KURUKSHETRA UNIVERSITY KURUKSHETRA

[Established by the State Legislature Act XII of 1956]

('A+' Grade, NAAC Accredited)

AQAR-2020-21

1.2.2 : Scheme of Examination for the programmes in the Department/Institute of

Mathematics

maths

1.2.2

Scheme / Structure of M.Sc Mathematics
CBCS course for Department of Mathematics, K.U.K

Course Name	:	Master of Science in Mathematics CBCS course for Department of Mathematics, KUK
Course Duration	:	Four Semesters
Course Code	:	MSM
To be effective	:	With effect from Session **2016-17** for **1st and 2nd Semesters** and from **2017-18** for **3rd and 4th Semesters** in the Department of Mathematics, K.U. Kurukshetra

General Rules :

1. There will be five theory papers and one practical paper in each semester. In addition, there will be two seminars, one each in 1st semester and 4th semester and two open elective papers, one each in 2nd and 3rd semesters.

2. A student of M.Sc Mathematics CBCS course shall have to opt one Open Elective Paper in second semester and one Open Elective Paper in third semester out of the list of Open Elective Papers offered at the level of Faculty of Sciences except those which are offered as Open Elective Papers by the Department of Mathematics.

3. Each theory paper (Core and Elective) will be of 100 marks, 70 marks for External Examination and 30 marks for Internal Assessment.

4. Each practical paper and open elective paper will be of 50 marks, 35 marks for External Examination and 15 marks for Internal Assessment.

5. Each seminar will be of 50 marks. The evaluation of seminars, which will be presented by every student in that semester, will be done by a Departmental Committee which will be constituted by the Staff Council of the Department and marks shall be awarded by the committee out of 50 marks. There shall be no external examination of the seminar.

6. Each theory paper will consist of two sections.

7. Paper setter will be requested to set eight questions in all, i.e., four questions from each section.

8. The examinee will be required to attempt five questions in all by selecting at least two questions from each section. All questions will be of equal marks.

9. Duration of examination of each theory paper will be of three hours and duration of examination of each practical paper will be of four hours.

10. The minimum pass percentage required to pass each paper will be as under:
    i. 40% in each theory (C/E/OE) External Examination
    ii. 40% in each Practical External Examination
    iii. 40% in each Seminar
    iv. 40% in aggregate of External Examination and Internal Assessment Test of each theory (C/E/OE) and Practical Paper.

11. The following criteria shall be adopted for the award of Internal Assessment of Minor tests for each paper:

i. Theory papers: -

a.	Total Internal Assessment	:	30 marks
b.	Two class tests (each of 1 hour duration)	:	22.5 marks
c.	Attendance	:	7.5 marks

ii. Practical papers: -

a.	Total Internal Assessment	:	15 marks
b.	Seminar / Viva voce for each practical paper	:	10 marks
c.	Attendance	:	5 marks

iii. Open elective theory papers: -

a.	Total Internal Assessment	:	15 marks
b.	One class test (of 1 hour duration)	:	10 marks
c.	Attendance	:	5 marks

iv. Criterion for the award of marks for attendance will be as follows:

Marks for attendance (Out of 7.5 marks) will be given as under:

a)	91 % onwards	: 7.5 Marks
b)	81 % to 90 %	: 6 Marks
c)	75 % to 80 %	: 4.5 Marks
d)	70 % to 74 %	: 3 Marks*
e)	65 % to 69 %	: 1.5 Marks*

Marks for attendance (Out of 5 marks) will be given as under:

a)	91 % onwards	: 5 Marks
b)	81 % to 90 %	: 4 Marks
c)	75 % to 80 %	: 3 Marks
d)	70 % to 74 %	: 2 Marks*
e)	65 % to 69 %	: 1 Mark*

* For students engaged in co-curricular activities of the Department only / authenticated medical grounds duly approved by the concerned Chairperson.

v. For practical papers, it will be optional for the department concerned to conduct either a viva-voce or a sessional test for each paper. The test of one hour duration for each paper will be conducted by the Department concerned at its own level.

vi. Internal assessment test/viva-voce is compulsory. In case the student(s) remain absent from appearing in the test(s)/viva-voce, the Chairperson of the Department concerned will decide the case at his/her own level.

vii. The marks of assessment/grades of Minor Test will be displayed on the notice board of the Department by the Chairperson of the Department before forwarding it to the Examination Branch.

viii. The Chairperson of the Department shall forward the final awards/grade of Minor Tests of the students in hard and soft copy to the Examinations Branch invariably within 20 days after the completion of the relevant Semester examination for declaration of the result and preparation of Transcript/DMC. The Minor Test Grade of a candidate who fails in any semester examination shall be carried forward to the next examination.

ix. The Chairperson of the Department shall preserve the record on the basis of which the Minor Test Grade has been prepared, for inspection, if needed by the University upto six months from the date of declaration of the concerned semester result.

12. One credit is equivalent to 25 marks.

13. Teaching hours : One credit is equivalent to one hour of teaching (lecture/ tutorial/seminar) per week per semester for each theory paper, One credit is equivalent to two hours of practical work per week per semester.

Theory papers (Core or Elective)	:	Four hours for lectures per week per paper
Practical paper	:	Four hours per week per paper for a group of fifteen students.
Seminar	:	Two hours per week for a group of fifteen students
Theory Papers (Open Elective)	:	Two hours per week per paper

14. Abbreviations used:

C	:	Core Paper
E	:	Elective Paper
OE	:	Open Elective Paper
L	:	Lecture
T	:	Tutorial
P	:	Practical
S	:	Seminar

Scheme / Structure of M.Sc. Mathematics
CBCS Four Semester Course for Department of Mathematics, KUK
(w.e.f. Session 2016-17)

Semester - I

Paper Code	C /E /OE	Name of Paper	Contact hours			Credits
			L	P	S	
Core Papers						
MSM 101	C	Abstract Algebra	4	0	0	4
MSM 102	C	Complex Analysis	4	0	0	4
MSM 103	C	Ordinary Differential Equations	4	0	0	4
MSM 104	C	Real Analysis	4	0	0	4
MSM 105	C	Topology	4	0	0	4
MSM 106	C	Practical-I	0	4	0	2
MSM 107	C	Seminar-I	0	0	2	2
		Total	20	4	2	24

Semester - II

Paper Code	C /E /OE	Name of Paper	Contact hours			Credits
			L	P	S	
Core Papers						
MSM 201	C	Advanced Abstract Algebra	4	0	0	4
MSM 202	C	Computer Programming	4	0	0	4
MSM 203	C	Measure and Integration	4	0	0	4
MSM 204	C	Mechanics of Solids	4	0	0	4
MSM 205	C	System of Differential Equations	4	0	0	4
MSM 206	C	Practical-II	0	4	0	2
Open Elective Papers						
	OE	One open elective paper is to be opted out of the list of optional papers offered at the Faculty of Science level in even semester	2	0	0	2
		Total	22	4	0	24
OE 207		**Applied Algebra and Analysis** (This open elective paper will be offered to the students of Faculty of Sciences except students of Department of Mathematics)	2	0	0	2

Semester - III

Paper Code	C /E /OE	Name of Paper	Contact Hours			Credits
			L	P	S	
Core Papers						
MSM 301	C	Functional Analysis	4	0	0	4
MSM 302	C	Fluid Mechanics	4	0	0	4
MSM 303	C	Practical-III	0	4	0	2
Elective Papers		**Any three of the following Elective Papers**				
MSM 304	E	Advanced Topology	4	0	0	4
MSM 305	E	Algebraic Coding Theory	4	0	0	4
MSM 306	E	Commutative Algebra	4	0	0	4
MSM 307	E	Differential Geometry	4	0	0	4
MSM 308	E	Elasticity	4	0	0	4
MSM 309	E	Financial Mathematics	4	0	0	4
MSM 310	E	Fuzzy Sets and Applications	4	0	0	4
MSM 311	E	Integral Equations	4	0	0	4
MSM 312	E	Mathematical Modeling	4	0	0	4
MSM 313	E	Mathematical Statistics	4	0	0	4
MSM 314*	E	Methods of Applied Mathematics	4	0	0	4
MSM 315	E	Number Theory	4	0	0	4
Open Elective Paper						
	OE	One open elective paper is to be opted out of the list of optional papers offered at the Faculty of Science Level in odd Semester	2	0	0	2
		Total	**22**	**4**	**0**	**24**
OE 307		**Applied Numerical Methods** (This open elective paper will be offered to the students of Faculty of Sciences except students of Department of Mathematics)	2	0	0	2

* Syllabus will be prepared later on.

Semester - IV

Paper Code	C /E /OE	Name of Paper	Contact Hours			Credits
			L	P	S	
Core Papers						
MSM 401	C	Mechanics and Calculus of Variations	4	0	0	4
MSM 402	C	Partial Differential Equations	4	0	0	4
MSM 403	C	Practical – IV	0	4	0	2
MSM 404	C	Seminar-II	0	0	2	2
Elective Papers		**Any three of the following Elective Papers**				
MSM 405	E	Advanced Complex Analysis	4	0	0	4
MSM 406	E	Advanced Discrete Mathematics	4	0	0	4
MSM 407	E	Advanced Functional Analysis	4	0	0	4
MSM 408	E	Algebraic Number Theory	4	0	0	4
MSM 409	E	Analytic Number Theory	4	0	0	4
MSM 410	E	Bio-Mathematics	4	0	0	4
MSM 411	E	Boundary Value Problems	4	0	0	4
MSM 412	E	Fluid Dynamics	4	0	0	4
MSM 413	E	General Measure and Integration Theory	4	0	0	4
MSM 414	E	Linear Programming	4	0	0	4
MSM 415	E	Mathematical Aspects of Seismology	4	0	0	4
MSM 416	E	Non-Commutative Rings	4	0	0	4
MSM 417	E	Wavelet Analysis	4	0	0	4
		Total	**20**	**4**	**2**	**24**

1.2.2

Kurukshetra University, Kurukshetra

(Established by the State Legislature Act-XII of 1956)

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SCHEME/STRUCTURE and SYLLABUS

of

Master of Science in Mathematics

CBCS LOCF

With Effect From Academic Session 2020-21

DEPARTMENT OF MATHEMATICS

KURUKSHETRA UNIVERSITY, KURUKSHETRA -136119

HARYANA, INDIA

1. Program Outcomes (POs)

PO1	Knowledge	Capable of demonstrating comprehensive disciplinary knowledge gained during course of study
PO2	Research Aptitude	Capability to ask relevant/appropriate questions for identifying, formulating and analyzing the research problems and to draw conclusion from the analysis
PO3	Communication	Ability to communicate effectively on general and scientific topics with the scientific community and with society at large
PO4	Problem Solving	Capability of applying knowledge to solve scientific and other problems
PO5	Individual and Team Work	Capable to learn and work effectively as an individual, and as a member or leader in diverse teams, in multidisciplinary settings.
PO6	Investigation of Problems	Ability of critical thinking, analytical reasoning and research based knowledge including design of experiments, analysis and interpretation of data to provide conclusions
PO7	Modern Tool usage	Ability to use and learn techniques, skills and modern tools for scientific practices
PO8	Science and Society	Ability to apply reasoning to assess the different issues related to society and the consequent responsibilities relevant to the professional scientific practices
PO9	Life-Long Learning	Aptitude to apply knowledge and skills that are necessary for participating in learning activities throughout life
PO10	Ethics	Capability to identify and apply ethical issues related to one's work, avoid unethical behaviour such as fabrication of data, committing plagiarism and unbiased truthful actions in all aspects of work
PO11	Project Management	Ability to demonstrate knowledge and understanding of the scientific principles and apply these to manage projects

2. **Program Specific Outcomes (PSOs)**

After successful completion of the programme, a student will be able to:

PSO1	Have deep understanding and knowledge in the core areas of Mathematics and demonstrate understanding and application of the concepts/theories/principles/ methods/ techniques in different areas of pure and applied Mathematics.
PSO2	Have capability to read and understand mathematical texts, demonstrate and communicate mathematical knowledge effectively and unambiguously through oral and/or written expressions and attain skills of computing/programming/using software tools/formulating models.
PSO3	Attain abilities of critical thinking, logical reasoning, investigating problems, analysis, problem solving, application of mathematical methods/techniques, disciplinary knowledge so as to develop skills to solve mathematical problems having applications in other disciplines and/or in the real world.
PSO4	Have strong foundation in basic and applied aspects of Mathematics so as to venture into research in different areas of mathematical sciences, jobs in scientific and various industrial sectors and/or teaching career in Mathematics.

3. **Programme Scheme/ Structure:**

The M.Sc. Mathematics programme is a two-year programme divided into foursemesters. A student is required to complete at least 116 credits for the completion of the course and the award of degree. Of these, 82 credits have to be earned from Core Courses, 30 from Elective coursesand 4 credits from open elective courses.

	SEMESTER	SEMESTER
PART-I (FIRST YEAR)	Semester I	Semester II
PART-II (SECOND YEAR)	Semester III	Semester IV

This Scheme will be effective in phased manner from the session 2020-21 initially for University Teaching Department of Mathematics.

I	Core Course 1 Abstract Algebra Core Course 2 Complex Analysis Core Course 3 Ordinary Differential Equations Core Course 4 Real Analysis Core Course 5 Topology Core Course 6 Practical-I Core Course 7 Seminar-I		
II	Core Course 8 Advanced Abstract Algebra Core Course 9 Computer Programming with MATLAB Core Course 10 Differential Equations Core Course 11 Measure and Integration Core Course 12 Mechanics of Solids Core Course 13 Practical-II		Open Elective 1 Basic Mathematics-I
III	Core Course 14 Fluid Mechanics Core Course 15 Functional Analysis Core Course 16 Practical-III	Elective 1 Elective 2 Elective 3	Open Elective 2 Basic Mathematics-II
IV	Core Course 17 Mechanics and Calculus of Variations Core Course 18 Partial Differential Equations Core Course 19 Practical-IV Core Course 20 Seminar-II	Elective 4 Elective 5 Elective 6	
Note: **Open Elective Course :**In each of the Semester II and Semester III, one open Elective course is to be opted out of the list of such courses offered at the University/Institute/College level OR one can choose a MOOC course of minimum credit 2 offered at SWAYAM Portal in that semester.			
Note: The open elective courses, Basic Mathematics-I and Basic Mathematics-II, will be offered to the students other than students of M.Sc. Mathematics Programme.			

with effect from the Session 2020-21 in phased manner

Elective 1- A student will opt for one of the following courses:

i.	MMATH21-304	Advanced Topology
ii.	MMATH21-305	Commutative Algebra
iii.	MMATH21-306	Differential Geometry
iv.	MMATH21-307	Elasticity

Elective 2- A student will opt for one of the following courses:

i.	MMATH21-308	Advanced Numerical Analysis
ii.	MMATH21-309	Fuzzy Sets and Applications
iii.	MMATH21-310	Mathematical Statistics
iv.	MMATH21-311	Number Theory

Elective 3- A student will opt for one of the following courses:

i.	MMATH21-312	Algebraic Coding Theory
ii.	MMATH21-313	Financial Mathematics
iii.	MMATH21-314	Integral Equations
iv.	MMATH21-315	Mathematical Modeling

Elective 4 - A student will opt for one of the following courses:

i.	MMATH21-405	Advanced Complex Analysis
ii.	MMATH21-406	Algebraic Number Theory
iii.	MMATH21-407	General Measure and Integration Theory
iv.	MMATH21-408	Mathematical Aspects of Seismology

Elective 5 - A student will opt for one of the following courses:

i.	MMATH21-409	Advanced Discrete Mathematics
ii.	MMATH21-410	Advanced Functional Analysis
iii.	MMATH21-411	Advanced Fluid Mechanics
	MMATH21-412	Boundary Value Problems

Elective 6 - A student will opt for one of the following courses:

	MMATH21-413	Bio-Mathematics
	MMATH21-414	Fourier and Wavelet Analysis
	MMATH21-415	Linear Programming
	MMATH21-416	Non-Commutative Rings

Choice of Elective Courses:

Under each Elective course a student may choose one course from a given basket of four options or amongst the courses actually offered by the Department/Institute/College. In case a particular course is over-subscribed, merit in the previous semester(s) examination(s) or the number of preferencesor the availability of teacher(s) or feasibility of the option will be taken into account to determine course allocations. The decision of the Department/Institute/College shall be final in this regard.

Scheme / Structure of M.Sc. Mathematics CBCS LOCF Programme with effect from the Session 2020-21 in phased manner

Semester - I

Course Code	Course Type	Nomenclature	Teaching Hours			Credits	Maximum Marks		
			L	P	T/S		Ext	Int	Total
MMATH20-101	Core	Abstract Algebra	4	0	1	5	80	20	100
MMATH20-102	Core	Complex Analysis	4	0	1	5	80	20	100
MMATH20-103	Core	Ordinary Differential Equations	4	0	1	5	80	20	100
MMATH20-104	Core	Real Analysis	4	0	1	5	80	20	100
MMATH20-105	Core	Topology	4	0	1	5	80	20	100
MMATH20-106	Core	Practical-I	0	4	0	2	40	10	50
MMATH20-107	Core	Seminar-I	0	0	2	2	0	50	50
		Total	**20**	**4**	**7**	**29**	**440**	**160**	**600**

Each End Term Theory Examination will be of three hours duration and End Term Practical Examination will be of four hours duration.

Semester – II

Course Code	Course Type	Nomenclature	Teaching Hours per week			Credits	Maximum Marks		
			L	P	T/S		Ext	Int	Total
MMATH20-201	Core	Advanced Abstract Algebra	4	0	1	5	80	20	100
MMATH20-202	Core	Computer Programming with MATLAB	4	0	1	5	80	20	100
MMATH20-203	Core	Differential Equations	4	0	1	5	80	20	100
MMATH20-204	Core	Measure and Integration	4	0	1	5	80	20	100
MMATH20-205	Core	Mechanics of Solids	4	0	1	5	80	20	100
MMATH20-206	Core	Practical-II	0	4	0	2	40	10	50
	Open Elective	Open Elective 1 #	-	-	-	2	40	10	50
		# One Open Elective course is to be opted out of the list of such courses offered at the University/Institute level OR A MOOC course offered at SWAYAM Portal in an even semester.							
OEM20-207	Open Elective	Basic Mathematics-I	2	0	0	2*	40*	10*	50*
		(*This open elective course will be offered and credited to the students other than students of M.Sc. Mathematics)							
		Total	**22**	**4**	**5**	**29**	**480**	**120**	**600**

Each End Term Theory Examination will be of three hours duration and End Term Practical Examination will be of four hours duration.

Semester – III

Course Code	Course Type	Nomenclature	Teaching Hours per week			Credits	Maximum Marks		
			L	P	T/S		Ext	Int	Total
Core Papers									
MMATH21-301	Core	Fluid Mechanics	4	0	1	5	80	20	100
MMATH21-302	Core	Functional Analysis	4	0	1	5	80	20	100
MMATH21-303	Core	Practical-III	0	4	0	2	40	10	50
Elective 1		**Any One of the following:**							
MMATH21-304	Elective	Advanced Topology	4	0	1	5	80	20	100
MMATH21-305	Elective	Commutative Algebra	4	0	1	5	80	20	100
MMATH21-306	Elective	Differential Geometry	4	0	1	5	80	20	100
MMATH21-307	Elective	Elasticity	4	0	1	5	80	20	100
Elective 2		**Elective**							
MMATH21-308	Elective	Advanced Numerical Analysis	4	0	1	5	80	20	100
MMATH21-309	Elective	Fuzzy Sets and Applications	4	0	1	5	80	20	100
MMATH21-310	Elective	Mathematical Statistics	4	0	1	5	80	20	100
MMATH21-311	Elective	Number Theory	4	0	1	5	80	20	100
Elective 3		**Elective**							
MMATH21-312	Elective	Algebraic Coding Theory	4	0	1	5	80	20	100

MMATH21-313	Elective	Financial Mathematics	4	0	1	5	80	20	100
MMATH21-314	Elective	Integral Equations	4	0	1	5	80	20	100
MMATH21-315	Elective	Mathematical Modeling	4	0	1	5	80	20	100
	Open Elective	Open Elective 2#	-	-	-	2	40	10	50
		# One Open Elective course is to be opted out of the list of such courses offered at the University/Institute level OR A MOOC course offered at SWAYAM Portal in an odd semester.							
OEM21-316	Open Elective	Basic Mathematics-II *	2	0	0	2*	40*	10*	50*
		(*This open elective paper will be offered and credited to the students other than students of M.Sc. Mathematics)							
		Total	**22**	**4**	**5**	**29**	480	120	600

Each End Term Theory Examination will be of three hours duration and End Term Practical Examination will be of four hours duration.

Semester – IV

Course Code	Course Type	Nomenclature	Teaching Hours per week			Credits	Maximum Marks		
			L	P	T/S		Ext	Int	Total
Core Papers									
MMATH21-401	Core	Mechanics and Calculus of Variations	4	0	1	5	80	20	100
MMATH21-402	Core	Partial Differential Equations	4	0	1	5	80	20	100
MMATH21-403	Core	Practical – IV	0	4	0	2	40	10	50
MMATH21-404	Core	Seminar-II	0	0	2	2	0	50	50
Elective 4		**Any One of the following:**							
MMATH21-405	Elective	Advanced Complex Analysis	4	0	1	5	80	20	100
MMATH21-406	Elective	Algebraic Number Theory	4	0	1	5	80	20	100
MMATH21-407	Elective	General Measure and Integration Theory	4	0	1	5	80	20	100
MMATH21-408	Elective	Mathematical Aspects of Seismology	4	0	1	5	80	20	100
Elective 5		**Any One of the following:**							
MMATH21-409	Elective	Advanced Discrete Mathematics	4	0	1	5	80	20	100
MMATH21-410	Elective	Advanced Functional Analysis	4	0	1	5	80	20	100

MMATH21 -411	Elective	Advanced Fluid Mechanics	4	0	1	5	80	20	100
MMATH21 -412	Elective	Boundary Value Problems	4	0	1	5	80	20	100
Elective 6		**Any One of the following:**							
MMATH21 -413	Elective	Bio-Mathematics	4	0	1	5	80	20	100
MMATH21 -414	Elective	Fourier and Wavelet Analysis	4	0	1	5	80	20	100
MMATH21 -415	Elective	Linear Programming	4	0	1	5	80	20	100
MMATH21 -416	Elective	Non-Commutative Rings	4	0	1	5	80	20	100
		Total	**20**	**4**	**7**	**29**	**440**	**160**	**600**

Each End Term Theory Examination will be of three hours duration and End Term Practical Examination will be of four hours duration.