UNIVERSITY OF CALICUT

Abstract

General & Academic - CBCSS UG Regulations 2019 - Scheme and Syllabus of B.Sc Mathematics Programme, w.e.f 2020 Admission onwards -Incorporating Outcome Based Education - Implemented - Subject to ratification of Academic Council - Orders Issued.

G & A - IV - J

U.O.No. 5657/2021/Admn   Dated, Calicut University.P.O, 27.05.2021

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*Read:-*1) U.O.No. 9389/2020/Admn Dated,13.10.2020.
2) Item no.3 in the minutes of the meeting of Board of Studies in Mathematics, Dated 31.03.2021.
3) Remarks of the Dean, Faculty of Science, Dated 16.04.2021.
4) Orders of the Vice Chancellor in the file of even no, Dated 17.04.2021.

ORDER

1. The scheme and syllabus of B.Sc Mathematics Programme under CBCSS UG Regulations 2019 of the University, w.e.f 2020 admission onwards has been implemented, vide paper read (1) above.

2. The Board of Studies in Mathematics UG has resolved to incorpate Outcome Based Education (OBE) in the scheme and syllabus of B.Sc Mathematics Programme, in tune with the new CBCSS UG Regulations 2019 with effect from 2020 Admission onwards, vide paper read (2) above.

3. The Dean, Faculty of Science, vide paper read (3) above, has approved to implement the scheme and syllabus of B.Sc Mathematics Programme (CBCSS-UG-2019) incorporating Outcome Based Education (OBE), in the existing syllabus forwarded by the Chairperson, Board of Studies in Mathematics, in tune with the new CBCSS UG Regulations 2019 with effect from 2020 Admission onwards.

4. Considering the urgency, the Vice Chancellor has accorded sanction to implement the scheme and syllabus of B.Sc Mathematics Programme incorporating Outcome Based Education (OBE), in the existing syllabus forwarded by the Chairperson, Board of Studies in Mathematics UG in tune with the new CBCSS UG Regulations 2019 of the University with effect from 2020 Admission onwards, subject to ratification by the Academic Council.

5. Scheme and syllabus of B.Sc Mathematics (CBCSS) programme incorporating Outcome Based Education (OBE) in the existing syllabus, in tune with CBCSS UG Regulations 2019, is therefore implemented with effect from 2020 Admission onwards, subject to ratification by the Academic Council.

6. Orders are issued accordingly.

7. U.O.No. 9389/2020/Admn, Dated13.10.2020 is modified to this extend.(syllabus appended).

Ajitha P.P

Joint Registrar

To

Principals of all affiliated colleges
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Forwarded / By Order

Section Officer

B.Sc. DEGREE PROGRAMME

CHOICE BASED CREDIT
SEMESTER SYSTEM

(CBCSS-UG Regulations 2019)

B.Sc. MATHEMATICS
(CORE, OPEN & COMPLEMENTARY COURSES)

OBE implemented SYLLABUS

(Effective from 2020 admission onwards)

UNIVERSITY OF CALICUT

Preface

The LOCF (Learning Outcomes based Curriculum Framework) committee constituted by University Grants Commission (UGC) has submitted its report concerning the syllabi for B.Sc. Mathematics and B.A./B.Sc. with Mathematics as a subject. The BoS Mathematics(UG), keeping this report in mind, took steps for implementing the Outcome Based Education (OBE) in the existing syllabus, without changing the content of the existing syllabus.

Aims of Bachelor's degree programme in Mathematics

The overall aim of B.Sc. Mathematics and B.A./B.Sc. with Mathematics as a Complementary course is to

1. create deep interest in learning mathematics;

2. develop broad and balanced knowledge and understanding of definitions, concepts, principles and theorems;

3. familiarize the students with suitable tools of mathematical analysis to handle issues and problems in mathematics and related sciences;

4. enhance the ability of learners to apply the knowledge and skills acquired by them during the programme to solve specific theoretical and applied problems in mathematics;

5. provide students/learners sufficient knowledge and skills enabling them to undertake further studies in mathematics and its allied areas on multiple disciplines concerned with mathematics;

6. encourage the students to develop a range of generic skills helpful in employment, internships and social activities.

Programme Outcomes

The programme outcome of the B.Sc Mathematics undergraduate course are the summation of the expected course learning outcomes given below.

PO1 Disciplinary knowledge :

Capability of demonstrating comprehensive knowledge of mathematics and understanding of one or more disciplines which form a part of an undergraduate programme of study.

PO2 Communications skills :

(i) Ability to communicate various concepts of mathematics effectively using examples and their geometrical visualizations.

(ii) Ability to use mathematics as a precise language of communication in other branches of human knowledge.

(iii) Ability to show the importance of mathematics as precursor to various scientific developments since the beginning of the civilization.

PO3 Critical thinking :

Ability to employ critical thinking in understanding the concepts in every area of mathematics.

PO4 Analytical reasoning :

Ability to analyze the results and apply them in various problems appearing in different branches of mathematics.

PO5 Problem solving :

(i) Capability to solve problems using concepts of linear algebra.

(ii) Capability to solve various models such as growth and decay models, radioactive decay model, LCR circuits and population models using techniques of differential equations.

(iii) Ability to solve linear system of equations, linear programming problems and network flow problems.

(iv) Ability to provide new solutions using the domain knowledge of mathematics acquired during this programme.

PO6 Research-related skills :

(i) Capability for inquiring about appropriate questions relating to the concepts in various fields of mathematics.

(ii) To know about the advances in various branches of mathematics.

PO7 Information/digital literacy : Capability to use appropriate software to solve system of equations and differential equations.

PO8 Self-directed learning :

Ability to work independently and do in-depth study of various notions of mathematics.

PO9 Lifelong learning :

Ability to think, acquire knowledge and skills through logical reasoning and to inculcate the habit of self-learning.

PO10 Application skills :

Ability to apply the acquired knowledge in all aspects.

PO11 Experimental skills :

PO12 Moral and ethical awareness/reasoning :

Ability to identify unethical behaviour such as fabrication, falsification ormisrepresentation of data and adopting objective, unbiased and truthful actions in all aspects

Course learning outcomes

Course learning outcomes of each course in B.Sc. Mathematics and B.A./B.Sc. Programme with Mathematics as a complementary course have been enshrined in the beginning of course contents of each course.

CORE COURSES													
Programme outcomes	Basic Logic and Number Theory	Calculus of Single Variable – 1	Calculus of Single Variable – 2	Linear Algebra	Abstract Algebra	Basic Analysis	Numerical Analysis	Linear Programming	Introduction to Geometry and Theory of Equations	Real Analysis	Complex Analysis	Calculus of Multi variable	Differential Equations
Disciplinary knowledge	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Communication skills	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Critical thinking	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Analytical thinking	✓	✓	✓			✓				✓	✓	✓	
Problem solving	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Research related skills	✓		✓	✓			✓		✓	✓	✓		✓
Information/ Digital Literacy	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Self-directed learning	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lifelong learning	✓			✓		✓				✓			
Applicational skills	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Experimental learning	✓	✓	✓				✓	✓					✓
Employability options	✓			✓			✓	✓				✓	✓
Ethics	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

ELECTIVE COURSES			
Programme outcomes	Graph Theory	Topology of Metric spaces	Mathematical Programming with Python and LaTeX
Disciplinary knowledge	✓	✓	✓
Communication skills	✓	✓	✓
Critical thinking		✓	✓
Analytical thinking		✓	✓
Problem solving	✓	✓	✓
Research related skills	✓	✓	✓
Information/Digital Literacy	✓	✓	✓
Self-directed learning	✓	✓	✓
Lifelong learning	✓	✓	✓
Applicational skills	✓	✓	✓
Experimental learning	✓		✓
Employability options	✓	✓	✓
Ethics	✓	✓	✓

OPEN COURSES				
Programme outcomes	Applied Calculus	Discrete Mathematics for Basic and Applied Sciences	Linear Mathematical Models	Mathematics for Decision Making
Disciplinary knowledge	✓	✓	✓	✓
Communication skills	✓	✓	✓	✓
Critical thinking	✓	✓	✓	✓
Analytical thinking	✓	✓	✓	
Problem solving	✓	✓	✓	✓
Research related skills	✓	✓	✓	✓
Information/ Digital Literacy	✓	✓	✓	✓
Self-directed learning	✓	✓	✓	✓
Lifelong learning	✓	✓	✓	✓
Applicational skills	✓	✓	✓	✓
Experimental learning	✓	✓	✓	✓
Employability options	✓	✓	✓	✓
Ethics	✓	✓	✓	✓

COMPLEMENTARY COURSES								
Programme outcomes	Mathematics				Mathematical Economics			
	MTS1 C01	MTS2 C02	MTS3 C03	MTS4 C04	MEC1 C01	MEC2 C02	MEC3 C03	MEC4 C04
Disciplinary knowledge	✓	✓	✓	✓	✓	✓	✓	✓
Communication skills	✓	✓	✓	✓	✓	✓	✓	✓
Critical thinking	✓	✓	✓	✓	✓	✓	✓	✓
Analytical thinking	✓	✓	✓			✓		✓
Problem solving	✓	✓	✓	✓	✓	✓	✓	✓
Research related skills				✓			✓	
Information/ Digital Literacy	✓	✓	✓	✓	✓	✓	✓	✓
Self-directed learning	✓	✓	✓	✓	✓	✓	✓	✓
Lifelong learning	✓			✓		✓		✓
Applicational skills	✓	✓	✓	✓	✓	✓	✓	✓
Experimental learning			✓	✓				✓
Employability options	✓			✓			✓	
Ethics	✓	✓	✓	✓	✓	✓	✓	✓

Core Courses

The following courses are compulsory for BSc Mathematics programme.

Sl. No	Code	Name of the course	Semester	No of contact hours/Week	Credits	Max. Marks			Exam dur.(Hrs)
						Internal	External	Total	
1	MTS1B01	Basic Logic and Number Theory	1	4	4	20	80	100	2.5
2	MTS2B02	Calculus of Single Variable-1	2	4	4	20	80	100	2.5
3	MTS3B03	Calculus of Single Variable-2	3	5	4	20	80	100	2.5
4	MTS4B04	Linear Algebra	4	5	4	20	80	100	2.5
5	MTS5B05	Abstract Algebra	5	5	4	20	80	100	2.5
6	MTS5B06	Basic Analysis	5	5	4	20	80	100	2.5
7	MTS5B07	Numerical Analysis	5	4	3	15	60	75	2
8	MTS5B08	Linear Programming	5	3	3	15	60	75	2
9	MTS5B09	Introduction to Geometry and Theory of Equations	5	3	3	15	60	75	2
		Project **OR** Research Methodology	5	2					
10		Open Course (Offered by Other Departments)	5	3	3	15	60	75	2
11	MTS6B10	Real Analysis	6	5	5	20	80	100	2.5
12	MTS6B11	Complex Analysis	6	5	5	20	80	100	2.5
13	MTS6B12	Calculus of Multi variable	6	5	4	20	80	100	2.5
14	MTS6B13	Differential Equations	6	5	4	20	80	100	2.5
15	MTS6B14	Elective	6	3	2	15	60	75	2
16	MTS6P15(PR) MTS6P15	Project Viva **OR** Research Methodology	6	2	2	15	60	75	2
				34	58			1450	

Elective Courses

One of the following three courses (Code MTS6B14(E01), MTS6B14(E02) and MTS6B14(E03)) can be offered in the sixth semester as an elective course.

Sl. No	Code	Name of the course	Semester	No of contact hours/Week	Credits	Max. Marks			Exam dur.(Hrs)
						Internal	External	Total	
1	MTS6B14(E01)	Graph Theory	6	3	2	15	60	75	2
2	MTS6B14(E02)	Topology of Metric Spaces	6	3	2	15	60	75	2
3	MTS6B14(E03)	Mathematical Programming with Python and LaTeX	6	3	2	15	60	75	2

Open Courses

One of the following four courses (MTS5D01, MTS5D02, MTS5D03 and MTS5D04) can be offered in the fifth semester as an open course for the students not having Mathematics as Core Course and Mathematics and Physics dual Core programme.

Sl. No	Code	Name of the course	Semester	No of contact hours/Week	Credits	Max. Marks			Unty. exam Dur. (Hrs)
						Internal	External	Total	
1	MTS5D01	Applied Calculus	5	3	3	15	60	75	2
2	MTS5D02	Discrete Mathematics for Basic and Applied Sciences	5	3	3	15	60	75	2
3	MTS5D03	Linear Mathematical Models	5	3	3	15	60	75	2
4	MTS5D04	Mathematics for Decision Making	5	3	3	15	60	75	2

Complementary Courses

Sl. No	Code	Name of the course	Semester	No of contact hours/Week	Credits	Max. Marks			Unty. exam Dur. (Hrs)
						Internal	External	Total	
1	MTS1C01	Mathematics – 1	1	4	3	15	60	75	2
2	MTS2C02	Mathematics – 2	2	4	3	15	60	75	2
3	MTS3C03	Mathematics – 3	3	5	3	15	60	75	2
4	MTS4C04	Mathematics – 4	4	5	3	15	60	75	2
		Mathematical Economics							
1	MEC1C01	Mathematical Economics	1	4	3	15	60	75	2
2	MEC2C02	Mathematical Economics	2	4	3	15	60	75	2
3	MEC3C03	Mathematical Economics	3	5	3	15	60	75	2
4	MEC4C04	Mathematical Economics	4	5	3	15	60	75	2

Credit Distribution of BSc Mathematics Programme

Sl. No	Course		Credits	
1	English		22	
2	Additional Language		16	
3	Core Course	13 Courses	51	55
		1 Elective	2	
		Project **OR** Research Methodology	2	
4	Complementary course - I		12	
5	Complementary course - II		12	
6	Open Course		3	
Total			120	

Scheme of Evaluation

The evaluation scheme for each course shall contain two parts: internal evaluation and external evaluation.

Internal Evaluation

20% of the total marks in each course are for internal evaluation. The colleges shall send only the marks obtained for internal examination to the university.

Components of Internal Evaluation

Sl No	Components	Marks (for Courses with Max. Marks 75)	Marks (for Courses with Max. Marks 100)
1	Class Room Participation (Attendance)	3	4
2	Assignment	3	4
3	Seminar	3	4
4	Test paper	6	8
	Total	**15**	**20**

a) Percentage of Class Room Participation (Attendance) in a Semester and Eligible Internal Marks

% of Class Room Participation (Attendance)	Out of 3 (Maximum internal marks is 15)	Out of 4 (Maximum internal marks is 20)
$50\% \leq CRP < 75\%$	1	1
$75\% \leq CRP < 85\%$	2	2
85% and above	3	4

CRP means % of class room participation (Attendance)

b) Percentage of Marks in a Test Paper and Eligible Internal Marks

Range of Marks in test paper (TP)	Out of 6 (Maximum internal marks is 15)	Out of 8 (Maximum internal marks is 20)
Less than 35%	1	1
$35\% \leq TP < 45\%$	2	2
$45\% \leq TP < 55\%$	3	3
$55\% \leq TP < 65\%$	4	4
$65\% \leq TP < 85\%$	5	6
$85\% \leq TP \leq 100\%$	6	8

Evaluation of Project

1. Evaluation of the Project Report shall be done under Mark System.

2. The evaluation of the project will be done at two stages:

   - Internal Assessment (supervising teachers will assess the project and award internal Marks)
   - External evaluation (external examiner appointed by the University)

3. Grade for the project will be awarded to candidates, combining the internal and external marks.

4. The internal to external components is to be taken in the ratio 1 : 4.

   Assessment of different components may be taken as below.

Internal assessment of Project (15 Marks)

(Supervising Teacher will assess the Project and award internal Marks)

Sl. No.	Components	Internal Marks
1	Originality	3
2	Methodology	3
3	Scheme / Organization of Report	4.5
4	Viva Voce	4.5
Total		**15**

External Evaluation of Project (60 Marks)

(To be done by the External Examiner appointed by the University)

Sl. No.	Components	External Marks
1	Relevance of the Topic, Statement of Objectives	12
2	Reference/ Bibliography, Presentation, quality of Analysis/ Use of Statistical Tools.	12
3	Findings and recommendations	18
4	Viva-Voce	18
Total		**60**

Pattern of Question Paper for University Examinations

	For Courses with Maximum External Marks 80 (2.5 Hrs)		For Courses with Maximum External Marks 60 (2 Hrs)	
Section A	Short answer type carries 2 marks each - 15 questions	Ceiling - 25	Short answer type carries 2 marks each - 12 questions	Ceiling - 20
Section B	Paragraph/Problem type carries 5 marks each - 8 questions	Ceiling - 35	Paragraph/Problem type carries 5 marks each - 7 questions	Ceiling - 30
Section C	Essay type carries 10 marks (2 out of 4)	$2 \times 10 = 20$	Essay type carries 10 marks (1 out of 2)	$1 \times 10 = 10$
Total		**80**		**60**

* Questions are to be evenly distributed over the entire syllabus. At least 20% of questions from each module must be included in each section of the question paper for courses having four modules in the syllabus and 30% for courses having three modules in the syllabus.