VIMALA COLLEGE (AUTONOMOUS), THRISSUR

B.Sc. DEGREE PROGRAMME

IN

MATHEMATICS

UNDER CHOICE BASED CREDIT AND SEMESTER SYSTEM

(CBCSSUG 2016)

SCHEME AND SYLLABUS

2016 ADMISSION ONWARDS

B.Sc. DEGREE PROGRAMME

MATHEMATICS (CORE COURSE)

DETAILS OF CORE COURSES

SL NO.	CODE	NAME OF THE COURSE	Semester	No. of Teaching Hours /Week	Credits
1	VMT1B01	Foundations of mathematics	I	4	4
2	VMT2B02	Calculus	II	4	4
3	VMT3B03	Calculus and analytic geometry	III	5	4
4	VMT4B04	Theory of equations, matrices and vector calculus	IV	5	4
5	VMT5B05	Vector calculus	V	5	4
6	VMT5B06	Abstract algebra	V	5	5
7	VMT5B07	Basic mathematical analysis	V	6	5
8	VMT5B08	Differential equations	V	5	4
9		Open Course (Offered by Other Departments)	V	2	2
10		Project/viva	V	2	---
11	VMT6B09	Real analysis	VI	5	5
12	VMT6B10	Complex analysis	VI	5	5
13	VMT6B11	Numerical methods	VI	5	4
14	VMT6B12	Number theory and linear algebra	VI	5	4
15	VMT6E01	Elective Course-Linear Programming	VI	3	2
16	VMT6(PR)	Project/viva	VI	2	2

DETAILS OF COMPLEMENTARY COURSES

Sl No	*Code*	*Name Of The Course*	*Semester*	*Number Of Teaching Hours/Week*	*Credits*
1	VMT1C01	Mathematics	I	4	3
2	VMT2C02	Mathematics	II	4	3
3	VMT3C03	Mathematics	III	5	3
4	VMT4C04	Mathematics	IV	5	3

DETAILS OF ELECTIVE COURSES

Sl No	*Code*	*Name Of The Course*	*Number Of Teaching Hours/Week*	*Credits*
1	VMT6E01	Graph Theory	3	2
2	VMT6E02	Linear Programming	3	2
3	VMT6E03	C Programming for Mathematical Computing	3	2
4	VMT6E04	Informatics and Mathematical Software	3	2

DETAILS OF OPEN COURSE OFFERED BY THE DEPARTMENT

Sl No	*Code*	*Name Of The Course*	*Number Of Teaching Hours/Week*	*Credits*
1	VMT5D01	Mathematics For Physical Sciences	2	2
2	VMT5D02	Mathematics For Natural Sciences	2	2
3	VMT5D03	Mathematics for Social Sciences	2	2

B.Sc. DEGREE PROGRAMME (MATHEMATICS CORE)
COURSE SRTUCTURE

Semester	Course Code	Course Title	Total hours	Hours /week	Credit
I	VEG1A 01	Common Course I – English	72	4	3
	VEG1A 02	Common Course II – English	90	5	3
	VML1A 01 VHD1A 01 VCK1A 01	Common Course III – Language other than English	72	4	4
	VMT1 B01	Core Course I - Foundations of Mathematics	72	4	4
	VPH1C01	1st Complementary Course I Physics	72	2	2
		I Complementary Course Practical I		2	
	VST1C01	2nd Complementary Course I Statistics	72	4	3
		Total	**450**	**25**	**19**
II	VEG2A 03	Common Course IV – English	72	4	4
	VEG2A 04	Common Course V – English	90	5	4
	VML2A 02 VHD2A 02 VCK2A 02	Common Course VI – Language other than English	72	4	4
	VMT2B02	Core Course II - Calculus	72	4	4
	VPH2C02	1st Complementary Course Physics	72	2	2
		I Complementary Course Practical II		2	
	VST2C02	II Complementary Course Statistics	72	4	3
		Total	**450**	**25**	**21**
III	VEG3A05	Common Course VI – English	90	5	4
	VML3A03 VHD3A 03 VCK3A 03	Common Course VIII - Language other than English	90	5	4
	VMT3 B03	Core Course III –Calculus and analytic geometry	90	5	4
	VPH3C03	1st Complementary Course III Physics	54	3	2
		I Complementary Course Practical III	36	2	
	VST3C03	2nd Complementary Course III Statistics	90	5	3
		Total	**450**	**25**	**17**
IV	VEG4A06	Common Course IX – English	90	5	4
	VML4 A04 VHD4A 04 VCK4A 04	Common Course X - Language other than English	90	5	4
	VMT4 B04	Core Course IV – Theory of Equations, Matrices and vector calculus	90	5	4

	VPH4C04	1st Complementary Course IV – Physics	54	3	2
		I Complementary Course Practical IV	36	2	4
	VST4C04	2nd Complementary Course IV Statistics	90	5	3
		Total	**450**	**25**	**21**
V	VMT5B05	Core Course V - Vector calculus	90	5	4
	VMT5B06	Core Course VI- Abstract Algebra	90	5	5
	VMT5B07	Core Course VII – Basic Mathematical Analysis	90	5	5
	VMT5B08	Core Course VIII – Differential Equations	108	6	4
	VMT5D01 VMT5D02 VMT5D03	Open Course – (*course from other streams*):	36	2	2
	VMT5PR	Project	36	2	*
		Total	**450**	**25**	**20**
VI	VMT6 B09	Core Course IX –Real Analysis	90	5	5
	VMT6B10	Core Course X – Complex Analysis	90	5	5
	VMT6 B011	Core Course XI – Numerical Methods	90	5	4
	VMT6 B012	Core Course XI I- Number theory and linear Algebra	90	5	4
	VMT6E01	Core Course XII -(Elective):	54	3	2
	VMT6PR	Project	36	2	2
		Total	**450**	**25**	**22**
		Total Credit			**120**

CREDIT AND MARK DISTRIBUTION IN EACH SEMESTERS

Total Credits: 120; Total Marks: 3200

Semester	*Course*	*Credit*	*Marks*
I	Common course: English	4	100
	Common course: English	3	100
	Common course: Additional Language	4	100
	Core Course I: Foundations of Mathematics	4	100
	Complementary course: I	2	80
	Complementary course: II	3	100
	Total	**20**	**580**
II	Common course: English	4	100
	Common course: English	3	100
	Common course: Additional Language	4	100
	Core Course II: CALCULUS	4	100
	Complementary course: I	2	80
	Complementary course: II	3	100
	Total	**20**	**580**
III	Common course: English	4	100
	Common course: Additional Language	4	100
	Core Course III: Calculus and analytic geometry	4	100
	Complementary course: I	2	80
	Complementary course: II	3	100
	Total	**17**	**480**
IV	Common course: English	4	100
	Common course: Additional Language	4	100
	Core Course IV: Theory of Equations, Matrices and vector calculus	4	100
	Complementary course: I	2	80
	Complementary course: II	3	100
	Complementary course: I Practical	4	80
	Total	**21**	**560**
V	Core Course V: Vector calculus	4	150
	Core Course VI: - Abstract Algebra	5	150
	Core Course VII – Basic Mathematical Analysis	5	150
	Core Course VIII: – Differential Equations	4	150
	Open course	2	50
	Total	**20**	**650**
	Core Course X: Real Analysis	5	150
	Core Course XI: – Complex Analysis	5	150

VI			
	Core Course XII: Numerical Methods	4	150
	Core Course XIII: Number theory and linear Algebra	4	150
	Core Course XIV: Elective	2	100
	Core Course XVI: Project	2	50
	Total	**22**	**750**
	Grand Total	**120**	**3600**

COURSE STRUCTURE MATHEMATICS (CORE)

Mark Distribution

Sl. No.	*Course*	*Marks*	Credits
1	English	600	22
2	Additional Language	400	16
3	Core course: Mathematics	1750	56
4	Complementary course I:	400	12
5	Complementary course II:	400	12
6	Open Course	50	2
	Total Marks	**3600**	**120**

Seven point Indirect Grading System

% of Marks	*Grade*	*Interpretation*	*Grade Point Average*	*Range of Grade points*	*Class*
90 and above	A^+	Outstanding	6	5.5 - 6	First Class with distinction
80 to below 90	A	Excellent	5	4.5 – 5.49	
70 to below 80	B	Very good	4	3.5 – 4.49	First Class
60 to below 70	C	Good	3	2.5 – 3.49	
50 to below 60	D	Satisfactory	2	1.5 – 2.49	Second Class
40 to below 50	E	Pass/Adequate	1	0.5 – 1.49	Pass
Below 40	F	Failure	0	0 – 0.49	Fail

CORE & COMPLEMENTARY COURSES
SHEME OF EVALUATION

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

Internal evaluation:

20% of the total marks in each course are for internal evaluation.

Components of Internal evaluation

Sl No	**Components**	**Marks** (for courses with Max Marks 50)	**Marks** (for courses with Max Marks 100)	**Marks** (for courses with Max Marks 150)
1	Attendance	2.5	5	7.5
2	Assignment / seminar / Viva	2.5	5	7.5
3	Test paper: I	2.5	5	7.5
4	Test paper: II	2.5	5	7.5
Total Marks		**10**	**20**	**30**

a) Percentage of Attendance in a Semester and Eligible Internal Marks

% of Attendance	**Marks** (for courses with Max Marks 50)	**Marks** (for courses with Max Marks 100)	**Marks** (for courses with Max Marks 150)
90% to 100%	2.5	5	7.5
85% to 89%	2	4	6
80% to 84%	1.5	3	4.5
76% to 79%	1	2	3
75%	0.5	1	1.5

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

% of Marks in Test Paper	**Marks** (for courses with Max Marks 50)	**Marks** (for courses with Max Marks 100)	**Marks** (for courses with Max Marks 150)
90% to 100%	2.5	5	7.5
80% to 89%	2	4	6
65% to 79%	1.5	3	4.5
50% to 64%	1	2	3
35% to 49%	0.5	1	1.5

EVALUATION OF PROJECT

The internal to external components is to be taken in the ratio 1:4.Assesment of different components may be taken as below.

Guidelines for doing project

The project work provides the opportunity to study a topic in depth that has been chosen or which has been suggested by a staff member. The students first carryout a literature survey which will provide the background information necessary for the investigations during the research phase of the project.
The various steps in project works are the following:-
a) Wide review of a topic.
b) Investigation on an area of Mathematics in systematic way using appropriate techniques.
c) Systematic recording of the work.
d) Reporting the results with interpretation in written and oral forms.

Internal assessment

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

Components	Internal Marks
Punctuality	2
Use of data	2
Scheme / Organization of Report	3
Viva Voce	3
Total	**10**

External Evaluation

(To be done by the External Examiner)

Components	External Marks
Relevance of Topic , Statement of Objectives, Methodology (Reference / Bibliography)	8
Presentation , Quality of Analysis/ Use of Statistical Tools, findings and recommendations	12
Viva Voce	20
Total	**40**

Credit and Mark Distribution of B.Sc Mathematics Programme

Sl No.	**Course**		**Credits**		**Marks**	
1	English		22		600	
2	Additional Language		16		400	
3	Core Course	12 courses and 1 Elective	54	56	1700	1750
		Project	2		50	
4	Complementary course - I		12		400	
5	Complementary course - II		12		400	
6	Open course		2		50	
	Total		**120**		**3600**	

2.EXTERNAL EVALUATION

80% of total marks in each course are for internal evaluation . External examination will be conducted at the end of each semester

(i)PATTERN OF QUESTION PAPER

Duration	*Pattern*	*Total Number Of Questions*	*Number Of Questions To Be Answered*	*Marks For Each Question*	*Marks*
3 hours	Objective	12	12	1	12
	Short answer	12	9	2	18
	Short essay	9	6	5	30
	Essay	3	2	10	20
				Total Marks	**80**
Duration	*Pattern*	*Total Number Of Questions*	*Number Of Questions To Be Answered*	*Marks For Each Question*	*Marks*
3 hours	Objective	12	12	1	12
	Short answer	14	10	4	40
	Short essay	9	6	7	42
	Essay	3	2	13	26
				Total Marks	**120**
Duration	*Pattern*	*Total Number Of Questions*	*Number Of Questions To Be Answered*	*Marks For Each Question*	*Marks*
2 hours	Objective	6	6	1	6
	Short answer	7	5	2	10
	Short essay	5	3	4	12
	Essay	3	2	6	12
				Total Marks	**40**

FIRST SEMESTER

VMT1B01: FOUNDATIONS OF MATHEMATICS

4 hours/week 4 credits

Syllabus

Text Books

1. S. Lipschutz: Set Theory and related topics (Second Edition), Schaum Outline Series, Tata McGraw-Hill Publishing Company, New Delhi.
2. Thomas /Finney : Calculus, 9th ed., LPE, Pearson Education.
3. K.H. Rosen: Discrete Mathematics and its Applications (sixth edition), Tata McGraw Hill Publishing Company, New Delhi.

Module 1 (16 hours)

Set theory

Pre-requisites: Sets, subsets, Set operations and the laws of set theory and Venn diagrams. Examples of finite and infinite sets. Finite sets and the counting principle. Empty set, properties of empty set (Quick review).

Syllabus:

Set operations, Difference and Symmetric difference, Algebra of sets, Duality, Classes of sets, Power sets (As in sections 1.6, 1.7 & 1.9 of Text book 1).

Relations: Product set, Relations (Directed graph of relations on set is omitted). Composition of relations, Types of relations, Partitions, Equivalence relations with example of congruence modulo relation, Partial ordering relations, n-ary relations. (As in Chapter 3 of text book 1 excluding 3.7).

Module II (16 hrs)

Functions

Pre-requisites: Basic ideas such as domain, co-domain and range of functions. Equality of functions, Injection, Surjection and Bijection(Quick review).

Syllabus: Identity function, constant functions, product (composition) of functions, theorems on one-one and onto functions, Mathematical functions, Recursively defined functions (As in Chapter 4 of text book 1). Indexed collection of sets, Operations on indexed collection of sets (As in 5.1, 5.2 and 5.3 of text book 1). Equipotent sets, Denumerable and countable sets, Cardinal numbers (Definitions and examples only as in 6.1, 6.2, 6.3 and 6.5 of text book 1)

Module III : (20hrs)

Function quick review , Shifting graphs , Limit and continuity , The Sandwich theorem, Target values and formal definition of limits, Extensions of limit concept, Continuity
(sections 3, 4, 1.1, 1.2, 1.3, 1.4 & 1.5 in text book 2)

Module IV (20 hrs)

Basic Logic

Pre-requisite: Nil.

Syllabus: Introduction, propositions, truth table, negation, conjunction and disjunction. Implications, biconditional propositions, converse, contra positive and inverse propositions and precedence of logical operators. Propositional equivalence: Logical equivalences. Predicates and quantifiers: Introduction, Quantifiers, Binding variables and Negations. (As in Chapter 1 of Text book 3).

References

1. P.R. Halmos: Naive Set Theory, Springer.

2. E. Kamke, Theory of Sets, Dover Publishers.

3. Anton : Calculus, Wiley.

4. R.P. Grimaldi: Discrete and Combinatorial Mathematics, Pearson Education.

SECOND SEMESTER

VMT2B02: CALCULUS

4 hours/week 4 credits

Syllabus

Text Books

1. Thomas / Finney : Calculus, 9th ed., LPE, Pearson Education.
2. Shanti Narayan, P.K. Mittal- Differential Calculus(S.Chand & Co) 2008

Module I : (20 hrs)

Extreme value of functions, The mean value theorem, The first derivative test for local extremum values , Graphing with y' and y" , Limit as x → Assymptotes and dominant terms Optimization, Linearization and differentials
(section 3.1, 3.2, 3.3, 3.4 & 3.5, 3.6, 3.7)

Module II (20 hrs)

Areas between curves, Finding volumes by slicing ,Volumes of solids of revolution (Disk method only), Lengths of plane curves, Areas of surface of revolution

(section5.1, 5.2, 5.3, 5.5 &5.6)

Module III (12hrs)

Moments and centres of mass,

Work (section 5.7&5.8)

Module IV (20 hrs)

Curvature and evolutes, radius of curvature – Cartesian equations, Centre of curvature, evolutes and involutes, properties of evolutes asymptotes and envelopes.

(Relevant chapters from Text 2)

References:

1. Anton : Calculus, Wiley.

2. S.K. Stein : Calculus with Analytic Geometry, McGraw Hill.

THIRD SEMESTER

VMT3B03: CALCULUS AND ANALYTIC GEOMETRY

5 hours/week 4 credits

Syllabus

Text Books

1. Thomas / Finney : Calculus, 9th ed., LPE, Pearson Education.

Module I : Transcendental functions (15 hrs)

Natural logarithms, The Exponential function, and log , Growth and decay (quick review), L'Hopital's Rule, Relative rates of growth, Hyperbolic functions.
(section 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.10)

Module II – Infinite Series (25 hrs)

Limits of sequence of numbers, Theorems for calculating limits of sequences, Infinite series, Integral test for series of non-negative terms, Comparison test for series of non negative terms, Ratio and root test for series of non negative terms, Alternating series, Absolute and conditional convergence. (section 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 8.7)
Module III (15 hrs)

Power series, Taylor and Maclaurin's series, Convergence of Taylor series ,Error estimate

(section 8.8, 8.9, 8.10)

Module IV (35 hrs)

Conic section and quadratic equations, Classifying conic section by eccentricity ,Quadratic equations and rotations, Parametrisation of plane curves, Calculus with parametrised curves, Polar coordinates, Graphing in polar co-ordinates, Polar equations for conic sections, Integration in polar coordinates. (section 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 9.7, 9.8 &9.9)

References

1. Anton : Calculus, Wiley.

2. S.K. Stein : Calculus and Analytic Geometry, McGraw Hill.

FOURTH SEMESTER

VMT4B04: THEORY OF EQUATIONS, MATRICES AND VECTOR CALCULUS

5 hours/week 4credits

Syllabus

Text Books

1. Bernard and Child: Higher Algebra, Macmillan

2. Shanti Narayanan & Mittal : A Text Book of Matrices, Revised edn., S. Chand

3. Thomas /Finney : Calculus, 9th ed., LPE, Pearson Education.

Module I : Theory of Equations (30 hrs)

Polynomial Equations and Fundamental Theorem of Algebra(without proof). Applications of the Fundamental theorem to equations having one or more complex roots, Rational roots or multiple roots. Relations between roots and co-efficients of a polynomial equation and computation of symmetric functions of roots. Finding equations whose roots are functions of the roots of a given equation. Reciprocal equation and method of finding its roots. Analytical methods for solving polynomial equations of order up to four - quadratic formula. Cardano's method for solving cubic equations. Ferrari's method (for quadratic equations). Remarks about the insolvability of equations of degree five or more. Finding the nature of roots without solving Descartes' rule of signs.
(Sections from Text 1)

Module II: (16hrs)

Rank of a matrix – Elementary transformation, reduction to normal form, row reduced echelon form. Computing the inverse of a non singular matrix using elementary row transformation.

(Section 4.1 to 4.13 of Text 2)

Module III(20 hrs)

System of linear homogeneous equations. Null space and nullity of matrix. Sylvester's law of nullity. Range of a matrix. Systems of linear non homogeneous equations. Characteristic roots and characteristic vectors of a square matrix. Some fundamental theorem. Characteristic roots of Hermitian, Skew Hermitian and Unitary matrices. Characteristic equation of a matrix, Cayley-Hamilton theorem.
(Sections 6.1 to 6.6 and 11.1 to 11.3 and 11.11of Text 2)

Module IV (24 hrs)

(A quick review of Section 10.1 to 10.4)

Lines and planes in space. Cylinders and Quadric surfaces, Cylindrical and spherical coordinates, Vector valued functions and space curves, Arc length and Unit tangent vector , Curvature, torsion and TNB frame

(section10.5, 10.6, 10.7,11.1,11.3, 11.4 of text 3)

Reference

1.Kenneth Hoffman & Ray Kunze : Linear Algebra, Pearson Education. 2.ManicavachagomPillai, Natarajan, Ganapathy- Algebra

3.Dickson: First Course in Theory of Equation

4. Frank Ayres, Jr. : Matrices, Schaum's Outline Series, Asian Student edition.

5. Devi Prasad : Elementary Linear Algebra, Narosa Pub. House.

6. Kreyszig : Advanced Engineering Mathematics, 8th ed., Wiley.

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

FIFTH SEMESTER

VMT5B05 : VECTOR CALCULUS

5 hours/week 4 credits

Syllabus

Text Books : Thomas / Finney : Calculus, 9th ed., LPE, Pearson Education.

Module I (15 hrs)

Functions of several variables ,Limits and Continuity , Partial derivatives , Differentiability linearization and differentials, Chain rule, Partial derivatives with constrained variables (section 12.1, 12.2, 12.3, 12.4, 12.5, 12.6)

Module II – Multivariable functions and Partial Derivatives (20 hrs)

Directional derivatives, gradient vectors and tangent planes , Extreme value and saddle points, Lagrange multipliers , Taylor's formula, Double Integrals , Double integrals in polar form (section 12.7, 12.8, 12.9, 12.10, 13.1, 13.3)

Module III (25 hrs)

Triple integrals in Rectangular Coordinates , Triple integrals in cylindrical and spherical co-ordinates, Substitutions in multiple integrals, Line integrals , Vector fields, work circulation and flux , Path independence, potential functions and conservative fields (section 13.4, 13.6, 13.7, 14.1, 14.2, 14.3)

Module IV – Integration in Vector Fields (30 hours)

Green's theorem in the plane , Surface area and surface integrals, Parametrized surfaces, Stokes' theorem (statement only) , Divergence theorem and unified theory (no proof). (section14.4, 14.5, 14.6, 14.7, 14.8)

References

1. Kreyszig : Advanced Engineering Mathematics, 8th ed., Wiley.

2. H.F. Davis and A.D. Snider: Introduction to Vector Analysis, 6th

ed., Universal Book Stall, New Delhi.

FIFTH SEMESTER

VMT5B06 : ABSTRACT ALGEBRA

5 hours/week 5 credits

Text Books:

1. John B. Fraleigh : A First Course in Abstract Algebra, 7th Ed., Pearson.

Module I (20 hrs)

Binary operations; Isomorphic binary structures; Groups; Sub groups (Sections 2, 3, 4 & 5).

Module II (25 hrs)

Cyclic groups; Groups and permutations; Orbits, cycles and Alternating groups (Sections 6, 8 & 9).

Module III (15 hrs)

Cosets and Theorem of Lagrange;

Homomorphisms (Sections 10 & 13).

Module IV (30 hrs)

Rings and Fields; Integral Domains (Sections 18, 19).

References

1. Joseph A. Gallian : Contemporary Abstract Algebra. Narosa Pub. House.

2. P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul: Basic Abstract Algebra, 2nded., Cambridge University Press.

3. Artin : Algebra, PHI.

6. Durbin : Modern Algebra : An Introduction, 5th ed., Wiley.

FIFTH SEMESTER

VMT5B07 : BASIC MATHEMATICAL ANALYSIS

5 hours/week 5 credits

Text 1 : Robert G. Bartle & Donald R. Sherbert : Introduction to Real Analysis, 3rd ed., Wiley.

Text 2 : J.W. Brown and Ruel V. Churchill : Complex Variables and Applications, 8th Ed., McGraw Hill.

Module I (20 hrs)

A quick review of sets and functions ,Mathematical induction ,Finite and infinite sets

Real Numbers ,The algebraic property of real numbers

(Sec. 1.1, 1.2, 1.3, 2.1 of text 1)

Module II (20 hrs)

Absolute value and real line ,The completeness property of R ,Applications of supremum property

Intervals, Nested interval property and uncountability of R

(Sec 2.2, 2.3, 2.4 and 2.5 of text 1)

Module III (30 hrs)

Sequence of real numbers, Sequence and their limits, Limit theorems, Monotone sequences

Subsequence and Bolzano – Weirstrass theorem, Cauchy criterio, Properly divergent sequences.

Open and closed sets

(Sec. 3.1, 3.2, 3.3, 3.4, 3.5, 3.6 and 11.1 of text 1)

Module IV : Complex Numbers (20 hrs)

Sums and Products; Basic Algebraic properties; Further properties, Vectors and Moduli; Complex conjugates; Exponential form; Product and powers in exponential form; Arguments of products and quotients; Roots of complex numbers; Regions in the complex plane,
Functions of complex variable, limits, theorems on limits, limits involving the points at infinity, Continuity.
(Sections 1 to 11 of Chapter 1, sections 12, 15 to 18 of chapter 2 from Text 2)

References

1. J.M. Howie : Real Analysis, Springer 2007.

2. Ghorpade and Limaye : A Course in Calculus and Real Analysis, Springer, 2006.

3. K.A. Ross : Elementary Real Analysis : The Theory of Calculus, Springer Indian Reprint.

4. J.V. Deshpande : Mathematical Analysis and Applications, Narosh Pub. House.

5. M.R. Spiegel : Complex Variables, Schaum's Outline Series.

FIFTH SEMESTER

VMT5B08 : DIFFERENTIAL EQUATIONS

5 hours/week 4 credits

Text Book :

1. W.E. Boyce & R.C. Diprima, Elementary Differential Equations and Boundary Value Problems. John Wiley & Sons, 7th Edn.
2. Ian Sneddon – Elements of Partial Differential Equations (Tata Mc Graw Hill)

Module I (24 hrs)

(a) Introduction, Some Basic Mathematical Models; Direction Fields, Solutions of some Differential equations, Classification of Differential Equations, Historical Remarks.

(Chapter 1, Sec. 1.1, 1.2, 1.3, 1.4)

(b) First order differential equations

Linear equations with variable coefficients , Separable equations, Modeling with first order equations , Differences between linear and non linear equations, Exact equations and integrating factors , The existence and uniqueness theorem (proof omitted)
(Chapter 2 – Sec. 2.1, 2.2, 2.3, 2.4, 2.6, 2.8)

Module II (29 hrs)

(a) Second Order Linear Differential Equations

Homogeneous equation with constant coefficients, Fundamental solutions of Linear Homogeneous equations, Linear independence and Wronskian, Complex roots of characteristic equations, Repeated roots; Reduction of order, Non homogeneous equations; Method of Undetermined coefficients, Variation of parameters, Mechanical and Electrical vibrations(upto and including e.g. 1)
(Chapter 3 – Sec. 3.1 to 3.8)

(b) Systems of First Order Linear equations

Introduction , Basic theory of systems of first order Linear Equations

(Chapter 7 – Sec. 7.1, 7.4)

Module III : Laplace Transforms (17 hrs)

Definition of Laplace Transforms , Solution of Initial Value Problem , Step functions , Impulse functions, The Convolution Integral

(Chapter 6 – Sec. 6.1, 6.2, 6.3, 6.5, 6.6)

Module IV : Partial Differential Equations (20 hrs)
Surfaces and Curves in three dimensions, solution of equation of the form

$dx/P = dy/Q = dz/R$, origin of first order and second order partial differential equations, Linear equations of the first order, Lagrange's method.

(Chapter 1 – Sec.1 and 3, Chapter 2- Section 1, 2 and 4 of Text2)

References

1. S.L. Ross : Differential Equations, 3rd ed., Wiley.

2. A.H. Siddiqi & P. Manchanda : A First Course in Differential Equation with Applications, Macmillan, 2006.

3. E.A. Coddington : An Introduction to Ordinary Differential Equation, PHI.

4. G.F. Simmons : Differential Equation with Application and Historical Notes, Second ed.

5. M. Braun : Differential Equations and their Applications, Springer.

SIXTH SEMESTER

VMT6B09 : REAL ANALYSIS

5 hours/week 5 credits

Text :

1. G. Bartle, Donald R. Sherbert : Introduction to Real Analysis (3rd Edn.)

2. R.R. Goldberg : Methods of Real Analysis.

3. Narayanan& Manicavachagom Pillay : Calculus, Vol. II

Module I : Continuous Functions (25 hrs)

Continuous functions (a quick review), Continuous functions on intervals , Uniform continuity

(Sec. 5.3, 5.4 of text 1)

Module II : Riemann Integral (25 hrs)

Riemann Integral , Riemann Integrable Functions , The fundamental theorem , Substitution theorem and application, Approximate Integration
(Sec. 7.1, 7.2, 7.3, 7.4 of text 1)

Module III : Sequence and series of functions (20 hrs)

A quick review of series of real numbers, Pointwise and uniform convergence, Interchange of limit and continuity, Series of functions .
(8.1, 8.2.1, 8.2.2, 9.4.1, 9.4.2, 9.4.5, 9.4.6 of text 1)

Module IV (20 hrs)

Improper Integrals

Improper integrals of the first kind, Improper integrals of the second kind, Cauchy Principal value, Improper Integrals of the third kind.
(Sections: 7.9, 7.10 of text 2)

Beta and Gamma functions

Beta Functions, Gamma Functions, Relation between Beta and Gamma Functions

(Chapter IX, Sec: 2.1, 2.2, 2.3, 3, 4, 5 of text 3)

References

1. J.V. Deshpande: Mathematical Analysis and Applications, Narosa Pub. House.

2. TorenceTao : Analysis I, TRIM 37, Hindustan Book Agency.

3. K.A. Ross: Elementary Real Analysis : Theory of Calculus, Springer.

4. K.G. Binmore: Mathematical Analysis, CUP.

SIXTH SEMESTER

VMT6B10 : COMPLEX ANALYSIS

5 hours/week 5credits

Text : James Ward Brown and Ruel V. Churchill : Complex Variables and Applications (8th Edn.), McGraw Hill.

Module I : Analytic Functions (24 hrs)

Functions of complex variable, Limits Theorems on limits, Limits involving the points at infinity, Continuity derivatives, Differentiation formula, Cauchy-Riemann Equations, Polar coordinates, Analytic functions, Harmonic functions (Sec: 12, 15 to 26 of Chapter 2)

Elementary functions

The exponential function, Logarithmic function, Complex exponents, Trigonometric functions, Hyperbolic functions, Inverse Trigonometric and Hyperbolic functions.

(Sec. 29 to 36 of Chapter 3)

Module II : Integrals (22 hrs)

Derivatives of functions $\omega(t)$; Indefinite integral of $\omega(t)$; Contours, Contour integrals, Antiderivatives, Cauchy-Goursat theorem (without proof), Simply and multiply connected domains, Cauchy's integral formula and its extension, Liouville's theorem and fundamental theorem of algebra, Maximum modulus principle.

(Sec: 37 to 54 excluding 42, 47 of Chapter 4)

Module III : Series (22 hrs)

A quick review of convergence of sequence and series of complex numbers.

Taylor series, Laurents series (without proof), Applications.

Power series: Absolute and uniform convergence. Continuity of sum of power series, Differentiation and integration of power series, Multiplication and division of power series.

(Sec: 55 to 60 & 62 to 67 of Chapter 5).

Module IV : Residues (22 hrs)

Isolated singular points, Residues, Cauchy's residue theorem, Residue at infinity, Three types of isolated singular points, Residues at poles, Zeroes of analytic functions, Zeroes and poles.

(Sec: 68 to 76 of Chapter

6). Applications of residues

Evaluation of improper integrals, Jordan's Lemma (statement only),

Definite integrals involving sines and cosines.

(Sec: 78, 79, 80 and 85 of Chapter 7).

References

1. Mark J.Ablowitz and Anthanassios S. Fokas: Complex Variables, Cambridge Text, 2nd Edn.

2. S. Ponnusamy : Foundation of Complex Analysis : Narosa.

3. Murray R. Spiegel: Complex Variables, Schaum's Outline series.

4. J.M. Howie: Complex Analysis: Springer India Reprint.

5. Stewart & Tall: Complex Analysis, CUP

SIXTH SEMESTER

VMT6B11 : NUMERICAL METHODS

5 hours/week 4 credits

Text :

S.S. Sastry : Introductory Methods of Numerical Analysis, Fourth Edition, PHI.

Module I : Solution of Algebraic and Transcendental Equation (23 hrs)

2.1 Introduction, 2.2 Bisection Method, 2.3 Method of false position, 2.4 Iteration method

2.5 Newton-Raphson Method, 2.6 Ramanujan's method , 2.7 The Secant Method ,

Finite Differences

3.1 Introduction , 3.3.1 Forward differences , 3.3.2 Backward differences , 3.3.3 Central differences, 3.3.4 Symbolic relations and separation of symbols , 3.5 Differences of a polynomial

Module II : Interpolation (23 hrs)

3.6 Newton's formulae for intrapolation, 3.7 Central difference interpolation formulae , 3.7.1 Gauss' Central Difference Formulae , 3.9 Interpolation with unevenly spaced points , 3.9.1 Langrange's interpolation formula , 3.10 Divided differences and their properties , 3.10.1 Newton's General interpolation formula ,3.11 Inverse interpolation ,
Numerical Differentiation and Integration

5.1 Introduction , 5.2 Numerical differentiation (using Newton's forward and backward formulae)

5.4 Numerical Integration , 5.4.1 Trapizaoidal Rule , 5.4.2 Simpson's 1/3-Rule , 5.4.3 Simpson's 3/8-Rule

Module III : Matrices and Linear Systems of equations (22 hrs)

6.3 Solution of Linear Systems – Direct Methods , 6.3.2 Gauss elimination , 6.3.3 Gauss-Jordan Method, 6.3.4 Modification of Gauss method to compute the inverse , 6.3.6 LU Decomposition, 6.3.7 LU Decomposition from Gauss elimination

6.4 Solution of Linear Systems – Iterative methods , 6.5 The eigen value problem , 6.5.1

Eigen values of Symmetric Tridiazonal matrix

Module IV : Numerical Solutions of Ordinary Differential Equations (22 hrs)

7.1 Introduction , 7.2 Solution by Taylor's series , 7.3 Picard's method of successive approximations , 7.4 Euler's method , 7.4.2 Modified Euler's Method, 7.5 Runge-Kutta method 7.6 Predictor-Corrector Methods , 7.6.1 Adams-Moulton Method , 7.6.2 Milne's method

References

1. S. Sankara Rao : Numerical Methods of Scientists and Engineer, 3rd ed., PHI.

2. F.B. Hidebrand : Introduction to Numerical Analysis, TMH.

3. J.B. Scarborough : Numerical Mathematical Analysis, Oxford and IBH

SIXTH SEMESTER

VMT6B12 : NUMBER THEORY AND LINEAR ALGEBRA

5 hours/week 4 credits

Text Books:

1. David M. Burton : Elementary Number Theory, Sixth Edn., TMH.

2. T. S. Blynth and E.F. Robertson: Basic Linear Algebra, second Edn springer under graduate mathematics series 2009

Module I – Theory of Numbers (30 hrs)

Divisibility theory in the integers – the division algorithm, the greatest common divisor, the Euclidean algorithm, the Diophantine equation ax + by = c. Primes and their distribution. The fundamental theorem of arithmetic. The sieve of Eratosthenes. The theory of congruences. Basic properties of congruence. Binary and decimal representation of integers. Linear congruences and Chinese remainder theorem.
(Sections 2.2, 2.3, 2.4, 2.5, 3.1, 3.2, 4.2, 4.3 & 4.4 of Text 1).

Module II (25 hrs)

Fermat's little theorem and pseudoprimes Wilson's theorem. The sum and number of divisors. The greatest integer function. Euler's phi-function. Euler's generalization of Fermat's theorem. Properties of the phi-function.
(Sections 5.2, 5.3, 6.1, 6.3, 7.2, 7.3 and 7.4 of Text 1) (Theorems 7.6 and 7.7 only).

Module III (15 hrs)

Vectorspaces - examples, linear combinations, spanning, linear independence, base, finite dimensional vector spaces
(All Sections in chapter 5 of text 2)

Module IV (20 hrs)

Linear mappings- Linear transformations, examples, nullspace, rank –nullity theorem, linear isomorphism.
(All Sections in chapter 6 of text 2)

References

1. C.Y. Hsiung : Elementary Theory of Numbers. Allied Publishers.

2. Neville Robbins : Beginning Number Theory, Second Ed. Narosa.

3. George E. Andrews : Number Theory, HPC.
4. Kenneth Hoffman & Ray Kunze : Linear Algebra, Pearson Education.

5. Frank Ayres, Jr. : Matrices, Schaum's Outline Series, Asian Student edition.

6. Devi Prasad : Elementary Linear Algebra, Narosa Pub. House.

B.Sc. DEGREE PROGRAMME
MATHEMATICS (ELECTIVE COURSE)
SIXTH SEMESTER

VMT6E02 : GRAPH THEORY

3 hours/week **2 credits**

Text :S. Arumugham& S. Ramachandran : Invitation to Graph Theory, Scitech Publications, Chennai-17.

AIM AND OBJECTIVE

In the last three decades graph theory has established itself as a worthwhile mathematical discipline and there are many applications of graph theory to a wide variety of subjects which include Operations Research, Physics, Chemistry, Economics, Genetics, Sociology, Linguistics, Engineering, Computer Science, etc.

Module I (17 hrs)
Isomorphic graphs, Ramsey numbers, Independent sets and Coverings, Intersection graphs and line graphs, Operation on graphs, Walks, Trials and Paths, Connected components, Blocks, Connectivity
sections 2.4, 2.5, 2.6, 2.7, 2.9, 4.0, 4.1, 4.2, 4.3,4.4.

Module II (10 hrs)
Eulerian and Hamiltanian graphs (omit Fleury's Algorithm) Trees
Sections : 5.0, 5.1, 5.2 (only upto and not including Theorem 5.5), 6.0, 6.1, 6.2.

Module III (10 hrs)
Matchings and Planarity
Sections 7.0, 7.1, 7.2, 8.0, 8.1, 8.2

Module IV (17 hrs)
Colourability, Chromatic numbers, Fivecolour theorem, Chromatic polynomials, Directed graphs, Paths and Connectedness.
Sections: 9.0, 9.1, 9.2, 9.4, 10.0, 10.1, 10.2.

References

1. R.J. Wilson: Introduction to Graph Theory, 4th ed., LPE, Pearson Education.
2. J.A. Bondy& U.S.R. Murty : Graph Theory with Applications.
3. J. Clark & D.A. Holton: A First Look at Graph Thoery, Allied Publishers.
4. N. Deo : Graph Theory with Application to Engineering and ComputerScience, PHI.

B.Sc. DEGREE PROGRAMME
MATHEMATICS (ELECTIVE COURSE)
SIXTH SEMESTER

VMT6 E01 : LINEAR PROGRAMMING

3 hours/week **2 credits**

Text Book : Gupta and Manmohan - Linear Programming And Theory of Games

MODULE 1:

Formulation, Convex sets, General LLP
(Section 0.4, 1..6, 1.7 , 1..8, chapter 2, chapter 3)

MODULE 2:

Simplex Method, Duality
(Section 4.6, 5.1, 5.2, 5.3, 5.4, 6.1, 6.2, 6.3, 6.4 (Theorem 1)

MODULE 3 :

The transportation problem, The assignment Problems
(Section 11.1 to 11-.11, 11.14, 12.1 to 12.4 |

References

1. K. V. Mital & Manmohan: Optimization methods in Operations Research and Systems Analysis, 3rd Edn., New Age International publishers.
2. Dipak Chatterjee: Linear Programming and Game Theory, Prentice Hall of India.

B.Sc. DEGREE PROGRAMME
MATHEMATICS (ELECTIVE COURSE)
SIXTH SEMESTER

VMT6E03 : C PROGRAMMING FOR MATHEMATICAL COMPUTING

3 hours/week **2 credits**

Course Requirements:

Basic familiarity with computer.

A C compiler (Turbo C or Turbo C++) to do the Assignments in the course.

Course Goals

Students who complete this course will:

1. Have the basic skills required for computer programming.
2. Learn to write, compile and debug a C program
3. Be able to solve Mathematical problems using C programs
4. Introduce how to use C for drawing graphs and use mathematical models.

Course Contents

The course has Theory Part and Practical Part. The total periods for the course is 54 hrs of which 36 hrs for theory and 18 hrs for practical. Theory part focus on learning C Language to solve mathematical problems as listed in the Annexure 1. As and when various structures in C Language are discussed take examples from mathematics background as far as possible and conduct lab sessions to reinforce the idea. The Practical sessions are for testing the programs with the help of a C/C++ compiler. For entertaining free software, use Linux environment.

A student must keep with the computer output obtained. He/She is expected to do a minimum of 12 programs selected from the list. (As shown in Annexure I) besides some other suitable sample programs to understand the style of C programming.

The student has to maintain an observation note book and a practical record. Of the 3 periods per week 2 are for theory class and 1 is for practical session.

The University will conduct only theory examination, but Practical examination should be conducted internally and this should be considered for internal mark. For internal assessment minimum three tests, of which one should be practical test, may be conducted.

Theory Session (36 hrs)

Text Books

1. E. Balaguruswamy : Programming in Ansi C, Tata McGraw Hill.

1. Basavaraj S. Anami, Shanmughappa, A., Angadi S. &Sunilkumar S. Manvi : Computer Concepts and Programming (A Holistic Approach to Learning C), Prentice Hall of India.

Module I (9 hrs)

Program Fundamentals: Computer Languages – Operating System – Compilation of Program – Different Types of Errors – Debugging of programs – Rewriting and Program Maintenance – Program Life Cycle (Text Book 2 – A quick review of Chapter 1 section 1.5).

Algorithms and Flow Charts: Algorithms and their characteristics – Flow Charts and their Uses – Advantages and Drawbacks of Flow Charts. (A quick view of Text Book 2 – Chapter 2 – All sections).

Overview of C: History of C – Importance of C – Sample programs – Basic Structure of a C Program – Programming Style – Executing C Program – DOS System (Text Book 1 – Chapter 1 – Section 1.1 to 1.12).

Constants, Variables and Data Types: Introduction – Character set – Keywords and Identifiers – Constants – Variables – Data Types – Declaration of storage class – Declaration of variables (Primary and User defined) – Assigning Values to variables – Symbolic constants (Text Book 1 – Chapter 2 – Sections 2.1 to 2.13).

Module II (9 hrs)

Operators and Expressions: Introduction – Arithmetic operators – Relational operators – Logical operators – Increment and Decrement operators – Conditional Operators – Arithmetic Expression – Evaluation of Expressions – Precedence of Operators – Some Computational Problems – Type Conversions in Expressions – Mathematical Functions (Text Book 1 – Chapter 3 – Sections 3.1 to 3.7 and 3.10 to 3.16).

Managing Output Operations: Introduction – Reading and writing a character and a string – Formatted Input – Formatted Output – Use of %c, %d, %e, %f, %s – (Text Book 1 – Chapter 4 – Sections 4.1 to 4.5).

Module III (9 hrs)

Decision Making and Branching: Introduction – If Statements (Simple if, if-else, nested if, ladder if) – Switch Statement – Conditional Operator – Go to Statement (Text Book 1 – Chapter 5 – Sections 5.1 to 5.9).

Decision Making and Looping: Introduction – While Statement – Do-while Statement – For Statement – Use of break, goto, continue in control statements (Text Book 1 – Chapter 6 – Sections 6.1 to 6.5).

Module IV (9 hrs)

Arrays: Introduction – One Dimensional Arrays – Two Dimensional Arrays – Initialization of arrays – Multi Dimensional Arrays (Text Book 1 – Chapter 7 – Sections 7.1 to 7.9).

User Defined Functions: Introduction – Need for user defined functions – The form of C functions – Return of values – Calling a function – category of functions – Recursion – Function with arrays (Text Book 1 – Chapter 9 – Sections 9.1 to 9.10 and 9.16, 9.17, 9.18).

References

1. K.R. Venugopal&Sudeer R. Prasad : Programming with C, Tata McGraw Hill.
2. YashhantKanetkar : Let us C, BPB Publication.
3. Byron Gottereid : Programming with C, Tata McGraw Hill.
4. V. Rajaraman : Computer Programming, Prentice Hall of India.

Lab Sessions (18 hrs)

All the concepts in the theory sessions must be tested on a computer using a C compiler. A minimum of 12 problems from the list given in the Annexure I must be solved using C programming technique. A student should keep a practical record of the problem given by the teacher, algorithm, program and the output obtained in the lab session.

Practical Examination

The practical examination of 1 hour duration is only for internal assessment.

Annexure I

List of Numerical Problems

Section A (minimum 4)

1. Find GCD / LCM of two numbers.
2. Find the factorial of a number using recursion.
3. Check whether a number is prime or not
4. Reverse a n-digit number.
5. Find the sum of a set of numbers.
6. Write First n multiple of 7.
7. Find the maximum of two numbers using a function program.
8. Add two matrices / transpose a matrix.

Section B (minimum 5)

1. Find the maximum and the minimum of n numbers
2. Find the sum of the squares of first n natural numbers using loop
3. Find the number of above average student based on their mathematics marks
4. Multiply two matrices
5. Find the sum of digits of a n-digit number
6. Find the first n Fibonacci numbers
7. Evaluate Trigonometric / logarithmic / exponential function for a given x using its infinite series
8. Solve a given quadratic equation
9. Find the mean and standard deviation of a set of marks
10. Arrange a set of numbers in ascending / descending order.

Section C (minimum 3)

1. Integrate a function using trapezoidal rule
2. Solve a first order differential equation using Euler's method
3. Find a real root, if any, of polynomial equation using Bisection method.
4. Solve a first order differential equation using by Rung-Kutta method
5. Newton-Raphson's Method
6. Integrate a function using Simpson's rule.

B.Sc. DEGREE PROGRAMME
MATHEMATICS (ELECTIVE COURSE)
SIXTH SEMESTER

VMT6E04: INFORMATICS AND MATHEMATICAL SOFTWARES

3 hours/week **2 credits**

Text books:

1. Text Book : Peter Norton: Introduction to Computers, 6th ed., McGraw Hill.
2. Python Tutorial Release 2.6.1 by Guido van Rossum, Fred L. Drake, Jr., editor. This Tutorial can be obtained from website (http://www.altaway.com/resources/python/tutorial.pdf)

Module I – Introduction to Computers (9 hrs)

Chapters 1 to 10 from the text.

Chapters 1 : Introduction to computers.

(a) Exploring computers and their use

(b) Looking inside computer system. Chapters

2 : Interacting with your computer

(a) Using keyboard and mouse

(b) Inputing data in other ways.

Chapters 3 : Seeing, hearing and printing data

(a) Video and sound

(b) Printing

Chapters 4 : Processing data

(a) Transforming data into information

(b) Modern CPUs.

Chapters 5 : Storing data

(a) Types of storage devices. Chapter 6

: Using operating systems.

(a) Operating system basics.

(b) Survey of PC and Network operating systems.

Chapter 7 : Networks

(a) Networking basics

(b) Data communications. Chapter 8

: Presenting the Internet

(a) The Internet and the world wide web.

(b) E-mail and other Internet Services

Chapters 9 : Working in the on-line world.

(a) Connecting to the Internet

(b) Doing Business in the on-line world.

Chapters 10 : Working with application software.

(a) Productivity software

(b) Graphics and Multimedia (Chapters 1 to 10 of Text 1).

Module II : Preliminaries of Python Programming (21 hrs including practicals)

Using the Python Interpreter.An Informal Introduction to Python. More Control Flow Tools. Data Structures.Modules. Input and Output (Chapters 1 to 7 of Text 2).

Module III : Advanced Python Programming (21 hrs including practicals)

Errors and Exceptions.Classes.Brief Tour of the Standard Library. Brief Tour of the Standard Library – Part II. Interactive Input Editing and History Substitution. Floating Point Arithmetic: Issues and Limitations (Chapters 8 to 14 of Text 2).

B.Sc. DEGREE PROGRAMME

MATHEMATICS (OPEN COURSE)
FIFTH SEMESTER

(For students not having Mathematics as Core Course)

VMT5D01 : MATHEMATICS FOR SOCIAL SCIENCES

3 hours/week **2 credits**

Text Book: Edward T. Dowling : Calculus for Business, Economics and Social

Sciences, Schaum's Outline Series, TMH, 2005.

Module I : Equations and Graphs (27 hrs)

2.1 Equations
2.2 Cartesian Coordinate System
2.3 Graphing linear equations
2.4 The slope of art line
2.5 Solving linear equations simultaneously
2.6 Solving quadratic equations
2.7 Practical applications

Functions

3.1 Concepts and definitions
32. Functions and graphs
3.3 The Algebra of Functions
3.4 Applications of linear functions
3.5 Facilitating non-linear graphs
3.6 Applications of non-linear functions- The derivative

4.1 Limits
4.2 Continuity
4.3 Slope of a Curvilinear function
4.4 Rates of change
4.5 The derivative
4.6 Differentiability and Continuity
4.7 Application

Differentiation

5.1 Derivative rotation
5.2 Rules of differentiation

5.3 Derivation of the rules of differentiation
5.4 Higher order derivatives
5.5 Higher order derivative notation
5.6 Implicit differentiation
5.7 Applications

Module II : Uses of Derivative (27 hrs)

6.1 Increasing and decreasing functions
6.2 Concavity
6.3 Extreme points
6.4 Inflection points
6.5 Curve sketching

Exponential and Logarithmic functions

7.1 Exponential functions
7.2 Logarithmic functions
7.3 Properties of exponents and logarithms
7.4 Natural exponential and Logarithmic functions
7.5 Solving natural exponential and logarithmic functions.
7.6 Derivatives of natural exponential and logarithmic functions.
7.7 Logarithmic differentiation

7.8 Applications of exponential functions

7.9 Application of Logarithmic functions Integration

Anti differentiation
8.1 Rules for indefinite integrals Multivariable Calculus

Functions of several variables

9.1 Partial derivatives

9.2 Rules of partial differentiation

9.3 Second order partial derivatives

More of Integration

10.1 Integration by substitution
10.2 Integration by parts

References

1. Srinath Baruah : Basic Mathematics and its Applications in Economics, Macmillan.

2. Taro Yamane: Mathematics for Economists, Second ed., PHI.

B.Sc. DEGREE PROGRAMME

MATHEMATICS (COMPLEMENTARY COURSE)

FIRST SEMESTER

VMAT 1C01 : MATHEMATICS

4 hours/week **3 credits**

Text : George B. Thomas Jr. and Ross L. Finney : Calculus, LPE, Ninth edition, Pearson Education.

Module I (20 hrs)

Limits and Continuity: Rules for finding limits. Target values and formal definitions of limits.

Extensions of limit concept, Continuity, Tangent lines (Section 1.2, 1.3, 1.4, 1.5 & 1.6 of the Text).

Module II (12 hrs)

Derivatives: The derivative of a function, a quick review of differentiation rules, rate of change.

(Section 2.1, 2.2, 2.3 of the Text)

Module III (24 hrs)

Application of derivatives: Extreme values of a function. The mean value theorem, First

derivative test, Graphing with y' and y". Limits as x Linearization and differentials (Section 3.1, 3.2, 3.3, 3.4, 3.5, 3.7 of the Text). The L'Hopital's

rule (See section 6.6 of the Text).

Module IV (16hrs)

Integration: Integral as an anti derivative, Indefinite Integral and constant of integration,

Fundumental theorems , Elementary Standard results, Methods of Integration ,Integration

through partial Fraction , Integration by parts , Definite integral , Evaluation by substitution,

Properties of Definite Integrals (Problem based)

References

1. S.S. Sastry, Engineering Mathematics, Volume 1, 4^{th} Edition PHI.

2. Muray R Spiegel, Advanced Calculus, Schaum's Outline series.

B.Sc. DEGREE PROGRAMME

MATHEMATICS (COMPLEMENTARY COURSE)

SECOND SEMESTER

VMAT2C02 : MATHEMATICS

4 hours/week **3 credits**

Text: George B Thomas, Jr and Ross L Finney: CALCULUS, LPE, Ninth edition, Pearson Education.

Module I: Hyperbolic functions, Application of Integrals and Improper Integrals, (24 hrs)

Hyperbolic Functions- Definitions and Identities, Derivatives and Integrals, Inverse Hyperbolic Functions- Derivatives and Integrals.

Application of Integrals : Areas , Areas between curves, Finding Volumes by slicing Volumes of Solids of Revolution (Disk method only), Lengths of plane curves. Areas of surfaces of revolution

Improper Integrals- Convergence and Divergence, Tests for Convergence and Divergence- Direct Comparison Test and Limit Comparison Test

(Section: 5.3, 5.5, 5.6 , 6.10 & 7.6 of the Text)

ModuleII: Infinite Series (28 hrs)

Limit of Sequences of Number, Theorems for calculating limits of sequences (Excluding Picard's Method), Infinite series, The ratio and root test for series of non negative terms, Alternating series, Absolute and conditional convergence, Power Series, Taylor and Maclaurin Series.

(Sections 8.1, 8.2, 8.3, 8.6, 8.7, 8.8, 8.9 of the Text)

Module III : Polar Coordinates (10 hrs)

Polar coordinates, Graphing in Polar Coordinates, Polar equations for conic sections, Integration in Polar coordinates, Cylindrical and Spherical Coordinates.

(Sections 9.6, 9.7, 9.8, 9.9, 10.7 of the Text)

Module IV : Multivariable Functions and Partial Derivatives (10 hrs)

Functions of Several Variables, Limits and Continuity, Partial Derivatives, differentiability, Chain rule (Sections 12.1, 12.2, 12.3, 12.4, 12.5 of the Text)

References

1. S.S. Sastry, Engineering Mathematics, Volume I & II, 4th Edition PHI.
2. Murray R. Spiegel, Advanced Calculus, Schaum's Outline Series.

B.Sc. DEGREE PROGRAMME

MATHEMATICS (COMPLEMENTARY COURSE)

THIRD SEMESTER

VMAT3C03 : MATHEMATICS

5 hours/week **3 credits**

Text :

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

2. Frank Ayres JR : Matrices, Schaum's Outline Series, TMH Edition.

3. Thomas / Finney : Calculus, 9th ed., LPE, Pearson Education.

Module I : Ordinary Differential Equations (20 hrs)

Basic concepts and ideas, Geometrical meaning of y' = f(x,y). Direction Fields, Separable Differential Equations. Exact Differential Equations; Integrating Factors, Linear Differential Equations; Bernoulli Equation, Orthogonal Trajectories of Curves.

(Sections 1.1, 1.2, 1.3, 1.5, 1.6, 1.8 of Text 1).

Module II : Matrices (20 hrs)

Rank of a Matrix, Non-Singular and Singular matrices, Elementary Transformations, Inverse of an elementary Transformations, Row Canonical form, Normal form.

Systems of Linear equations: Homogeneous and Non Homogenoeus Equations, Characteristic equation of a matrix; Characteristic roots and characteristic vectors. Cayley-Hamilton Theorem (statement only) and simple applications (relevant sections of Text 2).

Module III : Vector Differential Calculus (25 hrs)

A quick Review of vector algebra, Inner product and vector product in R^2 and R^3 .Vector and scalar functions and Fields, Derivatives, Curves, Tangents, Arc Length, Velocity and acceleration, Gradient of a scalar field; Directional Derivative, Divergence of a vector field, Curl of a Vector Field.

(Sections 12 of Text 3)

Module IV : Vector Integral Calculus (25 hrs)

Line Integrals, Independence of path, Green's Theorem in the Plane (without proof), surfaces for Surface Integrals, Surface Integrals, Triple Integrals, Divergence theorem of Gauss and Stoke's

theorem (without proofs).

(Section 13,14 of Text 3)

References :

1. S.S. Sastry, Engineering Mathematics, Volume II, 4^{th} ed., PHI.

2. Shanthi Narayanan & P.K. Mittal, A Text Book of Matrices, S. Chand.

3. Harry F. Davis & Arthur David Snider, Introduction to Vector Analysis, 6^{th} ed., Universal Book Stall, New Delhi.

4. Murray R. Spiegel, Vector Analysis, Schaum's Outline Series, Asian Student edition.

B.Sc. DEGREE PROGRAMME

MATHEMATICS (COMPLEMENTARY COURSE)

FOURTH SEMESTER

VMAT4C04 : MATHEMATICS

5 hours/week **3 credits**

Texts:

1. Erwin Kreyszig, Advanced Engineering Mathematics, Eighth Edition, Wiley, India.

2. George B. Thomas, Jr. and Ross L. Finney, Calculus, LPE, Ninth Edition, Pearson Education.

Module I: Linear Differential equations of Second and Higher order (20hrs)

Linear Differential equations of Second and Higher order: Differential Operators, Euler-Cauchy Equation, Wronskian, Nonhomogeneous Equations, Solutions by Undetermined Coefficients, Solution by variation of Parameters.

(Sections 2.1, 2.2, 2.3, 2.4, 2.6, 2.7, 2.8, 2.9, 2.10 of Text 1).

Module II: **Laplace Transforms (20 hrs)**

Laplace Transforms: Laplace Transform, Inverse Transform, Linearity, Shifting, Transforms of Derivatives of Integrals, Differential Equations. Unit step Function, Second Shifting Theorem, Dirac Delta Function, Differentiation and integration of Transforms, Convolution, Integral Equations, Partial Fractions, Differential Equations.

(Sections 5.1, 5.2, 5.3, 5.4, 5.5, 5.6 of Text 1 – excluding Proofs).

Module III : Fourier Series ,Partial differential Equations(30 hrs)

Fourier Series : Periodic Functions, Trigonometric Series, Fourier Series, Even and Odd functions, Half-range Expansions.

(Sections 10.1, 10.2, 10.4 of Text 1 – Excluding Proofs).

Partial differential Equations: Basic Concepts, Vibrating String, Wave Equation, Separation of Variables, Use of Fourier Series.

(sections 11.1, 11.2, 11.3 of Text 1).

Module IV: Numerical Methods (20 hrs)

Numerical Methods: Methods of First-order Differential Equations (Section 19.1 of Text 1).

Picard's iteration for initial Value Problems.(Section 1.9 of Text 1).

Numerical Integration: Trapezoidal Rule, Simpson's Rule. (Section 4.9 of Text 2).

References:

1.S.S. Sastry, Engineering Mathematics, Vol. II, 4^{th} ed., PHI.

2. Murray R. Spiegel, Advanced Calculus, Schaum's Outline Series.

3. Murray R. Spiegel, Laplace Transforms, Schaum's Outline Series.