MAHARAJA'S COLLEGE, ERNAKULAM

(A Govt. Autonomous College)

BOARD OF STUDIES IN MATHEMATICS (UG)

CURRICULUM

FOR

UG -MATHEMATICS PROGRAMME

UNDER

CHOICE BASED CREDIT SYSTEM (CBCS-UG)

(Effective from 2016 admission onwards)

P R E F ACE

The present time is experiencing unprecedented progress in the field of Science and technology in which mathematics is playing a vital role; and so the curriculum and syllabi of any academic programme has to be systematically subjected to thorough revision so as to make them more relevant and significant.

Maharaja's college, Ernakulum is a unique institution of higher learning in the state. Its hoary tradition and consistent achievement in various fields of human activity envelop it with a halo of an outstanding temple of knowledge.

The college was elevated to the status of autonomous College by the Government of Kerala and UGC in the year 2014. This is the only government college in Kerala which has been granted autonomy.

The College is also committed to prepare a comprehensive plan of action for Credit and semester system in Graduate programmes. Various workshops with the participation of the teachers from affiliated colleges and invited experts from other Universities were conducted at our institution. The syllabus and curriculum we present here is the follow-up of such workshops.

We gratefully acknowledge the assistance and guidance received from the academic and governing council of our college and all those who have contributed in different ways in this venture.

It is recommended that the content of this syllabus be reviewed and adapted in the light of the consultative process and based on its application in future curriculum revision initiatives. The syllabus and curriculum also be revised periodically.

I hope this restructured syllabus and curriculum would enrich the students.

Prof. T. M. Safiya

Chairman Board of Studies (UG)

GRADUATE DEGREE PROGRAMME IN MATHEMATICS
Restructured under credit semester system

BOARD OF STUDIES MEMBERS

Mathematics (UG)

MAHARAJA'S COLLEGE, ERNAKULAM

(A Govt. Autonomous College)

Sl.No.	Category	Name	Designation
1	Internal	T. M. Safiya (Chair person)	Associate Professor
2	Internal	Dr.P.V. Mathai	Associate Professor
3	Internal	Dr. Bloomy Joseph	Assistant Professor
4	Internal	Jaya S.	Assistant Professor
5	Internal	Jaya Augustine	Assistant Professor
6	Internal	Thasneem T.R.	Assistant Professor
7	Internal	Murali T.K.	Assistant Professor
8	External experts	Dr.E.Krishnan	Rtd. Professor,University college, TVM
9	External experts	Dr.M.N.NarayananNamboothiri	Rtd. Professor, CUSAT
10	Expert fromIndustry	P.Padmanabhan	Rtd. Scientist(ISRO)
11	Alumni member	Dr.MaryMetilda	Rtd.Principal, Maharaja's college
12	University Nominee	Dr.Paul Isaac	Associate Professor, Bharat Matha College, Thrikkakara

MAHARAJA'S COLLEGE, ERNAKULAM

[A GOVERNMENT AUTONOMOUS COLLEGE]

REGULATIONS FOR UNDER GRADUATE PROGRAMMES UNDER CHOICE BASED CREDIT SYSTEM- 2016 ADMISSION ONWARDS

1. TITLE

1.1. These regulations shall be called "Regulations for Under Graduate Programmes under Choice Based Credit System , 2016" of Maharaja's College, Ernakulam [Autonomous].

2. SCOPE

2.1 Applicable to all Under Graduate Programmes conducted by Maharaja's College Ernakulam [Autonomous] with effect from 2016-17 admissions.

2.2 The provisions herein supercede all the existing regulations for undergraduate programmes to the extent herein prescribed.

3. DEFINITIONS

3.1. ***'Academic Week'*** is a unit of five working days in which distribution of work is organized from day1 today5, with five contact hours of one hour duration on each day. A sequence of 18 such academic weeks constitutes a semester.

3.2. ***'College Co-ordinator'*** is a teacher nominated by the College Council to co-ordinate the continuous evaluation undertaken by various departments within the college. He/she shall be nominated to the college level monitoring committee.

3.3. ***'Common Course I'*** means a course that comes under the category of courses for English and ***'Common Course II'*** means additional language, a selection of both is compulsory for all students undergoing undergraduate programmes. ***'Common Course II'*** is exempted in the cases of B.A Economics (Honours), B.Sc. Physics(Instrumentation) and B.Sc. Environmental Chemistry and Water Management programmes.

3.4. ***'Complementary Course'*** means a course which would enrich the study of core courses.

3.5. ***'Core Course'*** means a course in the subject of specialization within a degree programme.

3.6. ***'Course'*** means a complete unit of learning which will be taught and evaluated within a semester.

3.7. ***'Credit'***is the numerical value assigned to a course according to the relative importance of the content of the syllabus of the programme**.**

3.8. ***'Department'*** means any teaching department in a college.

3.9. ***'Department Co-ordinator'*** is a teacher nominated by a Department Council to co-ordinate the continuous evaluation undertaken in that department.

3.10. ***'Department Council'*** means the body of all teachers of a department in a college.

3.11. ***'Faculty Advisor'*** means a teacher from the parent department nominated by the Department Council, who will advise the student in the choice of his/her courses and other academic matters.

3.12. **Grace Marks** shall be awarded to candidates as per the M.G.University orders issued from time to timein recognition of meritorious achievements in NCC/NSS/Sports/ Arts and Cultural Activities.

3.13. ***'Grade'*** means a letter symbol (e.g.,S, A, B, C, etc.), which indicates the broad level of performance of a student in a course/ semester/programme.

3.14. ***'Credit Point (CP)'*** of a course is the value obtained by multiplying the grade point (GP) by the Credit (C) of the course CP=GP x C.

3.15. ***'Cumulative Grade Point Average (CGPA)'*** is the value obtained by dividing the sum of credit points in all the courses taken by the student for the entire programme by the total number of credits and shall be rounded off to two decimal places.

3.16. ***'Choice based Course'*** means a course other thanin the subject of specialization which can be opted by a student/department in a degree programme.

3.17. '***Parent Department'*** means the department which offers core courses within a degree programme.

3.18. ***'Programme'*** means a three year programme of study with examinations spread over sixsemesters, according to the regulations of the respective programme, the successful completion of which would lead to the award of a degree.

3.19. ***'Semester'*** means a term consisting of a minimum of **450** contact hours distributed over **90** working days, inclusive of examination days, within **18** five-day academic weeks.

4. ELIGIBILITY FOR ADMISSION, AND RESERVATION OF SEATS

4.1 Eligibility and Norms for admission and reservation of seats for various Degree Programmes shall be according to the rules framed by the Mahatma Gandhi University/State Government from time to time.

5. DURATION

5.1 The duration of U.G. programmes shall be ***6 semesters*** (the semesters defined under 3.19 above).

5.2 The duration of odd semesters shall be from **June to October** and that of even semesters from **November to March.** There shall be one week *semester break after odd semesters and two months vacation during April and May in every academic year.*

5.3 A student may be permitted to complete the Programme, on valid reasons, within a period of 8 continuous semesters from the date of commencement of the first semester of the programme.

6. REGISTRATION

6.1 The strength of students for each course shall remain as per existing regulations.

6.2 Each student shall register for the courses in the prescribed registration form in consultation with the Faculty Advisor within two weeks from the commencement of each semester. Faculty Advisor shall permit registration on the basis of the preferences of the student and availability of seats.

6.3 The number of courses/credits that a student can take in a semester is governed by the provisions in these regulations pertaining to the minimum and maximum number of credits permitted.

6.4 Those students who possess the required minimum attendance and progress during a semester and could not register for the semester examination are permitted to apply for Notional Registration to the examinations concerned enabling them to get promoted to the next class.

7. SCHEME AND SYLLABUS

7.1. The U.G. programmes shall include (a) Common courses I & II, (b) Core courses, (c) Complementary Courses, (d) Choice Based Course I & II. Complementary Courses are exempted in the case of B.Com and B.A Economics (Honours) programmes.

7.2. Credit Transfer and Accumulation system can be adopted in the programme. Transfer of Credit consists of acknowledging, recognizing and accepting credits by an institution for

programmes or courses completed at another institution. The Credit Transfer Scheme shall allow students pursuing a programme in one College to continue their education in another College without break.

The College shall allow credit transfer, subject to the approval of the concerned Board of Studies and Academic Council.

8. PROGRAMME STRUCTURE

There shall be a maximum of three credits for the open course.

a	Programme Duration	6 Semesters
b	Total Credits required for successful completion of the programme	120
c	Minimum credits required from common courses	38*
d	Minimum credit required from common courses in B.Com.	24
e	Minimum credit required from common courses in B.A. Economics(Honours), B.Sc. Instrumentation and B.Sc. Environmental Chemistry	8
f	Minimum credits required from Core + Complementary + Vocational courses including Project	74*
g	Minimum credits required from Choice Based Course I & II	8
h	Minimum attendance required	75%

*except in the case of Language Restricted Programmes [LRPs] including B. Com., B.A Economics (Honours), B.Sc. Instrumentation and B.Sc. Environment Chemistry.

9. EXAMINATIONS.

The evaluation of each course shall contain two parts:

(i) In-Semester Assessment (ISA)

(ii) End-Semester Assessment (ESA)

The in-semester to end semester, assessment ratio shall be 1:4, for both courses with or without practical. There shall be a maximum of 80 marks for end semester assessment and maximum of **20** marks for in-semester assessment. For all courses (theory & practical), grades are given on a 10- point scale based on the total percentage of marks ***(ISA+ESA)*** as given below:

Percentage of Marks	Grade	Grade Point(GP)
95 and above	S Outstanding	10
85 to below 95	A^+ Excellent	9
75 to below 85	A Very Good	8
65 to below 75	A^- Good	7
55 to below 65	B^+ Above average	6
50 to below 55	B Average	5
40 to below 50	C Pass	4
Below 40	F Fail	0
	Ab Absent	0

10. CREDIT POINT(CP), SEMESTER GRADE POINT AVERAGE (SGPA) & CUMULATIVE GRADE POINT AVERAGE (CGPA)

Credit Point (CP) of a course is calculated using the formula

CP = C × GP, where C = Credit; GP = Grade point

Semester Grade Point Average (SGPA) of a Semester is calculated using the formula

SGPA= TCP/TC, where TCP = Total Credit Point of that Semester

TC = Total Credit of that Semester

Cumulative Grade Point Average (CGPA) of a Programme is calculated using the formula

$$CGPA = \sum(TCP \times TC) \div \sum TC$$

CGPA shall be rounded off to two decimal places

Grades for the different semesters and overall programme are given based on the corresponding CPA as shown below:

GPA	Grade
Equal to 9.5 and above	S Outstanding
Equal to 8.5 and below 9.5	A^+ Excellent
Equal to 7.5 and below 8.5	A Very Good
Equal to 6.5 and below 7.5	A^- Good
Equal to 5.5 and below 6.5	B^+ Above average
Equal to 5.0 and below 5.5	B Average
Equal to 4.0 and below 5.0	C Pass
Below 4.0	F Failure

Note: A separate minimum of 30% marks each for in-semester and end semester (for both theory and practical) and aggregate minimum of 40% are required to pass for a course. To pass in a programme, a separate minimum of Grade C is required for all the individual courses. If a candidate secures **F** Grade for any one of the courses offered in a Semester/Programme only **F** grade will be awarded for that Semester/Programme until he/she improves this to **C** grade or above within the permitted period. Candidate secures **C** grade and above shall be eligible for higher studies.

11. MARKS DISTRIBUTION FOR END SEMESTER EXAMINATION AND IN-SEMESTER EVALUATION

The end semester examination of all semesters shall be conducted by the college at the end of each semester. All theories, practicals and project(s) are treated as individual papers and marks should be in the 80(external)/20 (internal) pattern. In-semester evaluation is to be done through continuous assessment. Marks distribution for end semester and in-semester assessments and the components for in-semester evaluation with their marks are shown below:

Components of the in-semester evaluation and their marks are as below.

11.1 For all courses without practical

a) **Marks of End Semester Examination : 80**

b) **Marks of In Semester Evaluation : 20**

All the three components of the in-semester assessment are mandatory.

Components of In-Semester Evaluation	Marks
Attendance	**5**
Assignment /Seminar/Viva	**5**
2 Test papers*	**10**
Total	**20**

*marks of test papers shall be the average

11.2 For all courses with practical

a) Marks of theory -End Semester Examination : 80

b) Marks of theory – In Semester Evaluation : 20

Components of Theory–In Semester Evaluation	Marks
Attendance	**5**
Assignment/Seminar/Viva	**5**
2 Test papers*	**10**
Total	**20**

*marks of test papers shall be the average

c) Marks of Practical –End semester Examination: 80

(Practicals shall be conducted in even semesters for all programmes except commerce. For Commerce, in semester evaluation shall be conducted separately for odd and even semesters).

d) Marks of Practical- In Semester Evaluation: 20

Components of Practical-In Semester evaluation	Marks
Attendance	4
Record*	10
Viva / Working Model Projects	6
Total	**20**

*Marks awarded for Record should be related to number of experiments recorded.

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11.3 Project Evaluation: (Maximum marks100)

Components of Project-Evaluation	Marks
In-semester Evaluation*	20
Dissertation (End semester)	50
Viva-Voce (End semester)	30
Total	**100**

*Components of Internal Evaluation	Marks
Relevance and Contents	5
Analysis and Presentation	5
Pre-submission Presentation and Viva	10
Total	**20**

12. Attendance Evaluation

1) For all courses without practical

% of attendance	Marks
90 and above	5
85 – 89	4
80-84	3
76-79	2
75	1

(Decimals are to be rounded to the next higher whole number)

2) For all courses with practical

% of Attendance	Marks for theory
90 and above	5
85--89	4
80--84	3
76-79	2
75	1

% of Attendance	Marks for practical
90 and above	4
85—89	3
80—84	2
75—79	1

(Decimals are to be rounded to the next higher whole number)

13. In-Semester Assessment

The evaluation of all components is to be published in the department and is to be acknowledged by the candidates. All documents of in-semester assessments are to be kept in the department for two years and shall be made available for verification by the college authorities.

13.1 Grievance Redressal Mechanism for In-Semester Assessment

In-Semester assessment shall not be used as a tool for personal or other type of vengeance. A student has every right to know, how the teacher arrived at the marks. In order to address the grievance of students, a two-level Grievance Redressal mechanism is envisaged. A student can approach the upper level only if grievance is not addressed at the lower level.

Level 1:Department Level: The department cell chaired by the Head; with Dept. coordinator and teacher in-charge,as members.

Level 2: **College level**: A committee with the Principal as Chairman, Dept. Coordinator, HOD of concerned Department and a senior teacher nominated by the College council as members.

13.2 The college council shall nominate a senior teacher as coordinator of in-semester evaluations. This coordinator shall make arrangements for giving awareness of the in-semester evaluation components to students immediately after commencement of I semester

13.3 The in-semeste r evaluation report in the prescribed format should reach the Controller of Examinations before the 4th week of October and March in every academic year.

14. End SemesterExamination

The end semester examination of all semesters shall be conducted by the College at the end of each semester.

14.1 Students having a minimum of 75% average attendance for all the courses only can register for the examination. Condonation of shortage of attendance to a maximum of 10 days or 50 hours in a semester, subject to a maximum of 2 times during the whole period

of the programme, may be granted by the subcommittee of the College Council on valid grounds. This condonation shall not be counted for in-semester assessment.

Benefit of attendance may be granted to students attending University/College union/Co-curricular activities by treating them as present for the days of absence, on production of participation/attendance certificates, within one week, from competent authorities and endorsed by the Head of the institution. This is limited to a maximum of 10 days per semester and this benefit shall be considered for in-semester assessment also.

Those students who are not eligible to attend the end semester examination due to shortage of attendance, even with condonation, shall repeat the course along with the next batch upon the recommendation of the Head of the Department and the College Council.

14.2 All students are to do a project. This project can be done individually or as a group of 3 students. The projects are to be identified during the 4thsemester of the programme with the help of the supervising teacher. The report of the project in duplicate is to be submitted to the department at the sixth semester and are to be produced before the examiners appointed by the College.

14.3 Those candidates who have not appeared/failed in the end semester examinationsof 5th and 6th Semester shall be eligible to appear for special supplementary examination by paying separate fees. For reappearance/ improvement, the students can appear along with the next batch.

14.4 A student who registers his/her name for the end semester examination will be eligible for promotion to the next semester.

14.5 A student who has completed the entire curriculum requirement, but could not register for the Semester examination can register notionally, for getting eligibility for promotion to the next semester.

14.6 A candidate who has not secured minimum marks/credits in in-semester examinations can re-do the same subsequently with the next batch.

14.7 All programmes and courses shall have unique alphanumeric code.

15. PATTERN OF QUESTIONS

Questions shall be set to assess knowledge acquired, standard application of knowledge, application of knowledge in new situations, critical evaluation of knowledge and the ability to

synthesize knowledge. The question setter shall ensure that questions covering all skills are set. He/She shall also submit a detailed scheme of evaluation along with the question paper.

A question paper shall be a judicious mix of objective type, short answer type, short essay type /problem solving type and long essay type questions.

Pattern of questions for end semester examination for theory paper

	Total no. of questions	Number of questions to be answered	Marks of each question	Total marks
TOTAL	10	8	1	8
	8	6	2	12
	8	6	5	30
	4*	2	15	30
	30	**22**	x	**80**

*questions in bunches of two

16. There shall be 2 levelmonitoring committees for the successful conduct of the scheme. They are:

1. Department Level Monitoring Committee (DLMC), comprising HOD and two teachers nominated as members by the Department Council.

2. College Level Monitoring Committee (CLMC), comprising Principal, Controller of Examinations, Academic Coordinator, Department Co-ordinator and A.O/Superintendent as members.

17. TRANSITORY PROVISION

Notwithstanding anything contained in these regulations, the Principal shall, for a period of one year from the date of coming into force of these regulations, have the power to provide by order that these regulations shall be applied to any programme with such modifications as may be necessary.

MAHARAJA'S COLLEGE, ERNAKULAM

(A Govt. Autonomous College)

Common format for UG

Department of Mathematics

UG Programme : Mathematics
Total Credits: 120

Curriculum

e	Course	Credit	Marks			Weekly Contact Hours		Course Code	Course	Credit	Mar	
			Int.	Ext.	Total						Int.	Ext
01	Common Course: English	4	20	80	100	5	Semester II	ENG2CMR03	Common Course: English	4	20	80
02		3	20	80	100	4		ENG2CMR04		3	20	80
	Common Course: Additional Language	4	20	80	100	4			Common Course: Additional Language	4	20	80
01	Foundation of Mathematics	3	20	80	100	4		MAT2COR02	Analytic Geometry and Matrices	3	20	80
01	Complimentary Paper I(Statistics)	3	20	80	100	4		STA2CMP02	Complimentary Paper I(Statistics)	3	20	80
01	Complimentary Paper II(Physics)	3	20	80	100	4		PHY2CMP02	Complimentary Paper II(Physics)	3	20	80
	TOTAL	**20**			**600**	**25**			**TOTAL**	**20**		
05	Common Course: English	4	20	80	100	5	Semester IV	ENG4CMR06	Common Course: English	4	20	80
	Common Course: Additional Language	4	20	80	100	5			Common Course: Additional Language	4	20	80
03	**Calculus**	4	20	80	100	5		MAT4COR04	Integral Calculus, Theory of Equations and Fourier series	4	20	80
03	Complimentary Paper I(Statistics)	4	20	80	100	5		STA4CMP04	Complimentary Paper I(Statistics)	4	20	80
03	Complimentary Paper II(Physics)	4	20	80	100	5		PHY4CMP04	Complimentary Paper II(Physics)	4	20	80

	TOTAL	**20**			**500**	**25**			**TOTAL**	**20**		
05	Mathematical Analysis	4	20	80	100	5		MAT6COR09	Real Analysis	4	20	80
06	Differential Equations	4	20	80	100	6		MAT6COR10	Complex Analysis	4	20	80
07	Abstract Algebra	4	20	80	100	5		MAT6COR11	Transforms and special function	4	20	80
08	Numerical Analysis	4	20	80	100	5		MAT6COR12	Linear Algebra	4	20	80
01	Choice based paper I Combinatorics	4	20	80	100	4	**Semester VI**	MAT6CBP02	Choice based paper II- Operations Research	3	20	80
									Project and Viva	1	20	80
	TOTAL	**20**			**500**	**25**			**TOTAL**	**20**		

Mathematics (Core Course)

Semester	Title of the Course	Number of hours per week	Total Credits	Total hours/ semester	End Semester Exam Duration	Mark	
						ISA	ESA
1	MAT1COR01 - **Foundation of Mathematics**	4	3	72	3	20	80
2	MAT2COR02– **Analytic Geometry and Matrices**	4	3	72	3	20	80
3	MAT3COR03 – **Calculus**	5	4	90	3	20	80
4	MAT4COR04 – **Vector Calculus, Theory of Equations and Fourier series**	5	4	90	3	20	80
5	MAT5COR05– **Mathematical Analysis**	5	4	90	3	20	80
	MAT5COR06 – **Differential Equations**	6	4	108	3	20	80
	MAT5COR07 – **Abstract Algebra**	5	4	90	3	20	80
	MAT5COR08- **Numerical Analysis**	5	4	90	3	20	80
	MAT5CBP01 – Choice based paper I	4	3	72	3	20	80

6	MAT6COR09 – **Real Analysis**	5	4	90	3	20	80
	MAT6COR10 – **Complex Analysis**	5	4	90	3	20	80
	MAT6COR11 – **Transforms and Special Functions**	5	4	90	3	20	80
	MAT6COR12 – **Linear Algebra**	5	4	90	3	20	80
6	MAT6CBP02**–** Choice based paper II	4	3	72	3	20	80
	Project	**1**	1	18	-	20	80

Choice based papers during the fifth Semester

Code	**Title of the Course**	**No. of contact hrs/week**	**No. of Credit**	**Duration of Exam**
MAT5CBP01	**Combinatorics**	4	3	3 hrs
MAT5CBP	**Introduction to Higher Algebra**	4	3	3 hrs
MAT5CBP	**Mechanics**	4	3	3 hrs

Choice based papers during the Sixth Semester

Code	Title of the Course	No. of contact hrs/week	No. of Credit	Duration of Exam
MAT6CBP02	**Operations Research**	4	3	3 hrs
MAT6CBP	**Graph Theory**	4	3	3 hrs
MAT6CBP	**Computer Programming(Practical)**	4	3	3 hrs

Projects :

All students must do a project. The project can be done individually or as a group of maximum 3 students. However, the viva on this project will be conducted individually. The projects are to be identified during the IVth semester of the programme with the help of the supervising teacher. The report of the project in duplicate is to be submitted to the department and are to be produced before the examiners appointed by the Governing council.

COMPLEMENTARY COURSES:1. Mathematics for B. Sc Physics / Chemistry

Semester	Title of the paper	Number of hours per week	Total Credits	Total hours/ semester	End Semester Exam Duration	Mark	
						ISA	ESA
1	**MAT1CMP01– Differential & Integral Calculus and Matrices**	4	3	72	3 hrs	20	80
2	**MAT2CMP02 –Application of integrals, Partial Derivatives and Analytic Geometry**	4	3	72	3hrs	20	80
3	**MAT3CMP03– Vector Calculus ,Differential Equations**	5	4	90	3hrs	20	80
4	**MAT4CMP04- Fourier Series , Laplace Transforms, Complex Numbers and Numerical Methods**	5	4	90	3hrs	20	80

2. Mathematics for B.A Economics

Semesters	Title of the paper	Number of hours per week	Total Credits	Total hours/ semester	End Semester Exam Duration	Mark	
						ISA	ESA
3	**MAT3CME01**: **Graphing functions, Equations and Linear Algebra**	6	4	108	3 hrs	20	80
4	**MAT4CME02: Calculus, Exponential and Logarithmic Functions**	6	4	108	3 hrs	20	80

3. Mathematics for B.A Economics (Honours)

Semesters	Title of the paper	Number of hours per week	Total Credits	Total hours/ semester	End Semester Exam Duration	Mark	
						ISA	ESA
1	**ECH1COR04 Mathematical Economics I**	6	4	108	3 hrs	20	80
2	**ECH2COR08 Mathematical Economics II**	6	4	108	3 hrs	20	80

For the Board of Studies in Mathematics (U G)

Prof. T.M.Safiya (Chairperson)

B.Sc. DEGREE PROGRAMME

MATHEMATICS (CORE COURSE 1)
FIRST SEMESTER
MAT1COR01-FOUNDATION OF MATHEMATICS

4 hours/week **80 marks**

Objectives

- To explain the fundamental ideas of limits ;
- To introduce complex numbers;
- To introduce basic Number Theory;

Text Books:

1. George B. Thomas, Jr: Thomas' Calculus Eleventh Edition, Pearson, 2008
2. S. Bernard and J.M Child: Higher Algebra, AITBS Publishers, India,2009
3. J.W. Brown and Ruel.V.Churchill _ Complex variables and applications, 8^{th} edition. McGraw Hill.

Module 1 **(22 hours)**

Differential Calculus: Rates of change and limits, calculating limits using the limit laws, the precise definition of a limit, one sided limits and limits at infinity**,** derivative of a function, differentiation rules, the derivative as a rate of change, derivatives of trigonometric functions, the chain rule and parametric equations, implicit differentiation.
(Sections 2.1 – 2.4, 3.1 – 3.6 of Text 1)

Module II **(15 hours)**

Applications of Derivatives: Extreme values of functions, The Mean Value Theorem, Monotonic functions and the first derivative test.
(Sections 4.1 - 4.3 of Text 1)

Module III **(15 hours)**

complex numbers: Sums and products. Basic algebraic properties. Further properties. Vectors and moduli. Different representations. Exponential forms. Arguments of products and quotients. Product and powers in exponential form. oots of complex numbers. Regions in the complex plane. (Section 1 to 11 of chapter 1 of text 3.)

Module 4 **(20 hours)**

Theory of Numbers: Divisibility theory in the integers, the greatest common divisor, the Euclidean algorithm (division algorithm), Primes. The fundamental theorem of arithmetic. The theory of congruence. Basic properties of congruence. Fermat's little theorem Wilson's theorem. Euler's phi-function. Euler's generalization of Fermat's theorem.

(Text – 2 , Chapter – 1 and 26)

References :

1. George B. Thomas Jr. and Ross L. Finney : Calculus, LPE, Ninth edition, Pearson Education.
2. M.R Spiegel – Complex Variables, Schaum's Series
3. George E. Andrews : Number Theory, HPC.

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	3	2	2	1
II	2	2	2	1
III	2	2	2	1
IV	3	2	2	1
Total	**10**	**8**	**8**	**4**

B.Sc. DEGREE PROGRAMME

MATHEMATICS (CORE COURSE 2)
SECOND SEMESTER
MAT2COR02-ANALYTIC GEOMETRY AND MATRICES

4 hours/week **80marks**

Objectives

- To explain more ideas of conics;
- To explain rank of matrices , Characteristic roots and characteristic vectors

Text books:

1. Thomas calculus- Maurice D weir, Joel Hass, Frank R Giordano (Eleventh Edition)
2. Frank Ayres Jr - Matrices , Schaum's Outline Series, TMH Edition.

Module I

Conic Sections **(22 hours)**

Conic sections and quadratic equations, classifying conic sections by eccentricity, quadratic equations and rotations, conic and parametric equations;the cycloid
(Relevant sections 10.1, 10.2 ,10.3 10.4 of Text 1)

Module II **(20 hours)**

Polar coordinates

Polar coordinates, graphing in polar coordinates.
(Relevant sections 10.5, 10.6 of Text 1)

Module III **(10 hours)**

Polar Equations

Polar co-ordinates, polar equation of a line, polar equation of a circle and polar equation of a conic. Polar equations of tangent and normal to these curves
(Relevant sections 10.8 of Text 1)

Module IV **(20 hours)**

Matrices: Rank of a Matrix, Non-Singular and Singular matrices, Elementary Transformations, Inverse of an elementary Transformations, Equivalent matrices, Row Canonical form, Normal form, Elementary matrices only. Systems of Linear equations: System of non homogeneous, solution using matrices, Cramer's rule, system of homogeneous equations, Characteristic equation of a matrix; Characteristic roots and characteristic vectors. Cayley-Hamilton theorem and simple applications (Text 3, Chapters – 5, 10, 19, 23).

Reference Books:

1. S.K . Stein – Calculus and analytic Geometry , (McGraw Hill)
2. A. N. Das – Analytic Geometry of Two and Three Dimension (New Central Books)
3. Thomas and Finney - Calculus and analytical geometry (Addison-Wesley)

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	3	3	3	1
II	3	1	1	1
III	2	2	1	1
IV	2	2	3	1
Total	**10**	**8**	**8**	**4**

B.Sc. DEGREE PROGRAMME
MATHEMATICS (CORE COURSE 3)
THIRD SEMESTER
MAT3COR03-CALCULUS

5 hours/week **80marks**

Objectives

- To expand a function using Taylor's and Maclaurin's series.
- To understand partial derivatives and its applications
- To understand vector valued functions .
- To calculate the area under a given curve, length of an arc of a curve when the equations are given in parametric and polar form.
- To estimate the surface area and volume of solids.

Text Books:

1. George B. Thomas Jr. (Eleventh Edition) – Thomas' Calculus, Pearson, 2008.

PRE REQUISITE: Successive Differentiation

Module I **(15 hours.)**

Higher Order Derivatives

Concavity and curve sketching, Taylor and Maclaurin series.

Sections 4.4 and 11.8 of Text)

Module II **(25 hours.)**

Partial Differentiation: Partial derivatives, The chain rule, Extreme values and saddle points, Lagrange multipliers, Partial derivatives with constrained variables. (Section 14.3 , 14.4, 14.7, 14.8, 14.9 of Text)

Module III **(25 hours.)**

Vector Valued Functions

(A quick review) Lines and planes in space, Cylinders and Quadric surfaces, Vector functions Arc length and Unit tangent vector, Curvature and Unit normal vector, torsion and Unit Binomial vector, Directional derivatives and gradient vectors, tangent planes and Differentials
(Sections 12.5, 12.6, 13.1, 13.3, 13.4, 13.5, 14.5, 14.6 of Text)

Module IV **(25 hours.)**

Integral Calculus: Substitution and area between curves, volumes by Slicing and rotation about an axis. Volumes by cylindrical shells, Lengths of Plane Curves, Areas of surfaces of Revolution and the theorems of Pappus.

(Section 5.6, 6.1, 6.2, 6.3, 6.5 of Text)

Reference:

1. T. M. Apostol – Calculus Volume I & II (Wiley India)
2. Anton: Calculus, Wiley.

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	2	1	1	0
II	3	2	2	1
III	3	3	2	1
IV	2	2	3	2
Total	**10**	**8**	**8**	**4**

B.Sc. DEGREE PROGRAMME
MATHEMATICS (CORE COURSE 4)
FOURTH SEMESTER
MAT4COR04-INTEGRAL CALCULUS, THEORY OF EQUATION AND FOURIER SERIES

5 hours/week **80marks**

Objectives

- To apply Vector integration in physical problems
- To conceive the concept of equation and its roots.
- To introduce Fourier series

Text Books:

1.George B. Thomas Jr. (Eleventh Edition) – Thomas' Calculus, Pearson, 2008.
2. Bernard and Child - Higher Algebra, AITBS Publishers, India.
3. Erwin Creszig – Advanced Engineering Mathematics,VIII th edition

Module I **(20 hours)**

Multiple Integrals: Double integrals, areas, Double integrals in polar form, Triple integrals in rectangular coordinates, triple integrals in cylindrical and spherical coordinates , substitutions in multiple integrals.
(Section 15.1, 15.2(area only), 15.3, 15.4, 15.6,15.7 of Text 1)

Module II **(30 hours)**

Integration in Vector Fields: Line integrals, Vector fields, work circulation and flux, Path independence, potential functions and conservative fields, Green's theorem in the plane, Surface area and surface integrals, Parameterized surfaces, Stokes' theorem (statement only), Divergence theorem and unified theory (no proof).
(Sections 16.1 to 16.8 of Text 1)

Module III **(20 hours)**

Theory of Equations: Statement of fundamental Theorem of algebra. Deduction that every polynomial of degree n has n and only n roots. Relation between roots and coefficients. Transformation of equations. Reciprocal equations. Carden's method, Ferrari's method, Symmetric functions of roots (relevant topics of chapter 6 Text 2)

Module IV **(20 hours)**

Fourier series: Periodic functions, Trigonometric series, Functions of any period P=2L, Fourier series, even and odd functions, Half range expansions. (Relevant topics of text 1)

References:

1. H.F. Davis and A.D. Snider: Introduction to Vector Analysis, 6th ed., Universal Book Stall, New Delhi.

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	2	2	2	1
II	3	3	2	1
III	3	2	2	1
IV	2	1	2	1
Total	**10**	**8**	**8**	**4**

B.Sc. DEGREE PROGRAMME
MATHEMATICS (CORE COURSE 5)
FIFTH SEMESTER
MAT5COR05-MATHEMATICAL ANALYSIS

5 hours/week **80 marks**

Objectives:

- To introduce order completeness property and Archemedian properties of set of real numbers.
- To explain the concept of sequences and their convergences.
- To explain the properties of continuous functions..
- To explain the concept of uniform continuity.

Text Books:

1. Robert G bartle and Donald R sherbert- Introduction to Real Analysis

Module I **(20 hours)**

Real Numbers

The algebraic properties of R, The order properties of R, Absolute Value, the completeness property of R.
(Sections 2.1,2.2,2.3,2.4 of Text)

Module II **(20 hours)**

Countable and uncountable set

Applications of the supremum property, intervals and decimals, infinite sets.
(Sections : 2.5,2.6,2.7 of chapter 2 of Text)

Module III **(30 hours)**

Sequences

Sequences and their limits, limit theorems, monotone sequences, sequences and the Bolzano weirstrauss theorem, the Cauchy criterion.
(Sections : 3.1,3.2,3.3,3.4,3.5 of chapter 3 of Text)

Module IV **(20 hours)**

Continuous functions: Continuous function , combinations of continuous functions, continuous functions on intervals, Uniform continuity,
(Section 5.1,5.2,5.3,5.4 of chapter 5 of Text)

References:

1.Richard R Goldberg – Methods of real analysis 3rd edition , Oxford and IBM Publishing Co (1964)

2 Elias Zako – Mathematical analysis Vol1, Overseas Press, New Delhi (2006)

3. J. M .Howie – Real Analysis, Springer 2007

4 K.A Ross - Elementary Real Analysis, Springer, Indian Reprint

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	2	2	2	1
II	2	2	2	1
III	3	2	2	1
IV	3	2	2	1
Total	**10**	**8**	**8**	**4**

B.Sc. DEGREE PROGRAMME
MATHEMATICS (CORE COURSE 6)
FIFTH SEMESTER
MAT5COR06-DIFFERENTIAL EQUATIONS

6 hours/week **80 marks**

Objectives:

- To obtain an integrating factor which may reduce a given differential equation into an exact one and eventually provide its solution.
- To familiarize the orthogonal trajectory of the system of curves on a given surface.
- To find solution of the differential equation $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$
- To use Lagrange's method for solving the first order linear partial differential equation.

Text Books:

1. Shepley L. Ross - Differential Equations, 3rd ed., (Wiley India).
2. Ian Sneddon – Elements of Partial Differential Equation (Tata Mc Graw Hill)

Module I **(25 hours**

Exact differential equations and integrating factors (proof of theorem 2.1 excluded) , separable equations and equations reducible to this form,, linear equations and Bernoulli equations, special integrating factors and transformations. Orthogonal and oblique trajectories.

(Sections 2.1 , 2.2, 2.3 , 2.4, 3.1 of Text 1)

Module II **(30 hours.)**

Basic theory of linear differential equations. The homogeneous linear equation with constant coefficients. The method of undetermined coefficients, Variation of parameters, The Cauchy – Euler equation.

(Section 4.1 , 4.2 , 4.3, 4.4, 4.5 of Text 1)

Module III **(33 hours.)**

Power series solution about an ordinary point, solutions about singular points, the method of Frobenius , Bessel's equation and Bessel Functions, Differential operators and an operator method. (Section 6.1 , 6.2 , 6.3, 7.1 of Text 1)

Method IV **(20 hours)**

Surfaces and Curves in three dimensions, solution of equation of the form

$\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$. Origin of first order and second order partial differential equations, Linear equations of the first order, Lagrange's method

(Chapter 1 , section 1 and 3 & Chapter 2 Section 1, 2 and 4 of text 2)

Reference:

1. A.H.Siddiqi & P. Manchanda – A First Course in Differential Equation with Applications (Macmillian)
2. George. F. Simmons – Differential equation with applications and historical notes (Tata Mc Graw Hill)
   Books Agency)
3. Sankara Rao - Introduction to Partial Differential Equation,2nd edition, PHI.
4. Zafar Ahsan - Differential Equations and their Applications , 2nd edition, PHI

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	3	2	2	1
II	2	2	2	1
III	2	2	2	1
IV	3	2	2	1
Total	**10**	**8**	**8**	**4**

B.Sc. DEGREE PROGRAMME
MATHEMATICS (CORE COURSE 7)
FIFTH SEMESTER
MAT5COR07-ABSTRACT ALGEBRA

5 hours/week **80 marks**

Objectives:

- To introduce different types of groups.
- To explain the concept cyclic group and isomorphism.
- To explain the concept homomorphism and integral domain.
- To introduce ring and ideals.

Text book :

John B.Fraleigh - A first course in Abstract Algebra (3rd Edition),

Module 1 **(25 hours)**

Group

Binary operation-Groups,Definition and elementary properties-finite groups and group tables-subsets and sub groups-cyclic sub groups-functions and permutations- groups of permutations-examples.Cycles and Cyclic notations-even and odd permutations-the alternating groups.
(Chapters 1-5)

Module 2 **(25 hours)**

Cyclic Groups-Elementary Properties-Classification of cyclic groups-Subgroups of finite cyclic groups-Isomorphisms-Definition and elementary properties-How to show that two groups are isomorphic(Not Isomorphic)-Cayle's Theorem-Groups of Cosets--Applications-Criteria for the existence of a coset group-inner automorphisms and normal subgroups-Factor groups-Simple groups(Chapter- 6,7,11,12)

Module 3 **(20 hours)**

Homomorphism-Definition and Elementary Properties-The Fundamental Homomorphism theorem-Applications. Rings,Definition and Basic Properties-Multiplicative questions;Fields-Integral Domains-Divisors of Zero And Cancellation-Integral Domains.
(Chapters- 13,23,24.1,24.2)

Module 4 **(20 hours)**

Ring and Fields

Characteristic of a Ring- Quotient Ring and Ideals-Criteria for The Existence of a Coset Ring-Ideals And Quotient Rings.(Chapters-24.3,28)

References :

1. I.N Herstein - Topics in Algebra
2. Joseph A Gullian - A Contemporary Abstract Algebra,NarosaPub.House .
3. P.B Bhattacharya , S. K Jain and S. R . Nagpaul – Basic Abstract Algebra , 2nd edition, Cambridge University Press
4. Chatterjee - Abstract Algebra , 2nd edition, PHI

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	3	2	2	1
II	3	2	2	1
III	2	2	2	1
IV	2	2	2	1
Total	**10**	**8**	**8**	**4**

B.Sc. DEGREE PROGRAMME

MATHEMATICS (CORE COURSE 8)
FIFTH SEMESTER
MAT5COR08 - NUMERICAL ANALYSIS

5 hours/week **80 marks**

Objectives:

- To use numerical methods to find missing values of data.
- To solve differential equation using numerical methods.

Textbook

1. S.S.Sastry – Introductory methods of Numerical Analysis Vth edition

Module I **(15 hours)**

Numerical Analysis: Bisection Method, Method of False position, Iteration Method, Newton - Raphson Method , Ramanujan's method, secant method
(Sections 2.2, 2.3, 2.4, 2.5, 2.6 &2.7 of the text)

Module II **(15 hours)**

Interpolation : Finite differences, detection of errors by use of difference Tables, Differences of a polynomial, Newton's Formulae for Interpolation,Central Difference Interpolation Formulae ,Interpolation with unevenly spaced points, Divided Differences and Their Properties
(Chapter 3 section 3.3-3.7,3.9.1,3.10 of text 2)

Module III **(30hours)**

Numerical differentiation and Integration: Spline functions - linear splines , Quadratic splines,Cubic splines, Numerical differentiation-errors in Numerical differentiation, Cubic Splines Method, Differentiation Formulae with Function Values, Numerical integration-Trapezoidal Rule, Simpson's 1/3 rule, simpson's 3/8 rule
(chapter 5-5.1,5.1.1,5.1.2,5.2, chapter 6-6.2,6.2.1,6.2.2,6.2.3 6.4-6.4.1,6.4.2,6.4.3 of text 2)

Module IV **(30hours)**

Numerical solution of ordinary equation: Solution by Taylor's method,Picard's method of successive Approximations, Euler's method, Error Estimates for the Euler method, Modified Euler's method. Runge-Kutta Method (Chapters 8 section 8.1,8.2,8.3,8.4,8.4.1,8.4.2.8.5 of text 2)

References:

1. B.S. Grewal, Higher Engineering Mathematics
2. M.K.Jain,S.R.K. Iyenkar and R.K. Jain, Numerical Methods for scientific and Engineering Computation
3. Erwin Creszig – Advanced Engineering Mathematics

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	2	2	2	1
II	3	2	2	1
III	3	2	2	1
IV	2	2	2	1
Total	**10**	**8**	**8**	**4**

B.Sc. DEGREE PROGRAMME

MATHEMATICS (CORE COURSE 9)
SIXTH SEMESTER
MAT6COR09-REAL ANALYSIS

5 hours/week **80 marks**

Objectives:

- To explain indeterminate forms
- To explain the convergence of infinite series
- To check the convergence of infinite series
- To introduce Riemann integration and uniform convergence.

Text book:

1 Robert G Bartle, Donald R Sherbert - Introduction to Real Analysis, 2nd Edition.

Module I **(20 hours)**

Differentiation: The Derivative, Mean-Value Theorem, Indeterminate forms, L'Hospital rule, Taylor's Theorem, Application of Taylor's Theorem.
(Chapter6-6.1, 6.2, 6.3, 6.4.1, 6.4.2, 6.4.3)

Module II **(30 hours)**

Riemann Integral: Riemann Integral, Properties of Riemann Integral, Fundamental Theorem of Calculus, Integral as a limit, Darboux's Theorem.
(Chapter 7- 7.1, 7.2, 7.3, 7.4)

Module III **(20 hours)**

Infinite Series: Convergence of Infinite Series, Test for Absolute Convergence, Test for non absolute Convergence.
(Chapter 9 – 9.1, 9.2, 9.3)

Module IV **(20 hours)**

Sequence and Series of Functions: pointwise and uniform convergence, interchange of limit and continuity, series of function, test for uniform convergence
(Chapter 8- 8.1, 8.2 Chapter 9 – 9.4.1, 9.4.2, 9.4.3, 9.4.4, 9.4.5, 9.4.6)

References:

1. W.RUDIN, *Principles of Mathematical Analysis,* Second Edition, McGraw-Hill
2. A.E.TAYLOR, General Theory of Functions and Integration, Dover

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	2	2	2	1
II	3	2	2	1
III	3	2	2	1
IV	2	2	2	1
Total	**10**	**8**	**8**	**4**

B.Sc. DEGREE PROGRAMME

MATHEMATICS (CORE COURSE 10)
SIXTH SEMESTER
MAT6COR10-COMPLEX ANALYSIS

5 hours/week **80 marks**

Objective

- To conceive the concept of analytic functions and will be familiar with the elementary complex functions and their properties
- To familiar with the theory and techniques of complex integration
- To familiar with the theory and application of the power series expansion of analytic functions.

Text book:
James Ward Brown& Ruel. V. Churchill- Complex variables and applications (8^{th} edition)

Module 1 **(30 hours)**

Analytic functions: Functions of a complex variable-limits-theorems on limits-continuity-derivatives-differentiation formulas-Cauchy-Riemann equations-sufficient condition for differentiability-analytic functions examples-harmonic functions.
Elementary functions: Exponential function –logarithmic function –complex exponents – trigonometric functions- hyperbolic functions- inverse trigonometric and hyperbolic functions.

Module 2 **(25 hours)**

Integrals: Derivatives of functions –definite integrals of functions –contours –contour integrals –some examples –upper bounds for moduli of contour integrals –antiderivates –Cauchy-Goursat theorem (without proof)- simply and multiply connected domains- Cauchy's integral formula- an extension of Cauchy's integral formula- Liouville's theorem and fundamental theorem of algebra- maximum modulus principle(with out proof).

Module 3 **(15 hours)**

Series: Convergence of sequences and series -Taylor's series -proof of Taylor's theorem-examples- Laurent's series(without proof)-examples.

Module 4 **(20 hours)**

Residues and poles: Isolated singular points –residues –Cauchy's residue theorem –three types of isolated singular points-residues at poles-examples –evaluation of improper integrals-example –improper integrals from Fourier analysis –Jordan's lemma (statement only) –definite integrals involving sines and cosines.

Chapter2-sections12,15,16,18to22,24,25,26.
Chapter3-sections29,30,33to36.
Chapter4–sections37to41,43,44, 46 and 48to54.
Chapter5–sections55to60&62.
Chapter6-sections68to74(except71).
Chapter7–sections78to81&85.

Reference:

1. Lars V.Ahlfors - Complex Analysis – An Introduction to the Theory of Analytic Functions of one Complex Variables (4th edition), (McGRAW-HILL)
2. B. Choudhary - The Elements of Complex Variables.
3. A. David Wunsch – Complex Analysis with Applications (Pearson)

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	3	3	2	1
II	2	2	2	1
III	2	1	2	1
IV	3	2	2	1
Total	**10**	**8**	**8**	**4**

B.Sc. DEGREE PROGRAMME

MATHEMATICS (CORE COURSE 11)
SIXTH SEMESTER
MAT6COR11- -TRANSFORMS AND SPECIAL FUNCTIONS

4 hours/week **80 marks**

Objectives

- To use Laplace transform to solve Differential Equations
- To know the relation between Fourier & Laplace Transforms
- To use Z- transform to solve Difference Equations
- To apply beta and gamma functions to find elliptical integrals

Text book:

B.S.Grewal -Higher Engineering Mathematics- 43rd edition

Module I **(25 hours)**

Laplace Transforms

Introduction, Definition, Transforms of Elementary Functions, Properties of Laplace Transforms, Transforms of Periodic Functions, Transforms of Special Functions, Transforms of Derivatives, Transforms of Intergrals, Multiplication by t^n, Division by t, Evaluation of Integrals by Laplace Transforms, Inverse Transforms- method of Partial Fractions, Other methods of finding Inverse Transforms, Convolution Theorem, Application to Differential Equations, Simultaneous Linear Equations with constant coefficients, Unit step function, Unit Impulse function

(Chapter 21- 21.1-21.18)

Module II **(20 hours)**

Fourier Transforms

Introduction, Definition, Fourier Integral Theorem, Fourier Transforms, Properties of Fourier Transforms, Convolution, Parseval's Identity for Fourier Transforms, Relation between Fourier & Laplace Transforms (Chapter 22- 22.1-22.8)

Module III **(25hours)**

Z-Transforms

Introduction, Definition, Some standard Z-Transforms, Linearity property, Damping rule, Some Standard results, Shifting U_n to the right, Multiplication by n, Two basic Theorems, Some useful Z-Transforms, Some useful Inverse Z-Transforms, Convolution Theorem, Convergence of Z-Transforms, Two-sided Z-Transforms of u_n is defined by, Evaluation of Inverse Z-Transforms, Application to difference equations.

(Chapter 23- 23.1-23.16)

Module IV **(20 hours)**

Beta & Gamma Functions

Beta Function, Gamma Function, Relation between Beta & Gamma Function, Elliptical Integrals, Error function or Probability Integral.

(Chapter 7- 7.14- 7.18)

Reference:

1. Erwin Kreszig – Advanced Engineering Mathematics,VIII ed..
2. N.P Bali, Dr. Manish Goyal – A Textbook of Engineering Mathematics – 8th edition

2QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	3	3	2	1
II	2	2	2	1
III	3	1	2	1
IV	2	2	2	1
Total	**10**	**8**	**8**	**4**

B.Sc DEGREE PROGRAMME
MATHEMATICS (CORE COURSE)
SIXTH SEMESTER
MAT6COR12-LINEAR ALGEBRA

5 hours/week **80 marks**

- To introduce Vector space
- To find the basis and dimension of the Vector spaces
- To understand Linear Transformations

Text Book :

1. Richard Bronson, Gabriel B. Costa - Linear Algebra An Introduction (Second Edition), Academic Press 2009, an imprint of Elsevier.

Module I **(10 hours)**

Matrices

L-U decomposition and properties of R^n.

(Section 1.6-1.7 of text 1)

Module II **(30 hours)**

Vector spaces:

Vectors, Subspace, Linear Independence, Basis and Dimension, Row Space of a Matrix, Rank of a matrix

(Chapter – 2 Sections 2.1, 2.2, 2.3, 2.4, 2.5 and 2.6 of text 1)

Module III **(30 hours)**

Linear Transformations

Functions, Linear Transformations, Matrix Representations, Change of Basis, Properties of Linear Transformations.

(Chapter –3 Sections 3.1, 3.2, 3.3, 3.4, 3.5 of text 1)

Module IV **(20 hours)**

Diagonalization of matrices

Eigen values, eigen vectors, properties of Eigen values and eigen vectors, Diagonalization of matrices, Exponential matrices**.**

(Section 4.1-4.4 of text 1)

Reference:

1 I. N. Herstein – Topics in Algebra , Wiley India
2 Harvey E. Rose - Linear Algebra, A Pure Mathematical Approach, Springer
3 Devi Prasad, - Elementary Linear Algebra, Narosa Publishing House

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	1	1	1	0
II	4	3	2	2
III	4	2	3	1
IV	1	2	2	1
Total	**10**	**8**	**8**	**4**

MATHEMATICS (CHOICE BASED PAPER -I)

MAT5CBP01 COMBINATORICS

4 hours/week **80 marks**

Objectives

- To know permutation and combination
- To apply pigeonhole principle
- To apply principle of inclusion and exclusion

Text Book: Chen Chuan -Chong, Koh Khee Meng, Principles and Techniques in Combinatorics, World Scientific,1999.

Module - I **(15 hours)**

Permutations and Combinations

Two basic counting principles, Permutations, Circular permutations, Combinations, The injection and bijection principles, Arrangements and selection with repetitions ,Distribution problems
(Chapter I of the text)

Module - II **(25 hours)**

The Piegeonhole Principle and Ramsey Numbers

Introduction, The piegeonhole principle, More examples, Ramsey type problems andRamsey numbers, Bounds for Ramsey numbers
(Chapter 3 of the text)

Module - III **(17 hours)**

Principle of Inclusion and Exclusion

Introduction, The principle, A generalization, Integer solutions and shortest routes Surjective mappings and Sterling numbers of the second kind
(Chapter -4 Sections 4.1 to 4.4 of the text)

Module - IV **(15 hours)**

Principle of Inclusion and Exclusion Continued

Derangements and a generalization, The Sieve of Eratosathenes and Euler □ -function.
(Chapter -4 Sections 4.5 to 4.7 of the text)

Reference:

1.

1. V Krishnamoorthy, Combinatorics theory and applications, E. Hoewood, 1986

2. Hall,Jr, Combinatorial Theory, Wiley- Interscinice, 1998.

3.Brualdi, R A, Introductory Combinatorics, Prentice Hall,1992

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	3	3	2	1
II	3	2	2	1
III	2	1	2	1
IV	2	2	2	1
Total	10	8	8	4

MAT5CBP-Introduction to Higher Algebra

4 hours/week **72 marks**

Objectives

- To know Partial Fractions
- To apply continued fractions and its properties
- To know inequalities
- To get the idea of exponential and logarithmic functions and series

Text book:

1. Bernard and Child- Higher Algebra

Module I **(25 hrs)**

Partial fractions: Rational Fractions, Fundamental Theorems on Partial Fractions, Resolution of a Proper Fraction into Partial Fractions

Summation of series

Meaning of Summation, Method of Differences:

The series $S_r = 1^r + 2^r + 3^r + \cdots + n^r, values\ of\ S_r\ for\ r = 1,2,3, \ldots 10,$ $Bernoulli's\ Number,, \frac{d}{d_n}\ S_r = rS_{r-1} + B_r, Bernoulli's\ Theorem\ on\ S_r$

$(Chapter\ 7\ and\ 8\ )$

Module II **(20 hrs)**

Continued fractions and indeterminate equations of the first degree

Definitions, formation of Convergence, infinite Continued Fractions ,Simple and Recurring Continued Fractions. Simple Continued Fractions, Properties of the Convergents, an Irrational as a Simple Continued Fractions. Approximations, Miscellaneous Theorems, Symmetric Continued Fractions, Application to Theory of Numbers. Simple Recurring continued Fractions, Solutions of ax ± by = ±c, Solutions of ax ± by± cz ±..... = ±k

(Chapter 24 and 25)

Module III **(10 hrs)**

Inequalities

Weierstras's Inequalities Elementary Methods Arithmetic and Geometric Means and Extension Maxima and Minima

$(Chapter\ 14\ )$

Module IV **(17 hrs)**

Exponential and logarithmic functions and series

Continuity, Inequalities and Limits, The Exponential Theorem, Series for a^x
Meaning of an Irrational Index, Derivatives of $a^x, \log x \ and \ x^n$
Inequalities and Limits ,the way in which $e^x \ and \log x$ tend to ∞, Euler's constant γ, Series for log 2. The Exponential Function E(z), Complex Index , Series for $sin\ x\ , cos\ x \ and \ Exponential \ Values$. Use of Exponential Theorem in Summing Series (Chapter 19)

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	3	2	2	**1**
II	3	2	2	1
III	2	2	2	1
IV	2	2	2	1
Total	**10**	**8**	**8**	**4**

MAT5CBP-MECHANICS

4 hours/week **80marks**

Objectives

- To know Law of Forces
- To Know Newton's Law of motion and its application

Textbook: S.L. Loney, The elements of statistics and dynamics Part1 and Part 2, AITBS Publications and distributions , Delhi

Part A- Statics

Module I **16 hours**

Introduction, composition and resolution of forces, parallelogram law of forces, triangle law of forces, Lami's theorem, polygon of forces, λ-μ theorem , resultant of a finite number of coplanar forces acting upon a particle, conditions of equilibrium , parallel forces, resultant of two parallel forces acting upon on a rigid body, moments, moments of a force about a point and about an axis, generalised thermo of moments.

Module II **16 hours**

Couples, equilibrium of a rigid body acted on by three coplanar forces, general conditions of equilibrium of a rigid body under coplanar forces, friction, laws of friction, limiting friction, coefficient of friction and simple problems.

Part B -Dynamics

Module III **20 hours**

Velocity, relative velocity, acceleration, parallelogram laws of acceleration, motion under gravity, Newton's laws of motion and their application to simple problems, impulse, work, energy, kinetic and potential energies of a body , principle of conservation of energy.

Module IV **20 hours**

Projectiles , range on an inclined plane , collision of elastic bodies, Newton's experimental law, impact of sphere on a plane, direct and oblique impact of two spheres , loss of kinetic energy by impact , simple harmonic motion , examples of simple harmonic motion , simple pendulum.

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	3	2	2	**1**
II	2	2	2	1
III	2	2	2	1
IV	3	2	2	1
Total	**10**	**8**	**8**	**4**

MATHEMATICS (CHOICE BASED PAPER -II)

MAT6CBP02-OPERATIONS RESEARCH

4 hours/week **80 marks**

Objectives:

- To define a Euclidean space, a vector space and its basis.
- To write a given LPP in standard form and in a canonical form
- To identify a feasible solution, a basic feasible solution, and an optimal solution using simplex method.
- To identify the Transportation Problem and formulate it as an LPP and hence solve the problem
- To determine that an Assignment problem is a special case of LPP and hence solve by Hungarian method.
- To identify the queueing models.

Text Books:

1. K. V Mital and C. Mohan - Optimization Methods in Operations Research and System Analysis (3rd edition) (New Age International)
2. J. K. Sharma : Operation Research Theory and Application (3rd edition)

Module I **(10 hours)**

Mathematical Preliminaries: Euclidean Space: Vectors and vector space Linear dependence, dimensions of a vector space, basis.

Convex sets : Open and closed sets in E_n, convex linear combinations, convex sets, intersection of convex sets, convex hull of a set, vertices of a convex set, convex polyhedron, hyper planes, half spaces and polytopes, separating and supporting hyper planes, (All Theorems without proof)

Linear Programming I **(10 hours)**

Introduction, LP in two dimensional space, general LPP, Feasible solution, Basic and basic feasible solution, optimal solution.

Ch. 1 (Section 1 – 5 and 11 – 18 of text 1)

Module II **(20 hours)**

Linear Programming II: Simplex method (numerical example) Simplex tableau, Finding the first b.f.s., artificial variables, Degeneracy, simplex multipliers, Duality in LPP, Duality theorems, Application of duality, Dual simplex method.

Ch. 3 (Section 1 – 20 except 16 of text 1)

Module III **(17 hours)**

Transportation and Assignment Problems

Introduction, transportation problem, Transportation array, Transportation matrix, triangular basis, finding a basic feasible solution, testing of optimality, loop in a transportation problem, change the basis, Degeneracy, Unbalanced problem, Assignment problem.

Ch. 4 (Section 1 – 11 & 14 of text 1)

Module IV **(15 hours)**

Queuing Theory: Introduction, Essential features of queuing system, Calling population, Characteristic Queuing Process, Queue discipline, Service Process (or Mechanisms) , Performance measure of Queuing system. Transient- state and Steady – state, Relationship among Performance measure. Probability distribution in Queuing system, Distribution of arrival (Pure Birth Process), Distribution of interarrival times (Exponential process) Distribution of departure (Pure Death Process) Distribution of Service Times.

Ch. 15 (Section 15.1 – 15.4 of text 2)

Reference:

1. Operation Research by KantiSwarup, P. K. Gupta and Man Mohan - (Sultan Chand and Sons)
2. Problems in Operations Research by Gupta P. K. and Hira D. S. - (S. Chand)
3. Operations Research by Ravindran A., Philip D. T. and Solberg J. J. - (John Wiley and Sons)
4. B. K. Mishra , B. Sharma – Optimization Linear Programming (Ane Books)
5. Mokhtar S. Bazaraa, J. J. Jarvis, H.D. Sherali – Linear Programming and Network Flows (Wiley India)

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	3	2	2	1
II	3	3	2	1
III	2	2	2	1
IV	2	1	2	1
Total	**8**	**8**	**8**	**4**

MAT6CBP-GRAPH THEORY

4 hours/week **80 marks**

Objectives

- To understand basic concepts of graph theory
- To apply graph theory to solve practical problems.

Text books:

John Clark Derek Allen Holton - A first look at graph theory, Allied Publishers

Module I **(20 hours)**

Graph Theory: An introduction to graph. Definition of a Graph, Graphs as models, More definitions, Vertex Degrees, Sub graphs, Paths and cycles The matrix representation of graphs (definition & example only)
(Section 1.1 to 1.7 of text)

Module II **(17 hours)**

Trees and connectivity

Trees and connectivity, definitions and simple properties , bridges, Spanning trees , Cut vertices and connectivity.
(Sections 2.1,2.2,2.3,2.6 of text)

Module III **(15 hours)**

Euler Tours and Hamiltonian Cycles

Euler Tours and Hamiltonian Cycles .Euler's Tours, The Chinese postman problem .Hamiltonian graphs, The travelling salesman problem,
(sections 3.1,3.2,3.3,3.4 of text)

Module IV **(20 hours)**

Matchings

Matching and augmenting path, hall's marriage theorem- statement only, the personnel assignment problem, the optimal assignment problem.
(sections 4.1,4.2,4.3,4.4 of text)

Reference:

1. Douglas B West Peter Grossman - Introduction to Graph Theory
2. R. Balakrishnan, K. Ranganathan - A textbook of Graph Theory, Springer International Edition
3. S.Arumugham, S. Ramachandran - Invitation to Graph Theory, Scitech. Peter Grossman,

Module	Part A	Part B	Part C	Part D
I	3	2	2	1
II	3	3	2	1
III	2	2	2	1
IV	2	1	2	1
Total	**10**	**8**	**8**	**4**

MAT6CBP-COMPUTER PROGRAMMING (Practical)

4 hours/week **80 marks**

Objectives

- To understand basic concepts of LATEX programming
- To give a brief introduction to Python

Text: Guido van Rossum Fred L. Drake, Jr. editor python tutorial release 3.1.1 sections 8-11

Module I **(15 hours)**

LATEX Programming: Basic, document bibliography, bibliographic data base, table of contents, displayed text, row and columns, type setting mathematics, type setting modem.
Text: Indian TEX Users group, Trivandrum, India-LATEX tutorials-A primer.chapters 1-6

Module II **(15 hours)**

LATEX continued

Several kind of boxes, floats, cross reference in lattices, foot notes, margin and end notes.
Text: Text: Indian TEX Users group, Trivandrum, India-LATEX tutorials-A primer chapter 7-13)

Module III **(25 hours)**

Python: Wetting your appetite, using the python interpreter, an informal introduction to python, more control flow tools, data structures, modules, input and output.
Text: Guido van Rossum Fred L. Drake, Jr. editor python tutorial release 3.1.1 sections 1-7

Module IV **(17 hours)**

Python continued: Errors and exceptions, classes, brief tour to the standard library part 2.

CHOICE BASED COURSE SYSTEM AND GRADING

(COMPLEMENTARY COURSES)

SYLLABUS

(effective from 2016 admission onwards)

B.Sc. DEGREE PROGRAMME

MATHEMATICS
(COMPLEMENTARY COURSE TO PHYSICS/CHEMISTRY)
FIRST SEMESTER
MAT1CMP01-DIFFERENTIAL & INTEGRAL CALCULUS AND MATRICES

4 hours/week **80 marks**

Objectives

- To explain the fundamental ideas of limits
- To find the Extreme values of a function
- To find the solution of a system of linear equations using matrices

Text Books: -

1. George B. Thomas, Jr: Thomas' Calculus Eleventh Edition, Pearson, 2008.
2. Frank Ayres Jr : Matrices, Schaum's Outline Series, TMH Edition.

Module 1 **(22 hours)**

Differential Calculus: Rates of change and limits, calculating limits using the limit laws, the precise definition of a limit, one sided limits and limits at infinity**,** derivative of a function, differentiation rules, the derivative as a rate of change, derivatives of trigonometric functions, the chain rule and parametric equations, implicit differentiation.
(Sections 2.1 – 2.4, 3.1 – 3.6 of Text 1)

Module II **(15 hours)**

Applications of Derivatives: Extreme values of functions, The Mean Value Theorem, Monotonic functions and the first derivative test.
(Sections 4.1 - 4.3 of Text 1)

Module III **(15 hours)**

Integral Calculus: A quick review of indefinite integral as anti derivative. The Definite integral. The fundamental theorem of Calculus
(Section 5.3 and 5.4 of Text -1).

Module 1V **(20hours)**

Matrices : Rank of a Matrix, Non-Singular and Singular matrices, Elementary Transformations, Inverse of an elementary Transformations, Equivalent matrices, Row Canonical form, Normal form, Elementary matrices only.
Systems of Linear equations: System of non homogeneous, solution using matrices, Cramer's rule, system of homogeneous equations, Characteristic equation of a matrix; Characteristic roots and characteristic vectors. Cayley-Hamilton theorem (statement only) and simple applications
(Text 2, Chapters – 5, 10, 19, 23).

Reference Books :

1. Shanti Narayan : Differential Calculus (S Chand)
2. George B. Thomas Jr. and Ross L. Finney : Calculus, LPE, Ninth edition, Pearson Education.
3. David W. Lewis - Matrix Theory (Allied).
4. Muray R Spiegel, Advanced Calculus, Schaum's Outline series.

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	3	2	2	1
II	2	2	2	1
III	2	2	2	1
IV	3	2	2	1
Total	**10**	**8**	**8**	**4**

B.Sc. DEGREE PROGRAMME

MATHEMATICS (COMPLEMENTARY COURSE TO PHYSICS/CHEMISTRY)
SECOND SEMESTER

MAT2CMP01-APPLICATIONS OF INTEGRAL, PARTIAL DERIVATIVES AND ANALYTIC GEOMETRY

4 hours/week **80 marks**

Objectives

- To apply integrals in finding area and volume
- To introduce double and triple integrals

Text Books: -

1. George B. Thomas, Jr: Thomas' Calculus Eleventh Edition, Pearson, 2008.

Module I **(20 hours)**

Application of Integrals: Substitution and area between curves, Volumes by slicing and rotation about an axis (disc method only), Lengths of plane curves, Areas of surfaces of revolution and the theorem of Pappus (excluding theorem of Pappus)
(Section 5.6, 6.1, 6.3, 6.5 of Text - 1),

Module II **(15 hours)**

Partial Derivatives: Functions of several variables (Definition only), Partial derivatives, The Chain Rule
(Sections 14.3 - 14.4 of Text 1)

Module III **(17 hours)**

Multiple Integrals : Double Integrals, area of bounded region in plane only, Double Integrals in Polar form, Triple integrals in rectangular co-ordinates, Volume of a region in space
(Sections 15.1, 15.2, 15.3, 15.4 of Text - 1)

Module IV **(20hours)**

Analytic Geometry: Conic sections and Quadratic equations, Classifying Conic Sections by Eccentricity, Conics and Parametric equations, polar co-ordinates, Conic Sections in Polar coordinates.
(Sections 10.1, 10.2, 10.4, 10.5, 10.8 of Text 1)

Reference Books :

1. Shanti Narayan , P .K . Mittal :Integral Calculus (S. Chand & Company)
2. Analytic Geometry Manicavachacan Pillai

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	3	2	2	1
II	2	2	2	1
III	2	2	2	1
IV	3	2	2	1
Total	**10**	**8**	**8**	**4**

B.Sc. DEGREE PROGRAMME

MATHEMATICS (COMPLEMENTARY COURSE TO PHYSICS/CHEMISTRY)
THIRD SEMESTER

MAT3CMP01-VECTOR CALCULUS, ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS

5 hours/week **80 marks**

Objectives

- To apply integration in vector field
- To find the solutions of ordinary differential equations
- To solve partial differential equations

Text :-

1. A. H Siddiqi , P Manchanada : A first Course in Differential Equations with Application (Macmillan India Ltd 2006)
2. George B. Thomas, Jr: Thomas' Calculus Eleventh Edition, Pearson, 2008.
3. Ian Sneddon – Elements of Partial Differential Equation (Tata Mc Graw Hill)

Module I **(20 hours)**

Vector Differential Calculus : Vector Functions, Arc length and unit Tangent vector **T**, Curvature and unit Normal Vector **N**, Torsion and unit Binormal vector **B,** Directional Derivatives and Gradient Vectors**.**

(Sections 13.1, 13.3, 13.4, 13.5 and 14.5 of text 2)

Module II **(30 hours)**

Vector Integral Calculus: Line Integrals, Vector fields and Work, Circulation and Flux, Path independence, Potential Function and Conservation Fields, Green's theorem in Plane (Statement and problems only), Surface area and Surface integral, Parameterised Surface, Stoke's theorem(Statement and Problems only), the Divergence theorem and a Unified theory (Statement and simple problems only).

(Sections 16.1 to 16.8 of text 2)

Module III **(25 Hours)**

Ordinary differential equations: Exact Differential Equation, Linear Equations , Solutions by Substitutions, Equations of first order and not of first degree , First order equations of higher Degree solvable for p , Equations solvable for y , Equations solvable for x, Equations of first degree in x and y - Lagrange's and Clairaut's Equation

(sections 2.1 , 2.2 , 2.3 , 2.4 , 3.1 , 3.2 , 3.3 , 3.4 , 3.5 of text 1)

Module IV **(15 Hours)**

Partial Differential Equations: Surfaces and Curves in three dimensions, solution of equation of the form

$\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$. Origin of first order and second order partial differential equations, Linear equations of the first order, Lagrange's method(Chapter 1 , section 1 and 3 & Chapter 2 Section 1, 2 and 4 of text3)

Reference Books :

1. Shanti Narayan , P .K . Mittal :Vector Calculus (S. Chand & Company)
2. P.P.G Dyke : An introduction to Laplace Transfoorms and Fourier Serices (Springer 2005)
3. Harry F. Davis & Arthur David Snider: Introduction to Vector Analysis, 6th ed., Universal Book Stall, New Delhi.
4. Murray R. Spiegel: Vector Analysis, Schaum's Outline Series, Asian Student edition.
5. Merle C. Potter – Advanced Engineering Mathematics , Oxford University Press.

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	2	2	2	1
II	3	2	2	1
III	3	2	2	1
IV	2	2	2	1
Total	**10**	**8**	**8**	**4**

B.Sc. DEGREE PROGRAMME
MATHEMATICS (COMPLEMENTARY COURSE TO PHYSICS/CHEMISTRY)
FOURTH SEMESTER

MAT4CMP01-FOURIER SERIES, LAPLACE TRANSFORM, COMPLEX NUMBERS AND NUMERICAL METHODS

5 hours/week **80 marks**

Objectives

- To introduce Fourier series
- To introduce Laplace Transforms
- To get an idea of complex numbers
- To solve differential equations using numerical methods

Text Books

1. Erwin Kreyszig : Advanced Engineering Mathematics, Eighth Edition, Wiley, India.
2. J.W. Brown and Ruel.V.Churchill _ Complex variables and applications, 8th edition. McGraw Hill.
3. S.S . Sastry : Introductory methods of Numerical Analysis ,4th edition (Prentice Hall)

Module I **(20 hours)**

Fourier Series : Periodic Functions, Trigonometric Series, Functions of any period p = 2L Fourier Series, Even and Odd functions, Half-range Expansions.
(Sections 10.1, 10.2, 10.3, 10.4, of Text 1 – Excluding Proofs).

Module II **(20 hours)**

Laplace Transforms: Definition, Laplace Transforms and Inverse Transforms, transforms of derivatives and integrals, Differentiation and Integration of transforms, Convolution theorem.
(Sections: 5.1 to 5.5 of Text 1)

Module III **(25 hours)**

complex numbers: Sums and products. Basic algebraic properties. Further properties. Vectors and moduli. Different representations. Exponential forms. Arguments of products and quotients. Product and powers in exponential form. oots of complex numbers. Regions in the complex plane. (Section 1 to 11 of chapter 1 of text 2.)

Module IV **(25hours)**

Numerical Methods: (Use of Non Programmable Scientific Calculator is Permitted)
Bisection Method , Methods of false position , Iteration Method , Newton Raphson Method,

Numerical solution of ordinary differential equations: Taylor series method, Picard's method, Euler's and modified Euler's method, Runge- Kutta method
(section 2.1 , 2.2 , 2.3 , 2.4, 2.5 , 7.1-7.5of Text 3)

Reference :

1.B.S.Grewal -Higher Engineering Mathematics- 43rd edition
2.Srimanta Pal – Numerical Methods, Oxford University Press
3.Qazi Shoeb Ahamad, Zubir Khan – Numerical and Statistical Techniques, Ane Books

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	2	2	2	1
II	3	2	2	1
III	2	2	2	1
IV	3	2	2	1
Total	**10**	**8**	**8**	**4**

B.A. DEGREE PROGRAMME

MATHEMATICS (COMPLEMENTARY COURSE TO ECONOMICS)
THIRD SEMESTER
MAT3CME01-GRAPHING FUNCTIONS, EQUATIONS AND LINEAR ALGEBRA

6hours/week **80 marks**

Objectives

- To introduce graphs
- To solve equations
- To get an idea of vectors
- To solve system of equations

Text Books:-

1. Edward T Dowling : Theory and Problems of Mathematical Methods for Business and Economics, Schaum's Outline Series ,McGraw Hill (1993)
2. Methods for Business and Economics, Schaum's Outline Series ,McGraw Hill (1993)

MODULE I **(20hours)**

Review: Exponents, polynomials, factoring, fractions, radicals, order of mathematical operations.

Equations and Graphs: Equations, Cartesian Co-ordinate system, linear equations and graphs slopes intercepts. The slope intercept form. Determining the equation of a straight line. Applications of line equations in business and economics.

(Chapter 1,2)

MODULE II **(25hours)**

Functions: Concepts and definitions- graphing functions. The algebra of functions. Applications of linear functions for business and economics.

Solving quadratic equations: Facilitating non linear graphing. Application of non linear functions in business and economics.

System of equations: Introduction, graphical solutions. Supply-demand analysis. Break-even analysis. Elimination and substitution methods. IS-LM analysis. Economic and mathematical modeling. Implicit functions and inverse functions.

(Chapter 3,4)

MODULE III **(35hours)**

Linear (or Matrix) Algebra: Introduction. Definition and terms. Addition and subtraction of matrices. Scalar multiplication. Vector multiplication. Multiplication of matrices. Matrix expression of a system of linear equations. Augmented matrix. Row operation. Gaussian method of solving linear equations. Solving linear equations with. Matrix algebra: Determinants and linear independence. Third order determinants. Cramer's rule for solving linear equations. Inverse matrices. Gaussian method of finding an inverse matrix. Solving linear equations with an inverse matrix. Business and Economic applications. Special determinants. (Chapter 5,6)

MODULE IV **(28hours)**

Linear programming : using graphs**:** Use of graphs. Maximisation using graphs. The extreme point theorem. Minimisation using graphs.
(Chapter 7)

Reference Books : Taro Yamano : Mathematical Economics

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	2	2	2	1
II	3	2	2	1
III	3	2	2	1
IV	2	2	2	1
Total	**10**	**8**	**8**	**4**

B.A. DEGREE PROGRAMME
MATHEMATICS (COMPLEMENTARY COURSE TO ECONOMICS)
FOURTH SEMESTER

MAT4CME02- Calculus, Exponential and Logarithmic Functions

6hours/week **80 marks**

Objectives

- To understand calculus
- To know Exponential and logarithmic functions

Text Books:-

1. Edward T Dowling : Theory and Problems of Mathematical Methods for Business and Economics, Schaum's Outline Series ,McGraw Hill (1993)

Module 1 **(30 hours)**

Differential calculus: The derivative and the rules of differentiation: limits, continuity. The slope of curvilinear function. The derivative, differentiability and continuity. Derivative notation. Rules of differentiation. Higher order derivatives. Implicit functions. Differential calculus. Uses of derivatives. Increasing decreasing functions. Concavity and convexity. Relative extrema. Inflection points. Curve sketching. Optimisation of functions. The successive derivative test. Marginal concepts in economics. Optimising economic functions of business. Relation among total, marginal and average functions.
(Chapter 9,10)

Module 1I **(22 hours)**

Exponential and logarithmic functions: Exponential functions. Logarithmic functions properties of exponents and logarithms. Natural exponential and logarithmic functions. Solving natural exponential and logarithmic functions. Logarithmic transformation of non linear functions. Derivatives of natural exponential and logarithmic functions. Interest compounding. Estimating growth rates from data points.
(Chapter 11)

Module III **(28hours)**

Integral calculus: Integration rules for indefinite integrals. Area under a curve. The definite integral. The fundamental theorems of calculus. Properties of definite integrals. Area between curves. Integration by substitution. Integration by parts. Present value of cash flow consumers and producers surplus.
(Chapter 12)

Module 1V **(28hours)**

Calculus of Multivariable functions: Functions of several independent variables. Partial derivatives. Rules of partial differentiation . Second – order partial derivatives. Optimization of multivariable functions. Constrained optimization with Lagrange Multipliers. Income determination Multipliers. Optimization of multivariable functions in business and economics constrained optimization of multivariable economic functions. Constrained optimization of Cobb Douglas production functions.
(Chapter 13)

Reference Books : Taro Yamane : Mathematical Economics

QUESTION PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	3	2	2	1
II	2	2	2	1
III	2	2	2	1
IV	3	2	2	1
Total	**10**	**8**	**8**	**4**

B.A.(HONOURS)DEGREE PROGRAMME

SEMESTER I, CORE IV

ECH1COR04- MATHEMATICS IN ECONOMICS I (HONOURS)

. **6hours/week**

80 marks

Objectives

- To introduce concept of set theory
- To know the use of calculus
- To solve the system of equations

Text Books:-

1. Edward T Dowling : Theory and Problems of Mathematical Methods for Business and Economics, Schaum's Outline Series ,McGraw Hill (1993)
2. Taro Yamane : Mathematics for Economists

Module 1 **(25 hours)**

Set theory-set membership-set operations-Venn diagrams. Relations, functions, Concepts and definitions- graphing functions. The algebra of functions. Applications of linear functions for business and economics.

(Sections 3.1-3.4 of text 1, 1.1-1.3 ,1.6,1.7of text 2)

Module II **(25 hours)**

Limits and continuity, Continuous and discontinuous functions, Differentiable and non-differentiable functions.. Derivatives -product rule-quotient rule-chain rule- differentiation of exponential, logarithmic, and implicit functions

(Sections 9.1-9.9 of text 1).

Module III **(30 hours)**

Second order derivatives-convex, concave, point of inflexion, maxima-minima ,MRTS-cost functions. Integration-power rule- exponential function-by algebraic substitution-definite integral-area under a curve-consumer and producer surplus-income distribution-integration by parts (10.1-10.4,10.6,12.1-12.11 of text 1)

Module 1V **(28 hours)**

Linear algebra-systems of linear equations -scalar product- matrix operations-multiplication-transpose-determinants of order 2 and 3-cofactors-inverse-cramers rule- input-output model -IS-LM model.(Sections : 5.1-5.6,5.7,6.1-6.4,6.6,6.7 of text 1)

References

1. Chiang A C,Fundamental methods of mathematical economics, Mcgraw Hill
2. Henderson and Quandt, Micro economic theory: a mathematical approach
3. Simon and Blume, Mathematics for Econiomists:Viva –Norton student edition
4. Sydsaeter and Hammond, Mathematics for Economic Analysis,Pearson
5. Hamdy Taha, Operations Research
6. Avinash Dixit, (1990), Optimization in Economic Theory, (2nd edition)

Additional readings

1. Bertrand Russel(2012), Principles of Mathematics, Rutledge (special Indian edition)
2. Davis and Hersh(1998),The Mathematical Experience, Mariner Books.

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	2	2	2	1
II	2	2	2	1
III	3	2	2	1
IV	3	2	2	**1**
Total	**10**	**8**	**8**	**4**

B.A.(HONOURS) DEGREE PROGRAMME

SEMESTER II, CORE IV

SEMESTER II
CORE VIII
ECH2COR08- MATHEMATICS IN ECONOMICS II (HONOURS)

. **6hours/week**

80 marks

Objectives

- To introduce linear algebra
- To find partial derivatives
- To introduce optimization of functions

Text Books:-

1. Taro Yamane , Mathematics for Economists

2. Edward T Dowing : Theory and Problems of Mathematical Methods for Business and Economics, Schaum's Outline Series ,McGraw Hill (1993)

Module I **30 hours**

Linear algebra-linear independence-rank of a matrix-Eigen values-eigen vectors, propertiesDiagonalization

(Sections :10.3,10.15,11.1,11.3,11.4 of text 1)

Module II **22 hours**

Functions with two or more variables- partial derivatives with two variables second and higher order partial derivatives , total derivative, implicit functions

(Sections : 4.1-4.7 of text 1)

Module III **21 hours**

Optimization –convex and concave functions-quasi convex and quasi concavity (concepts only) - unconstrained optimization-constrained optimization-Lagrange multiplier method-envelope theorem (idea only) (Sections 13.5-13.10 of text 2)

Module IV **35 hours**

Difference equations- Linear Difference equations with constant coefficients and differential equations (first order and second order) - Linear Differential equations with constant coefficients (first order and second order) applications-growth model-multiplier-accelerator interaction.

(Sections : 9.1-9.5,9.7-9.9 8.1-8.2,8.7-8.8 of text 1)

References

1. Chiang A C,Fundamental methods of mathematical economics, Mcgraw Hill
2. Henderson and Quandt, Micro economic theory: a mathematical approach
3. Simon and Blume, Mathematics for Econiomists:Viva –Norton student edition
4. Sydsaeter and Hammond, Mathematics for Economic Analysis,Pearson

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	3	2	2	1
II	2	2	2	1
III	2	2	2	1
IV	3	2	2	1
Total	**10**	**8**	**8**	**4**