to create trust and understanding within and between communities.

Program's Objectives:

The study of mathematics is considered as indispensable for any branch of science and technology as well as for our everyday life. Thus, the study of mathematics can lead to exciting professional. Keeping in view these facts, the objectives of B.S program in mathematics are as follows.

1. To provide the setting for the individual to become acquainted with the elementary tools of mathematics and techniques to use them by covering wide range of basics tools of mathematics, i.e., limits continuity. Differentiation, integration, conic section.
2. To provide the students with necessary elementary background for all branches of modern mathematics and advanced topics involving analysis and to train the students in the use of axiomatic method.

3. To develop mastery level knowledge of mathematical methods and introduction to algorithm/numerical techniques suitable for applications of mathematics in the formulation of physical theories, computer sciences and engineering.

4. To provide the student with the introductory courses of programming and to make them able to solve problems related to engineering, other sciences and mathematics more efficiently.

5. To enable the students to apply mathematical ideas to familiar and to interpret situations, work with abstract concepts and in a context of generality, reason logically and work analytically, perform with high levels of accuracy and transfer expertise between different topics in mathematics.

6. To produce citizens with good ethical and moral values, well-equipped with effective communication skill. The goal is to stimulate the students to be socially responsible through social action projects on themes like, education, poverty, environment, health and hygiene.

Strategies:

Strategies are based on:

- Curriculum designing as per the objectives mentioned.
- Program curriculum based on the design of the program.
- Regular updating of the program to keep them at per with the national and international advancements.
- Providing furnished classrooms and the labs with latest computers.
- Employing qualified and experienced staff members and their regular grooming through training workshops and refresher courses.
- Affiliation of other colleges/institutes to develop a competitive environment as well as providing an opportunity of quality education to a comparatively great number of students.
- Develop cores of credibility among the students through lectures, seminars and visits.
- To provide the students a learning environment by maintaining variety of standard books stock in the library and constantly updating it according to the requirements of the students and staff.

Assessment of Educational Objectives of the Program:

The educational objectives of each program are regularly assessed. Table 1.1 shows the program objective assessment.

OBJECTIVES	HOW MEASURED	WHEN MEASURED (FREQUENCY)	IMPROVEMENT IDENTIFIED	IMPROVEMENT MADE (CORRECTIVE & PREVENTIVE ACTION)
As given in objectives1-6.	Regular assessment of students' knowledge and ability to exhibit the skill by the teacher through: • Class tests • Class exercises related to topics taught • Presentation of relevant topic • Quizzes*	Two pre and two post mid term varies according to difficulty level of the topic Once a semester As per course requirement	• Regularity of attendees required • Work based teaching • Improving language skill especially in English • Course / curriculum revision to enhance outcomes and make it more interactive • Enhancing communication skills • Individual guidance to students as per requirement	• Attendance rules applied more strictly • Teachers training and development • Student encouraged to join language courses • Course / curriculum revised • Regular presentations conducted. • Students had been motivated through tutorials to be confident enough in seeking help from teacher.
	Written examination*	Twice during each semester		

	Practical assignment in relevant course	Not fixed may vary from 4-5		
	Mini project in MATLAB based programming	once a week		
	Teaching/Learning Process Survey (teachers' evaluation by the student)	Once a semester	Shortcomings as per survey identified	Teachers are intimated the survey report who make effort to improve which is monitored by next survey
	Faculty Survey Form	Once a semester	More time to be spent on the following during teaching: • Presentation by students • Motivation of the students for oral discussion	All the improvements identified have been implemented
	Suggestion received from students through discussion.	When received		
	8) Students / Advisor	As and when received	1) Administrative and personal problems of students 2) Lab facilities	Complaints are addressed immediately
	New Introductions 1) Faculty Resume	Once a year	• Qualification • Training	• Sent for higher studies. • Internal and external training arranged.

	2) Active citizen programme (ACP) Introduced as per HEC requirement. 3) Revision of programme.	Once a year		

* From Fall semester 2018-onward, the evaluation format has been changed by the examination branch. The details are attached herewith.

Table 1: Programme Objectives Assessme

Standard 1.2: The program must have documented outcomes for graduating students. It must be demonstrated that the outcomes support the program objectives and that graduating students can perform these outcomes.

BS Program Outcomes
On successful completion of BS mathematics, the students will be able to:

- understand the fundamental principles/techniques/tools necessary to study higher mathematics involving analysis. They will be able to apply their conceptual and computational talent with a solid background to pursue higher educational program.

- apply their power of thinking coherently, analyze an argument logically and interpret a situation mathematically in precise manner.

- apply powerful tools of mathematics in different disciplines of natural sciences, engineering and information technology.

- know what constitutes a valid proof of results in studying analysis of various structures and will be able to create such proofs.

- Students should have effective communication skills and developed professionalism with high level of moral and ethical values.

Program Objectives	Program Outcomes				
	1	**2**	**3**	**4**	**5**
1	*	-	◊	-	-
2	◊	*	◊	*	-
3	◊	-	◊	-	-
4	*	-	◊	-	-
5	-	*	-	*	-
6	-	-	◊	-	*

Table 2: Outcomes vs Objectives

Legend: *****Denotes **Substantial** Contribution to the objectives

◊ Denotes **Moderate** Contribution to the objectives

-Denotes**No** Contribution to the objectives.

> **Standard 1.3:** The results of program's assessment and the extent to which they are used to improve the program must be documented.

Actions taken on the basis of assessment:

- Syllabi revision
- Teachers training
- Labs development
- Faculty development

Strengths of the Institute:

- Teamwork
- Work Environment
- Library, Computing and Internet facilities

Weaknesses of Institute:

- No arrangement to handle with power failure.
- Irregularity of students due to high dependency on private transport.
- High frequency of resit exams and improvement cases without proper support from exam branch. During the academic session, the regular faculty is busy in lectures, so no proper place (due to lack of class rooms) or invigilator is available to conduct the exams.

Future Plans:

Staff members have been motivated to improve their qualification and get themselves registered in MS and Ph.D. programmes. They are encouraged to participate in national and international conferences, seminars and workshops to enhance their knowledge and teaching skills. In accordance with this plan, four faculty members have got registered in Ph.D, where two of them have been enrolled in University Sains Malaysia, Penang, Malaysia and the other two in SMS and University of the Punjab.

> **Standard 1.4:** The department must assess its overall performance periodically using quantifiable measures.

Performance Measures:

Mathematics department assesses the overall performance using quantifiable measures e.g. statistical method.

Program	Session	No. of Students
B.S. Mathematics	2013-2017	33
	2014-2018	65

Table 3: No. of Students Enrolled

Year	No. of Students	No. of Faculty Members	Student-Faculty ratio
2013-2014	157	16	10:1
2014-2015	191	16	12:1
2015- 2016	212	14	15:1
2016- 2017	214	16	13:1
2017- 2018	233	15	16:1

Table 4: Student-Faculty Ratio

Program	Passing out Year	No. of Students
B.S. Mathematics	2016-2017	27
	2017-2018	57

Table 5: No. of Students Passed Out

Year	%age of Honor Students **Criteria:** CGPA 3.75 and above	Attrition Rate (Admitted –pass out) *100 Admitted
2017	12%	Admitted=33, Current=27 Attrition Rate=18%
2018	Total result not declared yet	

Table 6:Percentage of Honor Students & Attrition Rate

Year	No. Of Trainings, Seminars and workshops
2015	Two workshops and four trainings

Table 7: Faculty Training, Seminars and workshops (Appendix A)

Papers Published at National & International Level

Year	Papers published
2015	7
2014	21
2013	05
2012	11

Table 8: Number of Publications (Appendix B)

v) **Books in Library**

There are **975**library books in total.

Research Areas

The Faculty is involved in research in the following areas:

Name of Faculty Member	Area of research
Dr. Imrana Kousar	Graph Theory, Algebraic Number Theory
Dr. Misbah Irshad	CAGD, Soft Computing, Digital Image Processing
Dr. Maria Hussain	CAGD(Computer Aided Geometric Design)
Dr. Uzma Bashir	CAGD/Geometric Modelling
Dr. Shazia Javed	Digital Signal Processing, Optimization Theory
Dr. Tahira Sumbal Shaikh	CAGD(Computer Aided Geometric Design)
Dr. Salma Kanwal	Graph Theory
Dr. Saima Kamran	Graph Theory
Dr. Sehrish Iftikhar	General Relativity & Quantum Cosmology

Collaborations: Nil

Departmental Achievements (others).

Three of the staff members availed travel grants to participate in workshops and international conferences.

Honors and Awards: Nil

CRITERION 2: CURRICULUM DESIGN AND ORGANIZATION

The development of curriculums for each program of Mathematics is based on the detailed curriculum development guidelines issued by HEC.

PROGRAM BS MATHEMATICS

Road Map for BS Mathematics 2013-2017 (135 Credit Hours)

Semester I (17)	Semester II (17)	Semester III (17)	Semester IV (18)	Semester V (15)	Semester IV (15)	Semester VII (18)	Semester VIII (18)
Maj/Math-101 4 (4+0) Calculus I	Maj/Math-103 4 (4+0) Calculus II	Maj/Math-201 4 (4+0) Calculus III	Maj/Math-203 4 (4+0) Calculus IV	Maj/Math-301 3 (3+0) Real Analysis I	Maj/Math-307 3 (3+0) Real Analysis II	Maj/Math-401 3 (3+0) Set Theory and Lattices	Maj/Math-407 3 (3+0) Measure Theory
Maj/Math -102 4 (4+0) Group Theory and Linear Algebra	Maj/Math-104 4 (4+0) Infinite Series and Metric Spaces	Maj/Math-202 4 (4+0) Vector Algebra and Dynamics	Maj/Math-204 4 (4+0) Statics	Maj/Math-302 3 (3+0) Algebra I	Maj/Math-308 3 (3+0) AlgebraII	Maj/Math-402 3 (3+0) Functional Analysis	EC/Math-406 3 (3+0) Choose any four Group Theory Topology Theory of Differential equation Programming in MATLAB Number Theory
Minor 4(3+1) Choose any one Min/Phy-101 Applied Physics (3+1) Min/Stat 101 Intro-statistics (3+1) Min/Eco. 101	Minor 4 (3+1) Choose any one Computational Physics Introduction to Probability Distribution	Maj/Math-205 2 (2+0) Discrete Math	Maj/Math-206 3 (2+1) Programing Fundamentals	Maj/Math-303 3 (3+0) Numerical Analysis I	Maj/Math-309 3 (3+0) Numerical Analysis II	Maj/Math-403 3 (3+0) Complex Analysis	CC/Math-402 3 (3+0) ComprehensiveII

Micro Economics (4+0)	Macro Economics					
CC/Eng-101 3 (3-0) Language in use	CC/Eng-102 3 (3+0) Academic Reading and Writing Min/Phy-201 4(3+1) Cosmology Min/Stats 201 4(3+1) Statistics Inference Min/Eco 201 4(4+0) Mathematical Economics	Minor 4 (3+1) Choose any one Min/Phy-201 4(3+1) Cosmology Min/Stats 201 4(3+1) Statistics Inference Min/Eco 201 4(4+0) Mathematical Economics	Minor 4 (3+1) Min/Phy-202 Semi Conductor Devices Min/Stats-202 Introduction to Regression Analysis and Experimental Designs Min/Eco-202 Economics of Pakistan	Maj/Math -304 3 (3+0) Vector Analysis and Cartesian Tensor	EC/Math-306 3 (3+0) Choose any two Differential Geometry Mechanics Method of Mathematical Physics II	EC/Math-404 3(3+0) Choose any two Mathematical Statistics Graph Theory Operation Research
CC/IslE-101 2(2+0) Islamic Education	CC/PS-101 2 (2+0) PakistanStudies	CC/Eng-201 3 (3+0) Communic-ation Skills	CC-Eng-202 3 (3+0) Advanced Academic Reading and Writing	Maj/Math-305 3 (3+0) Methods of Mathematical Physics I	Social Action project	CC/Math-401 3(3+0) ComprehensiveI
				Active Citizen program (ACP)		

Road Map for BS Mathematics 2014-2018 (135 Credit Hours)

Semester I (19)	Semester II (19)	Semester III (18)	Semester IV (18)	Semester V (18)	Semester VI (18)	Semester VII (12)	Semester VIII (12)
Maj/Math-101 4 (4+0) Calculus I	Maj/Math-103 4 (4+0) Calculus II	Maj/Math-201 4 (4+0) Calculus III	Maj/Math-203 4 (4+0) Calculus IV	Maj/Math-301 3 (3+0) Real Analysis I	Maj/Math-307 3 (3+0) Real Analysis II	Maj/Math-401 3 (3+0) Set Theory and Lattices	Maj/Math-407 3 (3+0) Measure Theory
Maj/Math -102 4 (4+0) Group Theory and Linear Algebra	Maj/Math-104 4 (4+0) Infinite Series and Metric Spaces	Maj/Math-202 4 (4+0) Vector Algebra and Dynamics	Maj/Math-204 4 (4+0) Statics	Maj/Math-302 3 (3+0) Algebra I	Maj/Math-308 3 (3+0) Algebra II	Maj/Math-402 3 (3+0) Functional Analysis	EC/Math-406 3 (3+0) Choose any four Group Theory Topology Theory of Differential equation Programming in MATLAB Number Theory

Minor 4(3+1) Choose any one Min/Phy-101 Fundamental of Physics (3+1) Min/Stat 101 Intro-statistics (3+1) Min/Eco. 101 Micro Economics (4+0)	Minor 4 (3+1) Choose any one Computational Physics Introduction to Probability Distribution Macro Economics	Maj/Math-205 2 (2+0) Discrete Maths	Maj/Math-206 3 (2+1) Programing Fundamentals	Maj/Math-303 3 (3+0) Numerical Analysis I	Maj/Math-309 3 (3+0) Numerical Analysis II	Maj/Math-403 3 (3+0) Complex AnalysiS	CC/Math-402 3 (3+0) ComprehensiveII
CC/Eng-101 3 (3-0) Language in use	CC/Eng-102 3 (3+0) Academic Reading and Writing Min/Phy-201 4(3+1) Cosmology Min/Stats 201 4(3+1) Statistics Inference Min/Eco 201 4(4+0) Mathematical Economics	Minor 4 (3+1) Choose any one Min/Phy-201 4(3+1) Cosmology Min/Stats 201 4(3+1) Statistics Inference Min/Eco 201 4(4+0) Mathematical Economics	Minor 4 (3+1) Min/Phy-202 Advanced Physics Min/Stats-202 Introduction to Regression Analysis and Experimental Designs Min/Eco-202 Economics of Pakistan	Maj/Math -304 3 (3+0) Vector Analysis and Cartesian Tensor	EC/Math-306 3 (3+0) Choose any one Differential Geometry Mechanics	EC/Math-404 3(3+0) Choose any two Mathematical Statistics Graph Theory Operation Research	

CC/IslE-101 2(2+0)	CC/PS-101 2 (2+0)	CC/Eng-201 3 (3+0)	CC-Eng-202 3 (3+0)	Maj/Math-305 3 (3+0)	EC/Math-313 3 (3+0)	CC/Math-401 3(3+0)
Islamic Education	Pakistan Studies	Communication Skills	Advanced Academic Reading and Writing	Methods of Mathematical Physics	Transform Method	ComprehensiveI
				Active Citizen program (ACP)	Social Action project	

Note:-

1)   Definition of credit hours = 1 credit hour is equivalent to 16 teaching hours.

Curriculum Breakup for 2013-17	Credit Hours
Computing Core Courses • Calculus I • Group Theory and Linear Algebra • Calculus II • Infinite Series and Metric Spaces • Calculus III • Vector Algebra and Dynamics • Calculus IV • Static • Real Analysis • Algebra I • Numerical Analysis I • Vector Analysis and Cartesian Tensor • Methods of Mathematical PhysicsI • Real Analysis II • Algebra II • Numerical Analysis II • Set Theory and Lattices • Functional Analysis • Complex Analysis • Comprehensive I • Measure Theory • Comprehensive II • Discrete Mathematics • ProgrammingFundamentals	79
Supporting Sciences • Applied Physics • Introductory Statistics • Micro Economics • Computational Physics • Introduction to Probability Distribution • Macro Economics • Cosmology • Statical Inference • Mathematical Economics • Semiconductor Device • Introduction to Regression Analysis and Experimental Designs • Economics of Pakistan	16

General Education • Language in Use • Academic Reading and Writing • Communication Skills • Advance Academic reading and Writing • Islamic Education • Pakistan Studies	16
Elective Courses • Differential Geometry • Mechanics • Methods of Mathematical Physics II • Mathematical statistics • Graph Theory • Operation Research • Group Theory • Topology • Theory of Differential Equations • Programming in MATLAB • Number Theory	24
Total Credit Hours	**135**

Table 9: Curriculum Breakup for 2013-17

Curriculum Breakup for 2014-18	Credit Hours
Computing Core Courses • Calculus I • Group Theory and Linear Algebra • Calculus II • Infinite Series and Metric Spaces • Calculus III • Vector Algebra and Dynamics • Calculus IV • Static • Real Analysis • Algebra I • Numerical Analysis I • Vector Analysis and Cartesian Tensor • Methods of Mathematical Physics I • Real Analysis II • Algebra II • Numerical Analysis II • Set Theory and Lattices • Functional Analysis • Complex Analysis • Comprehensive I • Measure Theory • Comprehensive II • Discrete Mathematics • Programming Fundamentals	79
Supporting Sciences • Fundamental of Physics • Introductory Statistics • Micro Economics • Computational Physics • Introduction to Probability Distribution • Macro Economics • Cosmology • Statical Inference • Mathematical Economics • Advanced Physics • Introduction to Regression Analysis and Experimental Designs • Economics of Pakistan	16
General Education • Language in Use • Academic Reading and Writing • Communication Skills • Advance Academic reading and Writing • Islamic Education • Pakistan Studies	16

Elective Courses	
- Differential Geometry - Mechanics - Transform Methods - Mathematical statistics - Graph Theory - Operation Research - Group Theory - Topology - Theory of Differential Equations - Programming in MATLAB - Number Theory	24
Total Credit Hours	**135**

Table 10: Curriculum Breakup for 2014-18

Curriculum Course Requirements of BS Program

Semester	Course Number	Category(Credit Hours)					
		Minor Courses			Core Courses	Humanities and Social Sciences	Technical Electives
		Physics	Stats	Eco			
I	**Math-101**				4		
I	**Math-102**		4		4		
I	**Phy-101**	4					
I	**Stats-101**		4				
I	**Eco -101**			4			
I	**Eng-101**					3	
I	**Isl-101**					2	
II	**Math-103**				4		

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II	Math-104				4		
II	Phy-102	4					
II	Stats-102		4				
II	Eco-102			4			
II	Eng-102					3	
II	Ps-101					2	
III	Math-201				4		
III	Math-202				4		
III	Math-205				2		
III	Phy-201	4					
III	Stats-201		4				
III	Eco-201			4			
III	Eng-201					3	
IV	Math-203				4		

IV	Math-204				4		
IV	Math-206				2		
IV	Phy-202	4					
IV	Stats		4				
IV	Eco-202			4			
IV	Eng-202					3	
V	Math-301				3		
V	Math-302				3		
V	Math-303				3		
V	Math-304				3		
V	Math-305				3		
VI	Math-307				3		
VI	Math-308				3		
VI	Math-309				3		

VI	Math-306						3
VI	Math-310						3
VI	Math-311						3
VII	Math-401				3		
VII	Math-402				3		
VII	Math-403				3		
VII	Math-404						3
VII	Math-405						3
VII	Math-412						3
VII	Compreh-ensive I (Math-401)				3		
VIII	Math-406				3		
VIII	Math-407						3
VIII	Math-408						3
VIII	Math-409						3

VIII	Math-410						3
VIII	Math-411						3
VIII	Compreh-ensive II (Math-402)				3		
	Total	16	16	16	79	16	24

Table 10: Courses vs Credit hours of BS Program

BS Mathematics programs contents/courses meet the program objectives as shown in the table.

Group of Courses	Program Objectives					
	1	2	3	4	5	6
Maj/Math-101,Maj/Math-103, Maj/Math-201, Maj/Math-202, Maj/Math-203, Maj/Math-204, Maj/Math-205, Maj/Math-301, Maj/Math-307, Maj/Math-304, Maj/Math-305, Maj/Math-403, Maj/Math-406	x		x			
Maj/Math-102, Maj/Math-104, Maj/math-205, Maj/Math-302, Maj/Math-308, Maj/Math-402, Maj/Math-407, Maj/Math-408		x			x	
Maj/Math-206,EC/Math-405, EC/Math-410,EC/Math-412				x		
Maj/Math-303,Maj/Math-309,						

Group of Courses						
EC/Math-306, EC/Math-404, EC/Math-409, EC/Math-310, EC/Math-311			x			
CC/Eng-101,CC/Eng-102, CC/Isl-101,CC/Eng-201, CC/Ps-101,CC/Eng-202						x

Table 11:Courses versus Program Objectives of BS Program

Group of Courses	Program Outcomes					
	1	2	3	4	5	6
Maj/Math-101,Maj/Math-103, Maj/Math-201, Maj/Math-202, Maj/Math-203, Maj/Math-204, Maj/Math-205, Maj/Math-301, Maj/Math-307, Maj/Math-304, Maj/Math-305, Maj/Math-403, Maj/Math-406	x		x			
Maj/Math-102, Maj/Math-104, Maj/math-205, Maj/Math-302, Maj/Math-308, Maj/Math-402, Maj/Math-407, Maj/Math-408	x	x	x	x		
Maj/Math-206,EC/Math-405, EC/Math-410,EC/Math-412	x		x			
Maj/Math-303,Maj/Math-309, EC/Math-306, EC/Math-404, EC/Math-409, EC/Math-310, EC/Math-311	x		x			
CC/Eng-101,CC/Eng102,			x		x	

CC/Isl-101,CC/Eng-201, CC/Ps-101,CC/Eng-202						

Table 12: Courses versus Program Outcomes

Standard 2.2: Theoretical background, problems analysis and solution design must be stressed within the program's core material.

Program: BS Mathematics

The modules of all the programs adequately address:

1) Theoretical background
2) Problem solving
3) Solution design

- Some of the modules include the theoretical background and contain problem solving and solution design while others deal with Theoretical background, Problem analysis and Solution design separately.
- During teaching great stress is laid to problem solving and design of solution. Thus the modules stress the practicality of the program.

Elements	Courses
Theoretical background	**EC/Math-311,CC/EC-101,CC/EC-102,CC/Isl-101,CC/Eng-102,CC/PS-101,CC/Eng201, CC/Eng-202,Min/Phy-101,Min/Phy-102, Min/Phy-201,Min/Phy-202,Min/Stat-101, Min/Stat-102,Min/Stat-201,Min/Stat-202, Min/Eco-101,Min/Eco-102,Min/Eco-201, Min/Eco-202.**
Problem analysis	**Maj/Math-101,Maj/Math-103,Maj/Math-201, Maj/Math-202,Maj/Math-203,Maj/Math-204, Maj/Math-205,Maj/Math-301,Maj/Math-307, Maj/Math-304,Maj/Math-305,maj/Math-403, Maj/Math-406,Maj/Math-102,Maj/Math-104, Maj/Math-205,Maj/Math-302,Maj/Math-308, Maj/Math-402,Maj/Math-407,Maj/Math-408.**
Solution design	**Maj/Math-206,EC/Math-405,EC/Math-410, EC/ Math-412, Maj/Math-303,Maj/Math-309, EC/Math-306,EC/Math-404,EC/Math-409, EC/Math-310**

Table 13: Element vs Courses of BS Program

Standard 2.3: The curriculum must satisfy the core requirements for the program, as specified by the respective accreditation body.

The curriculum satisfies both the core requirements of credit hours and criteria of admission laid down by Lahore College for Women University and HEC and is in par with the international standards.

Standard 2.4: The curriculum must satisfy the major requirements for the program as specified by the respective accreditation body.

The curriculum satisfies major requirements of the program. The department has no professional body. However programs and curriculum got the approval of Board of Studies of department of Mathematics.

Standard 2.5: The curriculum must satisfy general education, arts, and professional and other discipline requirements for the program, as specified by the respective accreditation body/council.

The curriculum satisfies general education disciplines requirements. No formal accreditation with any professional body but it fulfills all the necessary/basic requirements. The programs and curriculum have the approval of Board of Studies of Mathematics, and Lahore College for Women University. The details have already been provided in table 10.

Standard 2.6: Information technology component of the curriculum must be integrated throughout the program.

The following two courses
- Programming Fundamentals (semester IV)
- Programming in MATLAB (semester VIII)

have been introduced to develop the programming skills in students.

Standard 2.7: Oral and written communication skills of the student must be developed and applied in the program.

The following four courses
- Language in Use (semester I)
- Academic Reading and Writing (semester II)
- Communication Skills (semester III)
- Advance Academic reading and Writing (semester IV)
- Active Citizens Program (semester V)

have been introduced to develop the oral and written communication skills of the students.

CRITERION 3: LABORATORIES AND COMPUTING FACILITIES

Before 2013 there was no lab facility available for BS students, the offered courses were taught in the computer lab of IT department or the students use their own laptops to serve the purpose.

In Fall semester 2017, the department have been equipped with a computer lab (F-21) containing 30 computers installed with MATLAB and MATHEMATICA. The necessary instructions to be followed by the students have been pasted in the lab. Only research students or those who have to take the particular course/ lecture are allowed to use this lab.No fire extinguishers have been made available to fulfill the safety regulations.

Standard 3.1: Manuals/documentation/instructions for experiments must be available and readily accessible to faculty and students.

Not applicable

Standard 3.2: There must be adequate support personnel for instruction and maintaining the laboratories:

The department has got no lab attendant/incharge forproper maintenance/ care of the systems and lab.

Standard 3.3: The university computing infrastructure and facilities must be adequate to support program's objectives:

Yes, the computing infrastructure of the University is appropriate enough to meet the program's objectives.

CRITERION 4: STUDENT SUPPORT AND ADVISING

Standard 4.1: Courses must be offered with sufficient frequency and number for students to complete the program in a timely manner:

The strategy for programs (courses) offering is controlled. The BS Mathematics and MS Mathematics courses are offered once a year.

Standard 4.2: Courses in the major area of study must be structured to ensure effective interaction between students, faculty and teaching assistants:

The effective student/faculty interaction in programs taught by more than one faculty members is streamlined by coordination of thefaculty members and the quality is maintained through curriculum which is adopted for the module.

The programs are structured to ensure effective interaction between students, faculty and HOD. The students require extra help are provided services through tutorials, question and answer session. Class discussion is highly encouraged. Seminars are arranged where the students are free to discuss the topics relating to the program. Debates are initiated. The students are free to interact with the HOD in case of any shortcoming.

Standard 4.3: Guidance on how to complete the program must be available to all students and access to academic advising must be available to make course decisions and career choices:

The students are provided guidance regarding the completion of the program and have access to qualified faculty as well as student counseling center. One of the faculty member, Dr, Misbah Irshad has been appointed as student's advisor. The students are encouraged to bring forward their suggestions and complaints.

CRITERION 5: PROCESS CONTROL

Standard 5.1: The process by which students are admitted to the program must be based on quantitative and qualitative criteria and clearly documented. This process must be periodically evaluated to ensure that it is meeting its objectives:

This is a 4 year degree program with minimum 135 credit hours. The program is divided into 8 semesters with 2 semesters each year.

Eligibility

Female students who have passed Intermediate with Mathematics, or A Level, or equivalent securing more than 60% marks can apply for admission.

Standard 5.2: The process by which students are registered in the program and monitoring of students' progress to ensure timely completion of the program must be documented. This process must be periodically evaluated to ensure that it is meeting its objectives:

Advertisements are made in leading newspapers and on Lahore College for Women University website. The student academic progress is monitored regularly by the Module Leader and regular written examination system. The process of registration and monitoring are reviewed once in a year three months before the date of admission.

Standard 5.3: The process of recruiting and retaining highly qualified faculty members must be in place and clearly documented. Also processes and procedures for faculty evaluation, promotion must be consistent with institution mission statement. These processes must be periodically evaluated to ensure that it is meeting its objectives:

- The standards are clearly indicated in the University Calendar which are followed. Qualifications which are required for each module are kept in mind. The criteria for recruiting are, qualification, experience which are judged through analysis of CVs and personal interviews. In case of permanent faculty members, the recruiting is done by a board constituted by Lahore College for Women University whereas; visiting faculty members are recruited by a board constituted by the Institute. The input of the students for maintaining the

quality of the teachers is done by evaluating the teacher's performance regularly once in a semester by the students. The results of these studies are sent to the teachers who are asked to improve and in extreme cases, replacements are made.

- An Annual Confidential Report (ACR) is initiated by the HOD annually for each faculty member and retention of the staff, their increment and promotion are based on ACRs.
- The faculty members performing well are rewarded by increment. Good working conditions constituting job satisfaction, salaries, providing facilities like admission in Ph.D. programs and scholarships are incentive to faculty member who perform well.

Standard 5.4: The process and procedures used to ensure that teaching and delivery of course material to the students emphasizes active learning and that course learning outcomes are met. The process must be periodically evaluated to ensure that it is meeting its objectives:

The process and procedure to ensure that the teaching and delivery of the program material to the students emphasizes active learning. For instance, exercises based on practicality of the knowledge given to the students and research laboratories initiated at the end of the program. Process is monitored and assessed regularly.

Standard 5.5: The process that ensures that graduates have completed the requirements of the program must be based on standards, effective and clearly documented procedures. This process must be periodically evaluated to ensure that it is meeting its objectives.

- The semester rules have been adopted by the department and QEC and the Head of Department ensure their compliance.
- The operation is reviewed once a year and is documented as Management of Academic Programs.

CRITERION 6: FACULTY

Standard 6.1: There must be enough full time faculty who are committed to the program to provide adequate coverage of the program areas/courses with continuity and stability. The interests and qualifications of all faculty members must be sufficient to teach all courses, plan, modify and update courses and curricula. All faculty members must have a level of competence that would normally be obtained through graduate work in the discipline. The majority of the faculty must hold a Ph.D. in the discipline:

There is a sufficient number of full time faculty which provides adequate coverage of the program with continuity and stability. The interest and the qualifications of all faculty members are pre-judged and monitored for each module forming a part of the program. The level of competency of the faculty members are evaluated at time of induction and monitored during teaching.

Program Area of Specialization	Courses in the Area and Average Number of Semesters per Year	Number of faculty Members in Each Area	Number of Faculty with Ph. D Degree
undergraduate	43 Modules 02 Semesters per year		
Total			

Faculty Distribution by Program Areas

Standard 6.2: All faculty members must remain current in the discipline and sufficient time must be provided for scholarly activities and professional development. Also, effective programs for faculty development must be in place:

All the faculty members remain current in the disciplines and sufficient time is provided for scholaric activities and professional development. Effective program for faculty development is in place. They are encouraged to attend international seminars and workshops.

Standard 6.3: All faculty members should be motivated and have job satisfaction to excel in their profession:

The faculty members are regularly motivated and efforts are made to provide job satisfaction so that they excel in their profession.

CRITERION 7: INSTITUTIONAL FACILITIES

Standard 7.1: The institution must have the infrastructure to support new trends in learning such as e-learning

- Department building is fully equipped with all latest new trends.
- Internet facility is available lab.

Standard 7.2: The library must possess an up-to-date technical collection relevant to the program and must be adequately staffed with professional personnel:

- Almost every up-to-date book is available in library covers all the areas of courses.
- Library provides services of books borrowing and adequate reading space.

Standard 7.3: Class-rooms must be adequately equipped and offices must be adequate to enable faculty to carry out their responsibilities:

- The number of class rooms is not sufficient. There are only 4 class rooms. The students registered for undergraduate, graduate or post graduate level have to be accommodated in

these rooms.

- Office of HOD and one staff room for the faculty.

CRITERION8: INSTITUTIONAL SUPPORT

Standard 8.1: There must be sufficient support and financial resources to attract and retain high quality faculty and provide the means for them to maintain competence as teachers and scholars:

- Teachers are recruited based on criterion established by the University.
- Existing faculty is sent to attend different courses to update their knowledge.
- Secretarial support is provided to the teachers to meet the working needs.

Standard 8.2: There must be an adequate number of high quality graduate students, research assistants and Ph.D. students:

The admission criteria ensures the intake of high quality students.

Standard 8.3: Financial resources must be provided to acquire and maintain Library holdings, laboratories and computing facilities:

- Describe the resources available for the library.
- Describe the resources available for laboratories.
- Describe the resources available for computing facilities.