MAHATHMA GANDHI UNIVERSITY KOTTAYAM

BOARD OF STUDIES IN MATHEMATICS (UG)

CURRICULAM FOR

B.Sc MATHEMATICS MODEL I

B.Sc MATHEMATICS MODELII

AND

MATHEMATICS COMPLEMENTARY COURSES

UNDER

CHOICE BASED CREDIT SYSTEM (UGCBCS2017)

(Effective from 2017 admission onwards)

ACKNOWLDGEMENT

There are many profound personalities whose relentless support and guidance made this syllabus restructuring 2017 a success. I take this opportunity to express my sincere appreciation to all those who were part of this endeavor for restructuring the syllabus UG course in Mathematics under Mahatma Gandhi University, Kottayam.

I express profound gratitude to the Honorable Vice –Chancellor, Pro- Vice Chancellor, Registrar, Members of the Syndicate and Academic Council, for their sincere Co-operation and guidance for completion of this work. I place on record my wholehearted gratitude to the members of Faculty of Science and Board of Studies for their untiring efforts. I also appreciate the efforts of members of University Academic Section and other staff.

I am also grateful to all teachers who participated in the workshops organized by the University for restructuring the syllabus. I also place on record my gratitude to all professionals, academicians and other stakeholders who gave valuable suggestion in this regard.

Dean- Faculty of Science

Mahatma Gandhi University

Kottayam

CONTENTS

AIMS AND OBJECTIVES

The courses for the UG Programme are framed using time tested and internationally popular text books so that the courses are at par with the courses offered by any other reputed university around the world.

Only those concepts that can be introduced at the UG level are selected and instead of cramming the course with too many ideas the stress is given in doing the selected conceptsrigorously. The idea is to make learning mathematics meaningful and an enjoyableactivity ratherthan acquiring manipulative skills and reducing the whole thing an exercise in using thumb rules.

As learning Mathematics is doing Mathematics, to this end, some activities are prescribed to increase students' participation in learning.

Every student has to do a project during 6^{th} semester. The topics for the project can be selected as early as the beginning of the 4^{th} semester.

Course Structure:

The U.G. Programme in Mathematics must include (a) Common courses, (b) Core courses, (c) Complementary Courses, (d) Open courses (e) Choice basedcourses (f) Project

Courses:

The number of Courses for the restricted programme should contain 12 core courses, 1 open course, 1 choice based course and 8 complementary courses. There should be 10 common courses, or otherwise specified, which includes the first and second language of study.

Objectives :

The syllabi are framed in such a way that it bridges the gap between the plus two and post graduate levels of Mathematics by providing a more complete and logic frame work in almost all areas of basic Mathematics.

By the end of the second semester, the students should have attained a foundation in basic Mathematics and other relevant subjects to complement the core for their future courses.

By the end of the fourth semester, the students should have been introduced to powerful tools for tackling a wide range of topics in Calculus, Theory of Equations and Geometry. They should have been familiar with additional relevant mathematical techniques and other relevant subjects to complement the core.

By the end of sixth semester, the students should have covered a range of topics in almost all areas of Mathematics, and had experience of independent works such as project, seminar etc.

B.Sc
MATHEMATICS
MODEL - I

CURRICULUM FOR B.Sc MATHEMATICS MODEL

I (UGCBCS 2017)

Course Structure

Total Credits:-120 (Eng:22+S.Lang:16+Complementary:28+open:4+Core:51)

Total hours:-150 (Eng:28+S.Lang:18+Complementary:36+open:4+Core:65)

Sl: No	Semester	Papers	Hours	Credits	Internal Marks	External Marks	Total Marks
1	I	English I	**5**	**4**	**20**	**80**	**100**
		English /Common course I	**4**	**3**	**20**	**80**	**100**
		Second Language I	**4**	**4**	**20**	**80**	**100**
		Mathematics Core Course - 1	**4**	**3**	**20**	**80**	**100**
		Complimentary1 Course - 1 (Statistics)	**4**	**3**	**20**	**80**	**100**
		Complimentary 2 Course – 1 (Physics Theory/ Computer)	**2 (T)**	**2**	**10**	**60**	**70**
			2 (P)	**0**			
	Total		**25**	**19**			**570**
2	II	English II	**5**	**4**	**20**	**80**	**100**
		English /Common course II	**4**	**3**	**20**	**80**	**100**
		Second Language II	**4**	**4**	**20**	**80**	**100**
		Mathematics Core Course- 2	**4**	**3**	**20**	**80**	**100**
		Complimentary1 Course –II (Statistics)	**4**	**3**	**20**	**80**	**100**
		Complimentary2 Course-II (Physics/ Computer)	**2 (T)**	**2**	**10**	**60**	**70**
			2 (P)	**2**	**20**	**40**	**60**
	Total		**25**	**21**			**630**

3	**III**	English III	**5**	**4**	**20**	**80**	**100**
		Sec. Lang./Common course I	**5**	**4**	**20**	**80**	**100**
		Mathematics Core Course – 3	**5**	**4**	**20**	**80**	**100**
		Complimentary1 Course – II (Statistics)	**5**	**4**	**20**	**80**	**100**
		Complimentary2 Course –II (Physics Theory/ Computer)	**3 (T)**	**3**	**10**	**60**	**70**
			2 (P)	**0**			
	Total		**25**	**19**			**470**
4	**IV**	English IV	**5**	**4**	**20**	**80**	**100**
		Sec. Lang./Common courseII	**5**	**4**	**20**	**80**	**100**
		Mathematics Core Course – 4	**5**	**4**	**20**	**80**	**100**
		Complimentary1 Course III	**5**	**4**	**20**	**80**	**100**
		Complimentary2 Course III (Physics/ Computer)	**3 (T)**	**3**	**10**	**60**	**70**
			2 (P)	**2**	**20**	**40**	**60**
	Total		**25**	**21**			**530**
5	**V**	Mathematics Core Course – 5	**6**	**4**	**20**	**80**	**100**
		Mathematics Core Course – 6	**6**	**4**	**20**	**80**	**100**
		Mathematics Core Course – 7	**5**	**4**	**20**	**80**	**100**
		Human Rights and Mathematics for Environmental studies	**4**	**4**	**20**	**80**	**100**
		Open Course	**4**	**3**	**20**	**80**	**100**
	Total		**25**	**19**			**500**
6	VI	Mathematics Core Course – 9	**5**	**4**	**20**	**80**	**100**
		Mathematics Core Course-10	**6**	**4**	**20**	**80**	**100**
		Mathematics Core Course-11	**5**	**4**	**20**	**80**	**100**
		Mathematics Core Course-12	**5**	**4**	**20**	**80**	**100**
		Choice Based Course	**4**	**3**	**20**	**80**	**100**
		Project	**0**	**2**	**20**	**80**	**100**
	Total		**25**	**21**			**600**

English:

Semester	Title of the Course	Number of hours per week	Total Credits	Total hours/ semester	University Exam Duration	Marks	
						Internal	External
1	English I	5	4	90	3 hrs	20	80
	English /Common course I	4	3	72	3 hrs	20	80
2	English II	5	4	90	3 hrs	20	80
	English /Common course II	4	3	72	3 hrs	20	80
3	English III	5	4	90	3 hrs	20	80
4	English - IV	5	4	90	3 hrs	20	80

Second Language:

Semester	Title of the Course	Number of hours per week	Total Credits	Total hours/ semester	University Exam Duration	Marks	
						Internal	External
1	Second Language I	4	4	72	3 hrs	20	80
2	Second Language II	4	4	72	3 hrs	20	80
3	Sec. Lang./ Common course I	5	4	90	3 hrs	20	80
4	Sec. Lang./ Common course II	5	4	90	3 hrs	20	80

MATHEMATICS CORE COURSES

Semester	Title of the Course	Number Of hours	Total Credits	Total hours/ semester	University Exam Duration	Marks	
						Internal	External
I	MM1CRT01: Foundation of Mathematics	4	3	72	3 hrs	20	80
II	MM2CRT01: Analytic Geometry, Trigonometry and Differential Calculus	4	3	72	3 hrs	20	80
III	MM3CRT01: Calculus	5	4	90	3 hrs	20	80
IV	MM4CRT01: Vector Calculus, Theory of Numbers and Laplace transforms	5	4	90	3 hrs	20	80
V	MM5CRT01: Mathematical Analysis	6	4	108	3 hrs	20	80
	MM5CRT02: Differential Equations	6	4	108	3 hrs	20	80
	MM5CRT03: Abstract Algebra	5	4	90	3 hrs	20	80
	Human rights and Mathematics for Environmental Studies.	4	4	72	3 hrs	20	80
	Open course	4	3	72	3 hrs	20	80
VI	MM6CRT01 : Real Analysis	5	4	90	3 hrs	20	80
	MM6CRT02: Graph Theory and metric spaces	6	4	108	3 hrs	20	80
	MM6CRT03 : Complex Analysis	5	4	90	3 hrs	20	80
	MM6CRT04 : Linear Algebra	5	4	90	3 hrs	20	80
	Choice Based Course	4	4	72	3 hrs	20	80
	MM6PRT01 : Project	-	2	-	-	20	80

OPEN COURSE DURING THE FIFTH SEMESTER

Title of the Course	No. of contact hrs/week	No. of Credit	Duration of Exam
MM5OPT01: History of Indian Mathematics	**4**	**3**	**3 hrs**
MM5OPT02: Applicable Mathematics	**4**	**3**	**3 hrs**
MM5GET03: Mathematical Economics	**4**	**3**	**3 hrs**

CHOICE BASED COURSE DURING THE SIXTH SEMESTER

Title of the Course	No. of contact hrs/week	No. of Credit	Duration of Exam
MM6CBT01: Operations Research	**4**	**3**	**3 hrs**
MM6CBT02:Basic Python Programming And Typesetting in LaTeX	**4**	**3**	**3 hrs**
MM6CBT03: Numerical Analysis	**4**	**3**	**3 hrs**

B.Sc DEGREE PROGRAMME MATHEMATICS (UGCBCS2017)

First Semester

MM1CRT01: Foundation of Mathematics

4 hours/week (Total Hours: 72) **3 credits**

Brief Description of the Course

This course introduces the concepts of mathematical logic methods of proofs, sets, functions, relations and partial orderings. A brief introduction of theory of Equations is also included. These topics are foundations of most areas of modern mathematics and are applied frequently in the succeeding semesters.

Syllabus

Text Books:

1. K.H. Rosen: Discrete Mathematics and its Applications (Sixth edition), Tata McGraw Hill Publishing Company, New Delhi.
2. S. Bernard and J.M Child: Higher Algebra, AITBS Publishers, India,2009

Module 1: Basic Logic **(20 hours)**

Propositional logic, Propositional equivalences, Predicates and quantifiers, Rules of inference, Introduction to proofs.

Text 1: Chapter – 1excluding sections 1.4 & 1.7

Module 2: Set theory **(12 hours)**

Sets, set operations, functions

Text 1: Chapter – 2 excluding section 2.4

Module 3: Relations **(20hours)**

Relations and their properties, representing relations, equivalence relations, partial orderings.

(Text 1: Chapter 7 excluding Sections 7.2 & 7.4)

Module 4: Theory of Equations **(20 hours)**

Roots of Equations, Relation Connecting the roots and coefficients of an equation, Transformation of equations, Special Cases, The Cubic equation, The Biquadratic Equation, Character and Position of the Roots of an Equation, Some General Theorems, Descartes's Rule of Signs, Corollaries, Reciprocal Equations

Text 2: Chapter VI Sections 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, Chapter XI Section 1

References:

1. Lipschutz: Set Theory and related topics (Second Edition), Schaum Outline Series, Tata McGraw-Hill Publishing Company, New Delhi. (Reprint 2009).
2. P.R. Halmos : Naive Set Theory, Springer.
3. Ian Chiswell&Wifrid Hodges: Mathematical Logic, Oxford university press

4. Richard Johnsonbaugh; Discrete Mathematics; Pearson Education; Dorling Kindersley India Pvt. Ltd

5. Clifford Stien, Robert L Drysdale, KennethBogart ; Discrete Mathematics for Computer Scientists; Pearson Education; Dorling Kindersley India Pvt. Ltd

6. Kenneth A Ross; Charles R.B. Wright ; Discrete Mathematics; Pearson Education; Dorling Kindersley India Pvt. Ltd

7. Ralph P. Grimaldi, B.V.Ramana; Discrete And Combinatorial Mathematics ; Pearson Education; Dorling Kindersley India Pvt. Ltd

8. Winfried Karl Grassman, Jean-Paul Tremblay; Logic And Discrete Mathematics A Computer Science Perspective ; Pearson Education; Dorling Kindersley India Pvt. Ltd

9. Lipschutz:Set Theory And Related Topics (2^{nd}Edition), SchaumOutlineSeries, Tata McGraw-Hill Publishing Company, New Delhi

10. H.S.Hall, S.R. Knight: Higher Algebra, Surjit Publications, Delhi.

Question Paper Pattern

Module	Part A (2 marks)	Part B (5 marks)	Part C (15 marks)	Total
I	3	2 or 3	1	7 or 6
II	3	2	0.5	5.5
III	3	2	1.5	6.5
IV	3	2 or 3	1	6 or 7
Total no. of questions	12	9	4	25
No. of questions to be answered	10	6	2	18
Total marks	20	30	30	80

B.Sc. DEGREE PROGRAMME MATHEMATICS (UGCBCS2017)
SECOND SEMESTER
MM2CRT01: ANALYTIC GEOMETRY, TRIGONOMETRY AND DIFFERENTIAL CALCULUS

4 hours/week (Total Hours : 72) **3 credits**

Text books:

1. **Manicavachagom Pillay, Natarajan : Analytic Geometry (Part I Two Dimensions)**
2. **S.L.Loney : Plane Trigonometry Part II , S.Chand and Company Ltd**
3. **Shanti Narayan , P.K.Mittal : Differential Calculus , S.Chand and Company**

MODULE I: Conic Sections **(22 hrs)**

Tangent and Normals of a Conic (Cartesian and Parametric form), Orthoptic Locus, Chords in terms of given points, Pole and Polar and Conjugate diameters of Ellipse.

Relevant Sections of Text 1

MODULE II: Polar Co-ordinates **(15 hrs)**

Polar Co-ordinates, Polar Equation of a line , Polar Equation of Circle, Polar Equation of Conic , Polar Equations of tangents and Normals , Chords of Conic Sections.

Relevant Sections of Text 1

MODULE III:Trigonometry **(17 hrs)**

Circular and Hyperbolic functions of complex variables, Separation of functions of complex variables into real and imaginary parts, Factorization of $x^n - 1, x^n + 1$, $x^{2n} - 2x^n a^n \cos n\theta + a^{2n}$ and Summation of infinite Series by $C + iS$ method

Relevant Sections of Text 2 Chapter – V, VI, VIII, IX.

Module IV: Differential Calculus **(18 hrs)**

Successive Differentiation and Indeterminate forms

Text 3: Chapter 5 and Chapter 10

References:

1. S. K. Stein : Calculus And Analytic Geometry, McGraw Hill

2. P. K. Jain , Khalil Ahmad : Analytic Geometry of Two Dimensions ,(2ndEdition) New AgeInternational (P) Limited Publishers

3. Thomas and Finney : Calculus and Analytic Geometry , Addison Wesley

QUESTON PAPER PATTERN

Module	Part A 2 Marks	Part B 5 Marks	Part C 15 Marks	Total
I	4	2	1	7
II	2	1	1	4
III	3	3	1	7
IV	3	3	1	7
Total No. of Questions	12	9	4	25
No. of Questions to be answered	10	6	2	18
Total Marks	20	30	30	80

B. Sc DEGREE PROGRAMME MATHEMATICS (UGCBCS 2017)

THIRD SEMESTER

MM3CRT01: CALCULUS

5 hours/week (Total Hours: 90) **4 credits**

Syllabus

Text Books:

1. **Shanti Narayan, P.K.Mittal: Differential Calculus , SChand and Company**
2. **George B Thomas Jr: Thomas' Calculus (12thEdition), Pearson.**

Module I: Differential Calculus **(27 hrs)**

Expansion of functions using Maclaurin's theorem and Taylor's theorem, Concavity and points of inflexion. Curvature and Evolutes. Length of arc as a function derivatives of arc, radius of curvature - Cartesian equations only. (Parametric, Polar, Pedal equation and Newtonian Method are excluded) Centre of curvature, Evolutes and Involutes, properties of evolutes. Asymptotes and Envelopes.

Text 1: Chapter 6, Chapter 13, Chapter 14 , Chapter 15 (Section 15.1 to 15.4 only), Chapter 18 (Section 18.1 to 18.8 only).

Module II: Partial Differentiation **(18 hrs)**

Partial derivatives, The Chain rule, Extreme values and saddle points, Lagrange multipliers.

Text 2 Chapter 14 (Sections 14.3, 14.4, 14.7 and 14.8 only) All other sections are excluded

Module III: Integral Calculus **(20 hrs)**

Volumes using Cross-sections, Volumes using cylindrical shells, Arc lengths, Areas of surfaces of Revolution.

Text 2: Chapter 6 (Section 6.1 to 6.4 only (Pappus Theorem excluded)

Module IV: Multiple Integrals **(25 hrs)**

Double and iterated integrals over rectangles, Double integrals over general regions, Area by double integration, Triple integrals in rectangular coordinates, Triple integrals in cylindrical and spherical coordinates, Substitutions in multiple integrals.

Text 2: Chapter 15 (Sections 15.4 and 15.6 are excluded)

References

1. T.M Apostol- Calculus Volume I & II(Wiley India)
2. Widder-Advanced Calculus, 2nd edition
3. K.C. Maity& R.K Ghosh- Differential Calculus(New Central Books Agency)
4. K.C. Maity& R.K Ghosh- Integral Calculus(New Central Books Agency)
5. Shanti Narayan, P.K. Mittal- Integral Calculus- (S. Chand & Co.)

6. Howard Anton et. Al. Calculus, Seventh Edition, John Wiley

QUESTION PAPER PATTERN

Module	Part A 2 Marks	Part B 5 Marks	Part C 15 Marks	Total
I	4	2	1	7
II	3	2	1	6
III	3	2	1	6
IV	2	3	1	6
Total number of questions	12	9	4	25
No. of Questions to be answered	10	6	2	18
Total Marks	20	30	30	80

B. Sc DEGREE PROGRAMME MATHEMATICS (UG CBCS 2017)
FOURTH SEMESTER
MM4CRT01 : VECTOR CALCULUS, THEORY OF NUMBERS AND LAPLACE TRANSFORM

5 hours/week(Total Hours : 90) **4 credits**

Syllabus

Text Books:

1. **Thomas Jr., Weir M.D, Hass J.R – Thomas' Calculus (12th Edition) Pearson, 2008.**
2. **David M Burton - Elementary Number Theory, 7th Edition,McGraw Hill Education(India) Private Ltd.**
3. **Erwin Kreyszig : Advanced Engineering Mathematics, Ninth Edition, Wiley, India.**

Module I: Vector Differentiation **(25 hrs)**

(A quick review of vectors), A vector equation and Parametric equations for lines and equation for a plane in space only (the distance from a point to a line and a plane and angle between planes are excluded) Vector functions, Arc length and Unit tangent vector, Curvature and the Unit normal vector, Tangential and Normal Components of Acceleration, Directional derivatives and Gradient vectors, tangent planes and Normal lines only.

Relevant sections from 12.5, 13.1, 13.3, 13.4, 13.5, 14.5, 14.6 (tangent planes and normal lines only) of Text 1

Module II: Vector Integration **(30 hrs)**

Line integrals, Vector fields and line integrals: Work, Circulation and Flux, Path Independence, Conservative Fields and Potential Functions (Proofs of theorems excluded), Green's theorem in the plane (Statement and problems only), Surfaces and Area: Parameterisations of surfaces, Implicit surfaces, Surface integrals, Stokes' theorem (Statement and simple Problems only), Divergence theorem only (Statement and Problems only) Gauss' law onwards are excluded.

Sections 16.1 to 16.6 and relevant portions from 16.7 & 16.8 of Text 1

Module III: Theory of Numbers **(15 hrs)**

Basic properties of congruence, Fermat's theorem, Wilson's theorem, Euler's phi function.

Text 2 : Chapter 4: section 4.2, Chapter 5: sections 5.2, 5.3 and Chapter 7: section 7.2.

Module IV: Laplace transforms **(20 hrs)**

Laplace transform, Linearity of Laplace transform, First shifting theorem, Existence of Laplace

transform, Transforms of derivatives, Solution of ordinary differential equation & initial value problem, Laplace transform of the integral of a function, Convolution and Integral equations. Text 3 (Sections 6.1, 6.2 and 6.5)

References

1. Anton, Bivens and Davis, Calculus (10th Edition) International Student Version, John Wiley & sons 2015
2. David M. Burton, Elementary Number Theory (7^{th} Edition), Mc Graw Hill Education
3. H.F. Davis and A.D. Snider: Introduction to Vector Analysis, 6th ed., Universal Book Stall, New Delhi.
4. Shanti Narayan, P.K Mittal – Vector Calculus (S. Chand)
5. Merle C. Potter, J. L. Goldberg, E. F. Aboufadel – Advanced Engineering Mathematics (Oxford)
6. Ghosh, Maity – Vector Analysis (New Central books)

QUESTON PAPER PATTERN

Module	Part A 2 Marks	Part B 5 Marks	Part C 15 Marks	Total
I	3	2	1 or 2	6 or 7
II	3	3	1 or 2	7 or 8
III	3	2	1	6
IV	3	2	1	6
Total No. of Questions	12	9	4	25
No. of Questions to be answered	10	6	2	18
Total Marks	20	30	30	80

B. Sc DEGREE PROGRAMME MATHEMATICS (UGCBCS 2017)

FIFTH SEMESTER

MM5CRT01 : MATHEMATICAL ANALYSIS

6 Hrs/Week (Total Hours : 108) **4 Credits**

SYLLABUS

Text Book : Introduction to Real Analysis – Robert G Bartle and Donald R Sherbert (3rd Edition) John Wiley & Sons, In. 2007

MODULE I: REAL NUMBERS **30 hours**

Finite and Infinite Sets, The Algebraic and Order Properties of R, Absolute Value and Real Line, The Completeness Property of R, Applications of the Supremum Property, Intervals.

Chapter 1: Section 1.3 and Chapter 2 : Sections 2.1, 2.2,2.3,2.4,2.5

MODULE II: SEQUENCES **30 hours**

Sequences and their Limits, Limit Theorems, Monotone Sequences, Subsequences and the Bolzano- Weierstrass Theorem, The Cauchy Criterion, Properly Divergent Sequences.

Chapter 3 : Sections 3.1,3.2,3.3,3.4, 3.5,3.6

MODULE III: SERIES **24 hours**

Introduction to Series, Absolute Convergence, Tests for Absolute convergence, Tests for nonabsoute Convergence

Chapter 3 : Section 3.7, Chapter 9 : Sections 9.1,9.2,9.3

MODULE IV: LIMITS **24 hours**

Limits of Functions, Limit Theorems, Some Extensions of the Limit Concept.

Chapter 4 : Sections 4.1,4.2,4.3

References:

1. Richard R Goldberg - Methods of real Analysis, 3rd edition , Oxford and IBM Publishing Company (1964)
2. Shanti Narayan - A Course of Mathematical Analysis, S Chand and Co. Ltd (2004)
3. Elias Zako - Mathematical Analysis Vol 1, Overseas Press, New Delhi (2006)
4. J.M Howie - Real Analysis, Springer 2007.
5. K.A Ross- Elementary - Real Analysis, Springer, Indian Reprints.
6. S.C Malik, Savitha Arora - Mathematical Analysis, Revised Second Edition

QUESTION PAPER PATTERN

Module	Part A 2 Marks	Part B 5 Marks	Part C 15 Marks	Total
1	3	2	1	6
2	3	3	1	7
3	3	2	1	6
4	3	2	1	6
Total number of questions	12	9	4	25
Total number of questions to be answered	10	6	2	18
Total	20	30	30	80

B.Sc DEGREE PROGRAMME(UGCBCSS2017)
MATHEMATICS (CORE COURSE 6)
FIFTH SEMESTER
M5CRT02 DIFFERENTIAL EQUATIONS

6 hours/week (Total: 108 hours) 4 credits

Syllabus

Text Book:

1. **G.F. Simmons, S.G. Krantz - Differential Equations, (Tata McGraw Hill-New Delhi).**
   (Walter Rudin Student Series)
2. **Ian Sneddon – Elements of Partial Differential Equation (Tata Mc Graw Hill)**

Module I What is a differential equation(26 hrs.)

The nature of solutions, Separable equations, First order linear equations, Exact equations, Orthogonal trajectories and families of curves, Homogeneous equations, Integrating factors, Reduction of order-dependent variable missing-independent variable missing

Text 1. Chapter 1 (Sections 1.2 to 1.9)

Module II Second order linear equations(26 hrs.)

Second order linear equations with constant coefficients (which includes Euler's equidimensional equations given as exercise 5 in page 63 of Text 1), The method of undetermined coefficients, The method of variation of parameters, The use of a known solution to find another, Higher order linear equations

Text 1. Chapter 2 (Sections 2.1, 2.2, 2.3, 2.4, 2.7 (example 2.17 is excluded))

Module III Power Series solutions and special functions(26 hrs.)

Introduction and review of power series,Series solutions of first order differential equations, Second order linear equations: ordinary points (specially note Legendre's equations given as example 4.7), Regular singular points, More on regular singular points.

Text 1. Chapter 4 (Sections4.1 4.2, 4.3, 4.4, 4.5)

Method IV Partial Differential equations (30 hrs.)

Methods of solution of $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$, Origin of first order partial differential equations, Linear equations of the first order , Lagrange's method(proof of theorem 2 and theorem 3 are excluded)Integral surfaces passing through a given curve

Text 2. Chapter 1 (Section 3)
Chapter 2 (Section 1, 2 and section 4 (no proof of theorem 2 and theorem 3) and section5)

Reference:

1. **Shepley L. Ross - Differential Equations, 3rd ed., (Wiley India).**
2. **A.H.Siddiqi& P. Manchanda – A First Course in Differential Equation with Applications (Macmillian)**

3. **G.F. Simmons – Differential equation with applications and historical notes 2nd Edn (Tata McGraw Hill)**
4. **E.A. Coddington- An Introduction to Ordinary Differential Equation, PHI.**
5. **Zafar Ahsan - Differential Equations and their Applications, 2nd edition, PHI**

QUESTON PAPER PATTERN

Module	Part A 2 Mark	Part B 5 Marks	Part C 15Marks	Total
I	3	4	1	**8**
II	4	2	1	**7**
III	2	2	1	**5**
IV	3	1	1	**5**
Total No. of Questions	**12**	**9**	**4**	**25**
No. Questions to be answered	**10**	**6**	**2**	**18**
Total Marks	**20**	**30**	**30**	**80**

B. Sc DEGREE PROGRAMME MATHEMATICS (UGCBCS 2017)

FIFTH SEMESTER

MM5CRT03 : ABSTRACT ALGEBRA

5 hours/week (Total Hrs: 90) **4 credits**

Syllabus

Text book :John B. Fraleigh : A First Course in Abstract Algebra (7th Edition) (Pearson)

Module I **(25 hrs)**

Groups and subgroups-Binary operations, Isomorphic binary structures, Groups-definition and examples, elementary properties of groups, finite groups and group tables, subgroups, cyclic subgroups, cyclic groups, elementary properties of cyclic groups.

Part I: Sections 2, 3, 4, 5 and 6

Module II: **(25 hrs)**

Permutations, cosets, and direct products-groups of permutations, Cayley's theorem, orbits, cycles and the alternating groups, cosets and the theorem of Lagrange, direct products.

Part II: Sections 8, 9, 10, 11.1 and 11.2

Module III **(20 hrs)**

Homomorphisms and Factor groups - Homomorphisms, properties of homomorphisms, factor groups, The Fundamental Homomorphism theorem, normal subgroups and inner automorphisms, simple groups.

Part III: Sections 13, 14, 15.14 to 15.18

Module IV **(20 hrs)**

Rings and fields-definitions and basic properties, homomorphisms and isomorphisms, Integral domains- divisors of zero and cancellation, integral domains, the characteristic of a ring. Ideals and factor rings. Homomorphisms and factor rings.

Part IV: Sections 18 and 19 and Part V: Section 26.

References :

1. I. N. Herstein - Topics in Algebra
2. Joseph A Gallian - Contemporary Abstract Algebra, Narosa Pub. House .
3. Artin – Algebra , PHI

QUESTON PAPER PATTERN

Module	Part A (2 marks)	Part B (5 marks)	Part C (15 marks)	Total
I	3	3	1	7
II	4	2	1	7
III	2	2	1	5
IV	3	2	1	6
Total No. of Questions	12	9	4	25
No. of questions to be answered	10	6	2	18
Total Marks	20	30	30	80

B. Sc DEGREE PROGRAMME MATHEMATICS (UGCBCS 2017)

FIFTH SEMESTER

CODE : HUMAN RIGHTS AND MATHEMATICS FOR ENVIORNMENTAL STUDIES

CORE MODULE SYLLABUS FOR ENVIRONMENTAL STUDIES& HUMAN RIGHTS FOR UNDER GRADUATE COURSES OF ALL BRANCHES OF HIGHER EDUCATION

Vision

The importance of environmental science and environmental studies cannot be disputed. The need for sustainable development is a key to the future of mankind. Continuing problems of pollution, solid waste disposal, degradation of environment, issues like economic productivity and national security, Global warming, the depletion of ozone layer and loss of biodiversity have made everyone aware of environmental issues. The United Nations Coference on Environment and Development held in Rio de Janerio in 1992 and world Summit on Sustainable Development at Johannesburg in 2002 have drawn the attention of people around the globe to the deteriorating condition of our environment. It is clear that no citizen of the earth can afford to be ignorant of environment issues..

India is rich in biodiversity which provides various resources for people. Only about 1.7 million living organisms have been described and named globally. Still many more remain to be identified and described. Attempts are made to conserve them in ex-situ and in-situ situations. Intellectual property rights (IPRs) have become important in a biodiversity-rich country like India to protect microbes, plants and animals that have useful genetic properties. Destruction of habitats, over-use of energy resource and environmental pollution have been found to be responsible for the loss of a large number of life-forms. It is feared that a large proportion of life on earth may get wiped out in the near future.

In spite of the deteriorating status of the environment, study of environment have so far not received adequate attention in our academic programme. Recognizing this, the Hon'ble Supreme Court directed the UGC to introduce a basic course on environment at every level in college education. Accordingly, the matter was considered by UGC and it was decided that a six months compulsory core module course in environmental studies may be prepared and compulsorily implemented in all the University/Colleges of India.

The syllabus of environmental studies includes five modules including human rights. The first two modules are purely environmental studies according to the UGC directions. The second two modules are strictly related with the core subject and fifth module is for human rights.

Objectives

- Environmental Education encourages students to research, investigate how and why things happen, and make their own decisions about complex environmental issues. By developing and enhancing critical and creative thinking skills, It helps to foster a new generation of informed consumers, workers, as well as policy or decision makers.
- Environmental Education helps students to understand how their decisions and actions affect the environment, builds knowledge and skills necessary to address complex environmental issues, as well as ways we can take action to keep our environment healthy and sustainable for the future, encourage character building, and develop positive attitudes and values.
- To develop the sense of awareness among the students about the environment and its various problems and to help the students in realizing the inter-relationship between man and environment for protecting the nature and natural resources.

- To help the students in acquiring the basic knowledge about environment and to inform the students about the social norms that provide unity with environmental characteristics and create positive attitude about the environment.

4 hours/week (Total Hrs: 72) **4 credits**

SYLLABUS

Text Book :

1. **Thomas Koshy : Fibonacci and Lucas numbers with applications, John Wiley & Sons, Inc (2001).**

Unit 1 :Multidisciplinary nature of environmental studies

Definition, scope and importance (**2 hrs**)
Need for public awareness.

Unit 2 : Natural Resources :

Renewable and non-renewable resources : Natural resources and associated problems.

a) **Forest resources** : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.

b) **Water resources** : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) **Mineral resources** : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) **Food resources** : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) **Energy resources**: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, Case studies.

f) **Land resources**: Land as a resource, land degradation, man induced landslides, soil erosion and desertification

- Role of individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles. (**10 hrs**)

Unit 3: Ecosystems

- Concept of an ecosystem
- Structure and function of an ecosystem
- Producers, consumers and decomposers
- Energy flow in the ecosystem
- Ecological succession
- Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the given ecosystem:- Forest ecosystem

(**6 hrs**)

ModuleII

Unit 1: Biodiversity and its conservation

- Introduction
- Biogeograhical classification of India
- Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- India as a mega-diversity nation
- Hot-sports of biodiversity
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts
- Endangered and endemic species of India

(**8 hrs**)

Unit 2: Environmental Pollution

Definition
Causes, effects and control measures of: -

a. Air pollution
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

- Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution
- Pollution case studies
- Disaster management: floods, earthquake, cyclone and landslides. (**8hrs**)

Unit 3: Social Issues and the Environment

- Urban problems related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people: its problems and concerns, Case studies
- Environmental ethics: Issues and possible solutions
- Climate change, global warming, acid rain, ozone layer depletion , nuclear accidents and holocaust, Case studies
- Consumerism and waste products
- Environment Protection Act
- Air (Prevention and Control of Pollution) Act
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation
- Public awareness (**10 hrs**)

Module III : Fibonacci Numbers in nature

The rabbit problem, Fibonacci numbers, recursive definition, Lucas numbers, Different types of Fibonacci and Lucas numbers. Fibonacci numbers in nature : Fibonacci and the earth, Fibonacci

and flowers, Fibonacci and sunflower, Fibonacci, pinecones, artichokes and pineapples, Fibonacci and bees, Fibonacci and subsets, Fibonacci and sewage treatment, Fibonacci and atoms, Fibonacci and reflections, Fibonacci, paraffins and cycloparaffins, Fibonacci and music, Fibonacci and compositions with 1's and 2's.

Text 1 : Chapters 2 & 3 (excluding Fibonacci and poetry, Fibonacci and electrical networks)

Module IV : Golden Ratio (10 Hrs)

The golden ratio, mean proportional, a geometric interpretation, ruler and compass construction, Euler construction, generation by Newton's method. The golden ratio revisited, the golden ratio and human body, golden ratio by origami, Differential equations, Gattei's discovery of golden ratio, centroids of circles,

Text 1 : Chapters 20, 21

Module V : Human rights

Unit1-Human Rights– An Introduction to Human Rights, Meaning, concept and development, Three Generations of Human Rights (Civil and Political Rights; Economic, Social and Cultural Rights).

Unit-2 Human Rights and United Nations – contributions, main human rights related organs - UNESCO,UNICEF, WHO, ILO, Declarations for women and children, Universal Declaration of Human Rights.

Human Rights in India – Fundamental rights and Indian Constitution, Rights for children and women, Scheduled Castes, Scheduled Tribes, Other Backward Castes and Minorities

Unit-3 EnvironmentandHuman Rights - Right to Clean Environment and Public Safety: Issues of Industrial Pollution, Prevention, Rehabilitation and Safety Aspect of New Technologies such as Chemical and Nuclear Technologies, Issues of Waste Disposal, Protection of Environment

Conservation of natural resources and human rights: Reports, Case studies and policy formulation. Conservation issues of western ghats- mention Gadgil committee report, Kasthurirengan report. Over exploitation of ground water resources, marine fisheries, sand mining etc. **(8 Hrs)**

Internal: Field study

- Visit to a local area to document environmental grassland/ hill /mountain
- Visit a local polluted site – Urban/Rural/Industrial/Agricultural Study of common plants, insects, birds etc
- Study of simple ecosystem-pond, river, hill slopes, etc

(Field work Equal to 5 lecture hours)

References

1. .Bharucha Erach, Text Book of Environmental Studies for undergraduate Courses. University Press, IInd Edition 2013 (TB)
2. Clark.R.S., Marine Pollution, Clanderson Press Oxford (Ref)
3. Cunningham, W.P.Cooper, T.H.Gorhani, E & Hepworth, M.T.2001Environmental Encyclopedia, Jaico Publ. House. Mumbai. 1196p .(Ref)
4. Dc A.K.Enviornmental Chemistry, Wiley Eastern Ltd.(Ref)
5. Down to Earth, Centre for Science and Environment (Ref)
6. Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment, Cambridge University Press 1140pb (Ref)
7. Jadhav.H & Bhosale.V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284p (Ref)
8. Mekinney, M.L & Schock.R.M. 1996 Environmental Science Systems & Solutions. Web enhanced edition 639p (Ref)
9. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. (TB)
10. Odum.E.P 1971. Fundamentals of Ecology. W.B. Saunders Co. USA 574p (Ref)
11. Rao.M.N & Datta.A.K. 1987 Waste Water treatment Oxford & IBII Publication Co.Pvt.Ltd.345p (Ref)
12. Rajagopalan. R, Environmental Studies from crisis and cure, Oxford University Press, Published: 2016 (TB)
13. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut (Ref)
14. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (Ref)
15. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Stadards, Vol I and II, Enviro Media (Ref)
16. Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (Ref)
17. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p (Ref)
18. (M) Magazine (R) Reference (TB) Textbook

Human Rights

1. Amartya Sen, The Idea Justice, New Delhi: Penguin Books, 2009.
2. Chatrath, K. J.S., (ed.), Education for Human Rights and Democracy (Shimla: Indian Institute of Advanced Studies, 1998)

3. Law Relating to Human Rights, Asia Law House,2001.
4. Shireesh Pal Singh, Human Rights Education in 21st Century, Discovery Publishing House Pvt.Ltd, New Delhi,
5. S.K.Khanna, Children And The Human Rights, Common Wealth Publishers,1998.2011.
6. Sudhir Kapoor, Human Rights in 21st Century,Mangal Deep Publications,Jaipur,2001.
7. United Nations Development Programme, Human Development Report 2004: Cultural Liberty in Today's Diverse World, New Delhi: Oxford University Press, 2004.

QUESTON PAPER PATTERN

Module	Part A (2 marks)	Part B (5 marks)	Part C (15 marks)	Total
I	4	2	1	7
II	3	2	1	7
III	2	2	1	5
IV	3	3	1	7
Total No. of Questions	12	9	4	25
No. of questions to be answered	10	6	2	18
Total Marks	20	30	30	80

B. Sc DEGREE PROGRAMME MATHEMATICS (UGCBCS 2017)

SIXTH SEMESTER

MM6CRT01 : REAL ANALYSIS

5 Hrs/Week (Total Hours : 90) **4 Credits**

SYLLABUS

Text Book : Introduction to Real Analysis – Robert G Bartle and Donald R Sherbert (3rd Edition) John Wiley & Sons, In

MODULE I: CONTINUOUS FUNCTIONS **30 hours**

Continuous Functions, Combinations of Continuous Functions, Continuous Functions on Intervals, Uniform continuity, Monotone and Inverse Functions.

Chapter 5: Sections 5.1,5.2,5.3,5.4,5.6

MODULE II: DIFFERENTIATION **30 hours**

The Derivative, The Mean Value Theorem, L' Hospital Rules, Taylor's Theorem

Chapter 6: Sections 6.1,6.2,6.3,6.4

MODULE III: THE REIMANN INTEGRAL **24 hours**

The Riemann Integral, Riemann Integrable Functions, The Fundamental Theorem

Chapter 7: Sections 7.1,7.2,7.3

MODULE IV: SEQUENCES AND SERIES OF FUNCTIONS **24 hours**

Point wise and Uniform Convergence, Interchange of Limits, Series of Functions.

Chapter 8: Sections 8.1,8.2, Chapter 9: Section 9.4

References:

1. Richard R Goldberg - Methods of real Analysis, 3rd edition , Oxford and IBM Publishing Company (1964)
2. Shanti Narayan - A Course of Mathematical Analysis, S Chand and Co. Ltd (2004)
3. Elias Zako - Mathematical Analysis Vol 1, Overseas Press, New Delhi (2006)
4. J.M Howie - Real Analysis, Springer 2007.
5. K.A Ross- Elementary - Real Analysis, Springer, Indian Reprints.
6. S.C Malik, Savitha Arora - Mathematical Analysis, Revised Second Edition

QUESTON PAPER PATTERN

Module	Part A (2 marks)	Part B (5 marks)	Part C (15 marks)	Total
I	3	2	1	6
II	3	3	1	7
III	3	2	1	6
IV	3	2	1	6
Total No. of Questions	12	9	4	25
No. of questions to be answered	10	6	2	18
Total Marks	20	30	30	80

B. Sc DEGREE PROGRAMME (UGCBCS 2017)

SIXTH SEMESTER

MM6CRT02 : GRAPH THEORY AND METRIC SPACES

6 hours/week (Total Hrs : 108) **4 credits**

Text books:

1. **John Clark Derek Allen Holton - A first look at graph theory, Allied Publishers**
2. **G. F. Simmons -- Introduction to Topology and Modern analysis (Tata McGraw Hill)**

Module I : Graph Theory (36 Hrs)

An introduction to graph. Definition of a Graph, More definitions, Vertex Degrees, Sub graphs, Paths and cycles, the matrix representation of graphs,

Text 1: Chapter 1 (Sections 1.1, 1.3 to 1.7)

Module II: Graph Theory (30 Hrs)

Trees. Definitions and Simple properties, Bridges, Spanning trees. Cut vertices and Connectivity. Euler's Tours, the Chinese postman problem. Hamiltonian graphs & the travelling salesman problem.

Text 1: Chapter 2 (Sections 2.1, 2.2 & 2.3, 2.6); Chapter 3 (Sections 3.1 (algorithm deleted), 3.2 (algorithm deleted), 3.3, and 3.4 (algorithm deleted)).

Module III: Metric Spaces (18 Hrs)

Metric Spaces – Definition and Examples, Open sets, Closed Sets, Cantor set.

Text 2: Chapter 2 (sections 9, 10 and 11).

Module IV: Metric spaces (24 Hrs)

Convergence, Completeness, Continuous Mapping (Baire's Theorem included).

Text 2: Chapter 2 (Sections 12 and 13).

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,

4. S. Bernard and J.M Child - Higher Algebra, AITBS Publishers, India,2009

QUESTON PAPER PATTERN

Module	Part A (2 marks)	Part B (5 marks)	Part C (15 marks)	Total
I	4	2	1	7
II	4	3	1	8
III	2	2	1	5
IV	2	2	1	5
Total No. of Questions	12	9	4	25
No. of questions to be answered	10	6	2	18
Total Marks	20	30	30	80

B. Sc DEGREE PROGRAMME MATHEMATICS (UGCBCS 2017)

SIXTH SEMESTER

MM6CRT03 : COMPLEX ANALYSIS

5 hours/week (Total Hrs: 90) **4 credits**

Syllabus

Text book:

James Ward Brown & Ruel V. Churchill - Complex variables and applications (8th edition)

Pre-requisites **(4 hours.)**

A quick review on Complex numbers and its properties, vectors and moduli, complex conjugates, exponential forms, arguments and its properties, roots of complex numbers, and regions in complex plane.

(No question shall be asked from this section.)

Module I: Analytic functions **(28 hours)**

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

Chapter 2 (Sections 12, 15, 16, 18 to 22, 24 to 26); Chapter 3 (Sections 29, 30, 33 to 36).

Module II: Integrals **(25 hours)**

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.

Chapter 4 (Sections 37 to 41, 43, 44, 46, 48 to 54);
Chapter 5 (Sections 55 to 60 and 62).

Module III: Series **(15 hours)**

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

Chapter 5 (Sections 55 to 60 and 62)

Module IV: Residues and poles **(18 hours)**

Isolated singular points, residues, Cauchy's residue theorem, three types of isolated singular points, residues at poles, examples. Applications of residues, evaluation of improper integrals, example.

Chapter 6 (Sections 68 to 70 and 72 to 74);
Chapter 7 (Section 78)

Reference:

1. Lars V. Ahlfors - Complex Analysis – An Introduction to the Theory of Analytic Functions of one Complex Variables (4th edition), (McGRAW-HILL)
2. J M Howie: Complex Analysis, Springer
3. Shanti Narayan - Theory of functions of a complex variable
4. Steven G Krantz - Complex Variables – A Physical approach with applications and MATLAB, Chapman & Hall/CRC (2007).
5. Kasana - Complex Variables: Theory and Applications , 2nd edition
6. B. Choudhary - The Elements of Complex Variables.
7. A. David Wunsch – Complex Analysis with Applications (Pearson)

QUESTON PAPER PATTERN

Module	Part A (2 marks)	Part B (5 marks)	Part C (15 marks)	Total
I	5	3	1	9
II	3	3	1	7
III	2	1	1	4
IV	2	2	1	5
Total No. of Questions	12	9	4	25
No. of questions to be answered	10	6	2	18
Total Marks	20	30	30	80

B. Sc DEGREE PROGRAMME MATHEMATICS (UGCBCS 2017)

SIXTH SEMESTER

MM6CRT04 : LINEAR ALGEBRA

5 hours/week (Total Hrs: 90) **4 credits**

SYLLABUS

Text Book :

1. **S. Blyth and E. F. Robertson : Basic Linear Algebra, Springer, Second Ed. (2002)**

Module 1

A review of algebra of matrices is followed by some applications of matrices, analytic geometry, systems of linear equations and difference equations. Systems of linear equations: elementary matrices, the process of Gaussian elimination, Hermite or reduced row-echelon matrices. Linear combinations of rows (columns), linear independence of columns, row equivalent matrices, rank of a matrix, column rank, normal form, consistent systems of equations.

Text 1: Chapter 1 ; Chapter 2 (Sections 1, 2 and 4) and Chapter 3.

Module 2

Invertible matrices, left and right inverse of a matrix, orthogonal matrix, vector spaces, subspaces, linear combination of vectors, spanning set, linear independence and basis.

Text 1: Chapter 4 and Chapter 5.

Module 3

Linear mappings: Linear transformations, Kernel and range, Rank and Nullity, Linear isomorphism. Matrix connection: Ordered basis, Matrix of f relative to a fixed ordered basis, Transition matrix from a basis to another, Nilpotent and index of nilpotency.

Text 1: Chapter 6 and Chapter 7.

Module 4

Eigenvalues and eigenvectors: Characteristic equation, Algebraic multiplicities, Eigen space, Geometric multiplicities, Eigenvector, diagonalisation, Tri-diagonal matrix.

Text 1: Chapter 9**.**

Reference:

1 Richard Bronson, Gabriel B. Costa - Linear Algebra An Introduction (Second Edition), Academic Press 2009, an imprint of Elsevier.
2 David C Lay: Linear Algebra, Pearson
3 Sheldon Axler - Linear Algebra Done Right (Third Edition, Undergraduate text in Mathematics), Springer 2015.
4 S. H. Friedberg, Arnold J. Insel and Lawrence E. Spence, - Linear Algebra, 2nd Edition, PH Inc.
5 S. Kumaresan - Linear Algebra: A Geometric Approach, Prentice Hall India Learning Private Limited; New title edition (2000)
6 Gilbert Strang – Linear Algebra and its applications, Thomson Learning,

QUESTON PAPER PATTERN

Module	Part A (2 marks)	Part B (5 marks)	Part C (15 marks)	Total
I	2	2	1	5
II	3	2	1	6
III	4	3	2	
IV	3	2		
Total No. of Questions	12	9	4	25
No. of questions to be answered	10	6	2	18
Total Marks	20	30	30	80

MAHATHMA GANDHI UNIVERSITY

B.Sc. DEGREE PROGRAMME (UGCBCS 2017)

MATHEMATICS (OPEN COURSES)

(DURING THE FIFTH SEMESTER)

SYLLABUS

(Effective from 2017 admission onwards)

UNDERGRADUATE PROGRAMME MATHEMATICS (UGCBCS 2017)

FIFTH SEMESTER (OPEN COURSE)

MM5GET02 : APPLICABLE MATHEMATICS

4 hours/week **4 credits**

The objective is to prepare students of all streams, particularly those with arts and commerce back ground for their higher studies and to approach competitive examinations. Detailed explanation and short cut method for solving problems are to be introduced to students, so that they can acquire better understanding of concepts and problem solving skill.. All questions asked to be of arts students' standard.

Module – I **(18 hours)**

Types of numbers, HCF & LCM of integers, Fractions, Simplifications (VBODMAS rule), squares and square roots, ratio and proportion, percentage, profit & loss.

Module – II **(18 hours)**

Quadratic equations (Solution of quadratic equations with real roots only), Permutations and combinations – simple applications, Trigonometry- introduction, values of trigonometric ratios of 0^0, 30^0, 45^0, 60^0 & 90^0, Heights and distances.

Module – III **(18 hours)**

Simple interest, Compound interest, Time and work, Work and wages, Time and distance, exponential series and logarithmic series.

Module – IV **(18 hours)**

Elementary mensuration – Area and perimeter of polygons, Elementary Algebra, monomial , binomial, polynomial (linear, quadratic & cubic), simple factorization of quadratic and cubic polynomials.

Differential Calculus - Differentiation – Standard results (derivatives), Product rule, Quotient rule and function of function rule (with out proof) and simple probles),

References –

1 M. Tyra, & K. Kundan- CONCEPTS OF ARITHMETIC, BSC PUBLISHING COMPANY PVT.LTD, C – 37, GANESH NAGAR, PANDAV NAGAR COMPLEX

2 GRE Math review (pdf)

3 Joseph Edward : Differential Calculus for beginners. Nabu Press (2011)

4 Calculus Volume I, S. Narayanan & T.K. Manikavachagam Pillai – S. Viswanathan (Printers & Publications) Pvt.Ltd
5 S Narayaynan, TK Manikavachagam Pillai : Calculus Volume I, S Viswanathan Printers and publications Pvt. Ltd.

QUESTON PAPER PATTERN

Module	Part A (2 marks)	Part B (5 marks)	Part C (15 marks)	Total
I	3	2	1	6
II	3	2	1	6
III	3	2	1	6
IV	3	3	1	7
Total No. of Questions	12	9	4	25
No. of questions to be answered	10	6	2	18
Total Marks	20	30	30	80

MAHATHMA GANDHI UNIVERSITY

B.Sc. DEGREE PROGRAMME (UGCBCS 2017)

MATHEMATICS (CHOICE BASED COURSE)

(DURING THE SIXTH SEMESTER)

SYLLABUS

(Effective from 2017 admission onwards)

B.Sc. DEGREE PROGRAMME MATHEMATICS (UGCBCS 2017)

SIXTH SEMESTER

MM6CBT01 : OPERATIONS RESEARCH

4 hours/week(Total Hrs : 72) 3 credits

Syllabus

Text Book: J.K SHARMA-OPERATIONS RESEARCH- THEORY AND APPLICATIONS, MACMILLAN PUBLISHERS, INDIA Ltd.

Module I: Linear Programming:- Model formulation and solution by the Graphical Method and the Simplex method (20Hrs.)

General Mathematical Model of LPP, Guidelines on linear Programming model formulation and examples of LP Model formulation.Introduction to graphical method, definitions, Graphical solution methods of LP Problems, Special cases in linear Programming, Introduction to simplex method, Standard form of an LPP, Simplex algorithm(Maximization case),Simplex algorithm (Minimization case),The Big M Method, Some complications and their resolution, Types of linear Programming solutions.
Chapter 2: Sections 2.6 to 2.8
Chapter 3: Sections 3.1 to 3.4
Chapter 4: Sections 4.1 to 4.6

Module II: Duality in Linear Programming (12 Hrs.)

Introduction, Formulation of Dual LPP, standard results on duality, Advantages of Duality,Theorems of duality with proof.

Chapter 5: Sections: 5.1 to 5.3, 5.5 with appendix.

Module III:Transportation and Assignment Problems (22 Hrs.)
Introduction, Mathematical model of Transportation Problem, The Transportation Algorithm, Methods for finding Initial solution, Test for optimality, Variations in Transportation Problem, Maximization Transportation problem,Introduction and mathematical models of Assignment problem, Solution methods of Assignment problem, variations of the assignment problem.

Chapter9: Sections 9.1 to 9.7
Chapter 10 : sections 10.1 to 10.4

Module IV: Theory of Games (18 Hrs.)
Introduction, Two-person zero sum games, pure strategic (Minimax and Maximin principles), Games with saddle point, mixed strategies, Games without saddle point, The rules of dominance, solution methods: Games without saddle point (Arithmetic method, Matrix method, Graphical method and Linear programming method)

Chapter 12: Section 12.1 to 12.6

Reference books:

1. .Kanti Swarup, P.K Gupta and Man Mohan-Operations Research (Sultan Chand and sons).
2. Frederick S Hillier and Gerald J. Lieberman -Introduction to operations research (Seventh edition),Mc Graw Hill edition.
3. Hamdy A Taha-Operations Research-An introduction (seventh edition), Prentice Hall of India Pvt.Ltd.).

Question Paper Pattern

Module	Part A (2 marks)	Part B (5 marks)	Part C (15 marks)	Total
I	5	4	1	10
II	1	2	-	3
III	4	2	2	8
IV	2	1	1	4
Total No. of Questions	12	9	4	25
No. of questions to be answered	10	6	2	18
Total Marks	20	30	30	80

MAHATHMA GANDHI UNIVERSITY
B.Sc. DEGREE PROGRAMME (UGCBCS 2017)
MATHEMATICS
(COMPLEMENTARY COURSES)
SYLLABUS
(Effective from 2017 admissions onwards)

COMPLEMENTARY COURSES

MATHEMATICSCOMPLEMENTARYCOURSETO PHYSICS/CHEMISTRY/PETROCHEMICALS/GEOLOGY/FOOD SCIENCEAND QUALITYCONTROL/ELECTRONICSANDCOMPUTERMAINTENANCE (ForModelI/ModelII/ModelIII)

Semester	Title of the paper	No. of hours per week	Total Credits	Total hours per semester	University Exam Duration	Marks	
						Internal	External
I	MM1CMT01: PARTIALDIFFERENTIATION ,MATRICES,TRIGONOMETRY ANDNUMERICALMETHODS	4	3	72	3 hours	20	80
II	MM2CMT01:INTEGRAL CALCULUS AND DIFFERENTIAL EQUATIONS	4	3	72	3 hours	20	80
III	MM3CMT01:VECTOR CALCULUS, ANALYTIC GEOMETRY AND ABSTRACT ALGEBRA	5	4	90	3 hours	20	80
IV	MM4CMT01 : FOURIER SERIES, LAPLACE TRANSFORM AND COMPLEX ANALYSIS	5	4	90	3 hours	20	80

B.Sc. DEGREEPROGRAMME(UGCBCS2017)
MATHEMATICSCOMPLEMENTARYCOURSETO
PHYSICS/CHEMISTRY/PETROCHEMICALS/GEOLOGY/FOOD SCIENCEAND
QUALITYCONTROL/ELECTRONICSANDCOMPUTERMAINTENANCE
(ForModelI/ModelII/ ModelIII)
FIRSTSEMESTER
MM1CMT01: PARTIALDIFFERENTIATION,MATRICES,TRIGONOMETRY ANDNUMERICALMETHODS

4hours/week (TotalHrs:72) 3credits

Syllabus

UseofNonProgrammableScientificCalculatoris Permitted

TextBooks:-

1. **GeorgeB.Thomas,Jr: Thomas'Calculus12thEdition,Pearson.**
2. **ShanthiNarayanan&P.K. Mittal,AText BookofMatrices,S.Chand.**
3. **S. L.Loney–PlaneTrigonometryPart–II,AITBSPublishersIndia,2009.**
4. **S. S.Sastry:IntroductorymethodsofNumericalAnalysis, 4th edition(PrenticeHall)**

ModuleI: PartialDifferentiation (14hrs)

Functionsofseveralvariables(Definitions and simple graphs only),Partialderivatives,TheChainRule.
Text1Chapter14(Sections14.1(Definitions and simple graphs only), 14.3and14.4)

ModuleII:Matrices (21hrs)

Rankof aMatrix, Elementary transformations of a matrix, Reduction toNormalform, Employment of only row (column) transformations, System of Linear Homogeneous Equations,Systems of linear nonhomogenousequations, Characteristic roots and characteristic vectors of a square matrix,Characteristic matrix andCharacteristicequation of a matrix, CayleyHamiltontheorem, Expression of the inverse of a nonsingular matrix A as a polynomial in A with scalar coefficients
Text2 Chapter4 (Sections4.1 to 4.8 and 4.11)
Chapter6 (Sections 6.1, 6.2 and 6.6)
Chapter11 (Sections 11.1 and 11.11)
(ProofsofallTheoremsin ModuleIIare excluded.)

ModuleIII:Trigonometry (23hrs)

Expansions of $\sin n\theta$, $\cos n\theta$, $\tan n\theta$, $\sin^n\theta$, $\cos^n\theta$, $\sin^n\theta\cos^m\theta$, circular and hyperbolic functions,inversecircularandhyperbolicfunction,Separationintorealandimaginaryparts,Summationof infiniteseriesbasedonC+iSmethod.
Text3(RelevantSectionsofChapters3to5and8)

ModuleIV:NumericalMethods (14Hrs)

BisectionMethod,MethodofFalseposition,IterationMethod,Newton-RaphsonMethod.
Text4,Chapter2(Sections2.1, 2.2,2.3,2.4and2.5)

ReferenceBooks:

1. Shanti Narayan: DifferentialCalculus(SChand)
2. GeorgeB.ThomasJr.andRossL.Finney:Calculus,LPE,Ninthedition,PearsonEducation.
3. S.S.Sastry,EngineeringMathematics,Volume1, 4thEditionPHI.

4. MurayRSpiegel,AdvancedCalculus,Schaum'sOutlineseries.
5. FrankAyresJr: Matrices,Schaum's outlineSeries,TMHEdition.(Allied)
6. DavidW.Lewis- MatrixTheory.

QUESTONPAPERPATTERN

Module	PartA 2Mark	PartB 5Marks	PartC 15Marks	Total
I	3	3	-	6
II	3	2	2	7
III	4	2	1	7
IV	2	2	1	5
TotalNo.of Questions	12	9	4	25
No.Questionsto beanswered	10	6	2	18
TotalMarks	20	30	30	80

B. Sc. DEGREE PROGRAMME (UGCBCS 2017)
MATHEMATICS
COMPLEMENTARY COURSE TO
PHYSICS/CHEMISTRY/PETROCHEMICALS/GEOLOGY/FOOD SCIENCE AND QUALITY CONTROL/ELECTRONICS AND COMPUTER MAINTENANCE
(For Model I / Model II / Model III)
SECOND SEMESTER

MM2CMT01 : INTEGRAL CALCULUS AND DIFFERENTIAL EQUATIONS

4 hours/week (Total Hrs : 72) **3 Credits**

Syllabus

Text Books:-

1. **George B. Thomas, Jr.: Thomas' Calculus 12th Edition,(Pearson).**
2. **A. H. Siddiqi, P. Manchanada : A first Course in Differential Equations with Applications (Macmillan India Ltd 2006)**
3. **Ian Sneddon : Elements of Partial Differential Equations (Tata Mc Graw Hill)**

Module I: Integral Calculus **(15 hrs)**

Volumes using Cross-Sections, Volumes using Cylindrical shells, Arc lengths, Areas of surfaces of Revolution.

Text 1: Chapter 6 (Sections 6.1 to 6.4)

Module II: Multiple Integrals **(17 hrs)**

Double and iterated integrals over rectangles, Double integrals over general regions, Area by double integration, Triple integrals in rectangular co-ordinates.

Text 1: Chapter 15 (Sections 15.1, 15.2,15.3, 15.5)

Module III: Ordinary Differential Equations **(20 Hrs)**

Separable Variables, Exact Differential Equation, Equations reducible to exact form, Linear Equations, Solutions by Substitutions, Homogeneous equations and Bernoulli's Equations.

Text 2 : Chapter 2

Module IV: Partial Differential Equations **(20 Hrs)**

Surfaces and Curves in three dimensions, Solution of equations 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.

Text 3: Chapter 1 (Sections 1 and 3), Chapter 2 (Sections 1, 2 and 4)

Reference Books:

1. Shanti Narayan, P. K. Mittal : Integral Calculus (S. Chand & Company)
2. Differential Equations, E. Rukmangadachari, Pearson.
3. R. K. Ghosh, K. C. Maity – An introduction to Differential Equations, New Central Books.

QUESTION PATTERN

Module	Part A 2 Marks	Part B 5 Marks	Part C 15 Marks	Total

I	3	2	1	6
II	3	3	1	7
III	3	2	1	6
III	3	2	1	6
Total No. of Questions	12	9	4	25
No. of Questions to be answered	10	6	2	18
Total Marks	20	30	30	80

B. Sc. DEGREE PROGRAMME(UGCBCS 2017)
MATHEMATICS
COMPLEMENTARY COURSE TO
PHYSICS/CHEMISTRY/PETROCHEMICALS/GEOLOGY/FOOD SCIENCE AND QUALITY CONTROL/ELECTRONIS AND COMPUTER MAINTENANCE
(For Mode I/ Model II/ Model III)
THIRD SEMESTER
MM3CMT01:VECTOR CALCULUS, ANALYTIC GEOMETRY AND ABSTRACT ALGEBRA

5 hours/week (Total Hrs : 90) **4 credits**

Text Books: -

1. **George B. Thomas, Jr: Thomas' Calculus Twelfth Edition, Pearson.**
2. **John B Fraleigh – A First course in Abstract Algebra (Seventh Edition)**

Syllabus

Module I: Vector valued Functions (15 hrs)

Curves in space and their tangents, Arc length in space, Curvature and Normal Vectors of a curve, Directional Derivatives and Gradient Vectors**.**

Text 1: Chapter 13 (Sections 13.1, 13.3 and 13.4), Chapter 14 (Section 14.5 only)

Module II: Integration in Vector Fields (25hrs)

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

Text 1: Chapter 16 (Sections 16.1 to 16.8)

Module III: Analytic Geometry (25 hrs)

Polar coordinates, Conic sections, Conics in Polar coordinates.

Text 1: Chapter 11 (Sections 11.3, 11.6 and 11.7)

Module IV: Abstract algebra (25 hrs)

Groups, Subgroups, Cyclic groups, Groups of Permutations, Homomorphism.

Text 2: Chapter 1 Sections 4, 5 and 6 (Proofs of Theorems/ Corollary 5.17, 6.3, 6.7, 6.10, 6.14, 6.16 are excluded)
Chapter 2, Section 8 (Proofs of theorems 8.15 and 8.16 are excluded)

Chapter 3, Sections 13.1, 13.2 and 13.3, 13.11, 13.12 only

Reference Books:

1. Harry F. Davis & Arthur David Snider: Introduction to Vector Analysis, 6th ed.,
2. Universal Book Stall, New Delhi.
3. Murray R. Spiegel: Vector Analysis, Schaum's Outline Series, Asian Student edition.
4. I.N. Herstein - Topics in Algebra
5. Joseph A Gallian - A Contemporary Abstract Algebra, Narosa Publishing House.

QUESTON PAPER PATTERN

MODULE	PART A(2 Marks Each)	PART B(5 Marks Each)	PART C(15 Marks Each)	TOTAL
I	3	2	1	6
II	3	3	1	7
III	3	2	1	6
IV	3	2	1	7
Total no of questions	12	9	4	25
No. Of Questions to be answered	10	6	2	18
Total	20	30	30	80

B.Sc. DEGREE PROGRAMME(UGCBCS 2017)
MATHEMATICS
COMPLEMENTARY COURSE TO PHYSICS/CHEMISTRY/PETROCHEMICALS/GEOLOGY/FOOD SCIENCE AND QUALITY CONTROL/ELECTRONICS AND COMPUTER MAINTENANCE
(For Model I/ Model II/ Model III)
FOURTH SEMESTER
MM4CMT01 : FOURIER SERIES, LAPLACE TRANSFORM AND COMPLEX ANALYSIS

5 hours/ week (Total 90 hours) **4 credits**

Syllabus

Text: Erwin Kreyszig, Advanced Engineering Mathematics, Eighth Edition, Wiley, India.

ModuleI: Fourier Series and Legendre Polynomials (25 hours)

Periodic Functions, Trigonometric Series, Fourier Series, Functions of any period p = 2L, Even and Odd functions, Half range Expansions.

A brief introduction to power series and power series method for solving Differential equations, Legendre equation and Legendre polynomials $P_n(x)$.

(Proofs of all theorems in this module are excluded.)

(Sections 10.1 to 10.4, 4.1 and 4.3)

ModuleII: Laplace Transforms (20 hours)

Laplace Transform, Inverse Laplace transform, Linearity, Shifting, transforms of Derivatives and Integrals, Differential Equations, Differentiation and Integration of Transforms, Laplace transform general Formula(relevant formulae only), Table of Laplace Transforms(relevant part only)

(Proofs of all theorems in this module are excluded.)

(Sections 5.1, 5.2, 5.4. 5.8 and 5.9)

ModuleIII: Complex Numbers and Functions (25 hours)

Complex Numbers, Complex Plane, Polar form of Complex Numbers, Powers and Roots, Derivative, Analytic Functions, Cauchy-Riemann Equations, Laplace's Equation, Exponential Function, Trigonometric Functions, Hyperbolic Functions, Logarithm, General Power.

(Proofs of all theorems in this module are excluded.)

(Sections 12.1 to 12.4 and 12.6 to 12.8)

ModuleIV: Complex Integration (20 hours)

Line Integral in the Complex Plane, Cauchy's Integral Theorem, Cauchy's Integral Formula, Derivatives of Analytic functions.

(Proofs of all theorems in this module are excluded.)

(Sections 13.1 to 13.4)

Reference:

1. Michael D.Greenberg Advanced Engineering Mathematics, Pearson Education, 2002.
2. B.S.Grewal, Higher Engineering Mathematics, 42nd Edition, Khanna Publishers
3. Brown and Churchill, Complex Variables and Applications, McGraw-Hill Higher Education, Edition 8, 2008.

Question paper pattern

Module	Part A 2 Marks	Part B 5 Marks	Part C 15 marks	Total
I	2	2	1	6

II	3	2	1	5
III	4	3	1	8
I*V*	3	2	1	6
Total No. of Questions	12	9	4	25
No. of Questions to be answered	10	6	2	18
Total Marks	20	30	30	80