

UNIVERSITY OF CALICUT

(Abstract)

B.Sc programme in Mathematics – School of Distance Education/Private mode - under Choice Based Credit Semester System (UG)-Scheme and Syllabus - approved –implemented-with effect from 2011 admission-Orders issued

GENERAL & ACADEMIC BRANCH-IV ‘J’ SECTION

No. GA IV/J2/5106/10

Calicut University PO, Dated

18.07.2011

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- Read:**
- 1. U.O.No. GAIV/J2/3601/08 dated, 17.02.2010.**
 - 2. U.O.No. GAIV/J2/3601/08 Vol IV dated, 10.05.2011.**
 - 3. U.O.No.GAIV/J2/5106/10 dated 01.06.2011.**
 - 4. Item No. 1 of the minutes of the meeting of the Board of Studies in Mathematics UG held on 29.03.2011.**
 - 5. Orders of the Vice-Chancellor on 18.05.2011 in the file of even no.**

ORDER

As per University Order read as first, Choice based Credit Semester System was implemented for UG programmes under the School of Distance Education and Private mode of the University with effect from 2011-12 admission.

The syllabi of programmes under School of Distance Education/Private mode was equalised with that of Regular programmes under Choice based Credit Semester System UG and was implemented vide paper read as second above.

Vide paper read as 3rd, “MATHEMATICS FOR SOCIAL SCIENCE” was implemented as open course for other degree programmes under Choice based Credit Semester System (UG) in School of Distance Education and Private mode.

The Board of Studies in Mathematics UG vide paper read as 4th above, finalized the syllabus of B.Sc. programme in Mathematics under Choice based Credit Semester System UG of the School of Distance Education and Private mode.

The Vice-Chancellor considering the exigency, exercising the powers of the Academic Council approved the minutes subject to ratification by the Academic Council.

Sanction has therefore been accorded for implementing the scheme and Syllabus of B.Sc programme in Mathematics under Choice based Credit Semester System UG 2010 in School of Distance Education and Private mode with effect from 2011 admission.

Orders are issued accordingly. Scheme and Syllabus appended.

Sd/-

ASSISTANT REGISTRAR (G&A-IV)

To

For REGISTRAR

**The Director,
School of Distance Education,
University of Calicut.**

Forwarded/By Order

Copy to:

**PS to VC, PA to Registrar, Chairman,
B/S Mathematics UG, CE, EX, DR III,
EGI, Enquiry, System Administrator
(with a request to upload in the University web
Information Centres, GAI`F`G`, GAI, III/
SF/FC/DF**

SECTION OFFICER

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UNIVERSITY OF CALICUT

SCHOOL OF DISTANCE EDUCATION

**B.Sc. DEGREE PROGRAMME
CHOICE BASED CREDIT SEMESTER SYSTEM (CCSS UG)**

**CORE AND COMPLEMENTARY COURSES
SYLLABUS**

(effective from 2011 admission onwards)

UNIVERSITY OF CALICUT

SCHOOL OF DISTANCE EDUCATION

**B.Sc. DEGREE PROGRAMME
CHOICE BASED CREDIT SEMESTER SYSTEM (CCSS UG)
MATHEMATICS (CORE COURSE)**

SYLLABUS

(effective from 2011 admission onwards)

DETAILS OF MATHEMATICS (CORE COURSE)

Sl. No.	Code	Semester	Title of the Course	Contact Hrs/Week	No. of Credit		Weightage
1	MM1B01	1	Foundations of Mathematics	4	4		30
2	MM2B02	2	Informatics and Mathematical Softwares	4	4		30
3	MM3B03	3	Calculus	5	4		30
4	MM4B04	4	Calculus and Analytic Geometry	5	4		30
5	MM5B05	5	Vector Calculus	5	4		30
6	MM5B06	5	Abstract Algebra	5	4		30
7	MM5B07	5	Basic Mathematical Analysis	5	4		30
8	MM5B08	5	Differential Equations	5	4		30
9		5	Open Course offered by other department	3	4		30
10		5	Project	2	--		--
11	MM6B09	6	Real Analysis	5	4		30
12	MM6B10	6	Complex Analysis	5	4		30
13	MM6B11	6	Numerical Methods	5	4		30
14	MM6B12	6	Number Theory and Linear Algebra	5	4		30

Sl. No.	Code	Semester	Title of the Course	Contact Hrs/Week	No. of Credit		Weightage
15							
	MM6B13(E01)	6	Graph Theory	3	2		30
	MM6B13(E03)		C Programming for Mathematical Computing***				
16	MM6B14(PR)	6	Project	2	4	--	--

- In the 6th semester an elective course shall be chosen among the two courses (Code MM6B13(E01), MM6B13(E03)).
- The syllabus of MM6B13(E01) Graph Theory will be revised.

Open Course for students of other departments during the Fifth Semester

Code	Title of the Course	No. of contact hrs/week	No. of Credit	Duration of Exam	Weightage
MM5D03	Mathematics for Social Sciences	3	4	3 hrs	30

PATTERN OF QUESTION PAPER

For each course the external examination is of 2 hours 45 minutes duration and has maximum weightage 30. The question paper has 3 parts. Part I contains 12 short answer type questions and each has weightage 1. Part II has 7 short essay type/paragraph questions of which 5 are to be answered and each has a weightage 2. Part III contains three essay type questions of which 2 are to be answered and each has weightage 4.

Part	No. of Questions	No. of questions to be answered	Weightage
I (Short Answer)	12	All	12x1 = 12
II (Short Essay)	7	5	5x2 = 10
III (Long Essay)	3	2	2x4 = 8

B.Sc. DEGREE PROGRAMME
MATHEMATICS (CORE COURSE)
FIRST SEMESTER

MM1B01: FOUNDATIONS OF MATHEMATICS

4 hours/week

4 credits

30 weightage

Syllabus

Text Books

1. K.H. Rosen: Discrete Mathematics and its Applications (fifth edition), Tata McGraw Hill Publishing Company, New Delhi.
2. S. Lipschutz: Set Theory and related topics (Second Edition), Schaum Outline Series, 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. Standard set operations. Classes of sets. Power set of a set (Quick review).

Syllabus: Cartesian product of two and more sets, relations. Difference and Symmetric difference of two sets. Set identities, Generalized union and intersections (As in section 1.7 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 2 excluding 3.7).

Module 2 (22 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 2).

Indexed collection of sets, Operations on indexed collection of sets (As in 5.1, 5.2 and 5.3 of text book 2).

Special kinds of functions, Associated functions, Algorithms and functions, Complexity of Algorithms (As in Chapter 5.7 of text book 2).

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 2).

Module 3(22hrs.)

Basic Logic-1

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 1).

Module 4 (12 hrs.)

Basic Logic-2

Methods of proof: Rules of inference, valid arguments, methods of proving theorems; direct proof, proof by contradiction, proof by cases, proofs by equivalence, existence proofs, uniqueness proofs and counter examples. (As in Chapter 1 of Text book 1).

References

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

E. Kamke, Theory of Sets, Dover Publishers.

B.Sc. DEGREE PROGRAMME
MATHEMATICS (CORE COURSE)
SECOND SEMESTER

MM2B02 : INFORMATICS AND MATHEMATICAL SOFTWARES

4 hours/week

4 credits

30 weightage

Syllabus

**Text Book :- Python for Education-Learning Maths and Physics using Python
and writing them in Latex - Dr.Ajith Kumar B.P.**

Published by Calicut University Central Co-op Store
(free download from www.iuac.res.in/phoenix)

Module I(24 hrs.)

1.Introduction

Hardware Components, Software components, The user interface, High Level Languages
(sections 1.1 to 1.4of the Text.)

2. Programming in Python

Getting started with Python, Variables and Data Types, Operators and their Precedence, Python Strings, Python Lists, Mutable and Immutable Types, Input from the Keyboard, Iteration: while and for loops, Conditional Execution: if, elif and else,Modify loops:break and continue, Line joining,Functions, More on Strings and Lists, Python Modules, File Input/Output,Formatted printing, Exception Handling.

(sections 2.1 to 2.18 of the text)

Module II(18 hrs.)

1.Arrays and Matrices

The NumPy Module, Vectorized Functions

(sections 3.1 and 3.2 of the Text)

2.Numerical methods

Polynomials,Finding roots of an equation, Equation solving using matrices.

(sections 6.4 to 6.6 of the Text)

Module III(15hrs.)

Data visualization

The Matplotlib Module, Plotting mathematical functions, Famous Curves, 2D plot using colors,Meshgrids,3D Plots

(sections 4.1 to 4.3, 4.6,4.8 and 4.9 of the Text)

Module IV(15hrs.)

Typesetting using Latex

Document classes, Modifying Text, Dividing the document, Environments, Typesetting Equations, Arrays and matrices.
(sections 5.1 to 5.6 of the Text)

References: (1) Python Tutorial Release 2.6.1 by Guido Van Rossum ,Fred L Drake.Jr.
(free download from <http://www.altway.com/resources/python/tutorial.pdf>)

(2)http://www.scipy.org/Numpy_Example_List

(3)<http://docs.scipy.org/doc/>

(4)Latex-User's Guide and Manual-Leslie Lamport.(Pearson Education)

(5)Informatics and mathematical software-Part II
-An Introduction to Python and Latex-Pramod C.E

(Calicut University Central Co-op Stores)

B.Sc. DEGREE PROGRAMME
MATHEMATICS (CORE COURSE)
THIRD SEMESTER
MM3B03: CALCULUS

5 hours/week

4 credits

30 weightage

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

Module I : (24 hrs)

- 3. Function quick review
- 4. Shifting graphs
- 1.1 Limit and continuity
- 1.2 The Sandwich theorem
- 1.3 Target values and formal definition of limits
- 1.4 Extensions of limit concept
- 1.5 Continuity
- 3.1 Extreme value of functions
- 3.2 The mean value theorem
- 3.3 The first derivative test for local extremum values

Module II (24 hrs)

- 3.4 Graphing with y' and y''
- 3.5 Limit as $x \rightarrow \pm \infty$
Asymptotes and dominant terms
- 3.6 Optimization
- 3.7 Linearization and differentials
- 4.5 Riemann sums and definite – integrals
- 4.6 Properties, area and the mean value theorem.

Module III (18 hrs)

- 4.7 The fundamental theorem
- 4.8 Substitution in definite integrals.
- 5.1 Areas between curves
- 5.2 Finding volumes by slicing

5.3 Volumes of solids of revolution (Disk method only)

Module IV (24 hrs)

5.5 Lengths of plane curves

5.6 Areas of surface of revolution

5.7 Moments and centres of mass

5.8 Work

References:

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

Seminar Topics

Clogging arteries, sensitivity, conversion of mass to energy

Cubic equation, biquadratic equations, Cardon's method, Ferraris method.

Fluid pressure and force

Basic pattern and other modelling applications

B.Sc. DEGREE PROGRAMME
MATHEMATICS (CORE COURSE)
FOURTH SEMESTER

MM4B04 : CALCULUS AND ANALYTIC GEOMETRY
5 hours/week 4 credits 30 weightage

Text Book

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

Module I : Transcendental functions (15 hrs)

- 6.2 Natural logarithms
- 6.3 The Exponential function
- 6.4 a^x and $\log_a x$
- 6.5 Growth and decay (quick review)
- 6.6 L'Hopital's Rule
- 6.7 Relative rates of growth
- 6.10 Hyperbolic functions

Module II – Infinite Series (25 hrs)

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

Module III (15 hrs)

- 8.8 Power series
- 8.9 Taylor and Maclaurin's series
- 8.10 Convergence of Taylor series
Error estimate

Module IV (35 hrs)

- 9.1 Conic section and quadratic equations

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

References

Anton : Calculus, Wiley.

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

Seminar topics

Reduction formula – for integration.

Transformations of equations – Reciprocal equations, Descartes' rule of signs, Sturm's theorem.

Application of power series (8.11)

B.Sc. DEGREE PROGRAMME
MATHEMATICS (CORE COURSE)
FIFTH SEMESTER
MM5B05 : VECTOR CALCULUS

5 hours/week

4 credits

30 weightage

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

Module I (20 hrs)

(A quick review of Section 10.1 to 10.4)

- 10.5 Lines and planes in space.
- 10.6 Cylinders and Quadric surfaces
- 10.7 Cylindrical and spherical coordinates
- 11.1 Vector valued functions and space curves.
- 11.3 Arc length and Unit tangent vector
- 11.4 Curvature, torsion and TNB frame

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

- 12.1 Functions of several variables
- 12.2 Limits and Continuity
- 12.3 Partial derivatives
- 12.4 Differentiability linearization and differentials
- 12.5 Chain rule
- 12.6 Partial derivatives with constrained variables
- 12.7 Directional derivatives, gradient vectors and tangent planes
- 12.8 Extreme value and saddle points
- 12.9 Lagrange multipliers
- 12.10 Taylor's formula

Module III (20 hrs)

- 13.1 Double Integrals
- 13.3 Double integrals in polar form
- 13.4 Triple integrals in Rectangular Coordinates
- 13.6 Triple integrals in cylindrical and spherical co-ordinates.
- 13.7 Substitutions in multiple integrals.

Module IV – Integration in Vector Fields (30 hours)

- 14.1 Line integrals
- 14.2 Vector fields, work circulation and flux
- 14.3 Path independence, potential functions and conservative fields
- 14.4 Green's theorem in the plane
- 14.5 Surface area and surface integrals
- 14.6 Parametrized surfaces
- 14.7 Stokes' theorem (statement only)
- 14.8 Divergence theorem and unified theory (no proof).

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.

Seminar topics

Modelling projectile motion (11.2)

Planetary motion and Satellite (11.5)

Area, moments and Centre of mass (13.2)

Masses and Moments in three dimension (13.5)

B.Sc. DEGREE PROGRAMME
MATHEMATICS (CORE COURSE)
FIFTH SEMESTER
MM5B06 : ABSTRACT ALGEBRA

5 hours/week

4 credits

30 weightage

Text Books:

1. John B. Fraleigh : A First Course in Abstract Algebra, 7th Ed., Pearson.
2. D. Prasad : Linear Algebra, Narosa Pub. House.

Module I (20 hrs)

Binary operations; Isomorphic binary structures; Groups; Sub groups

(Sections 2, 3, 4 & 5 of Text 1).

Module II (25 hrs)

Cyclic groups; Groups and permutations; Orbits, cycles and Alternating groups

(Sections 6, 8, & 9 of Text 1).

Module III (15 hrs)

Cosets and Theorem of Lagrange; Homomorphisms

(Sections 10 & 13 of Text 1).

Module IV (30 hrs)

Rings and Fields; Integral Domains

(Sections 18 & 19 of Text 1).

Vector spaces; Subspaces; Linear Dependence and Independence; Basis and Dimension

(Chapter 2 of Text 2).

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, 2nd ed., Cambridge University Press.
3. Artin : Algebra, PHI.
4. K. Hofman and R. Kunze : Linear Algebra, Pearson Education
5. J.B. Fraleigh & R.A. Beauregard : Linear Algebra, Addison Wesley.
6. Durbin : Modern Algebra : An Introduction, 5th ed., Wiley.

B.Sc. DEGREE PROGRAMME
MATHEMATICS (CORE COURSE)
FIFTH SEMESTER

MM5B07 : BASIC MATHEMATICAL ANALYSIS

5 hours/week

4 credits

30 weightage

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 \mathbb{R}

Applications of supremum property

Intervals, Nested interval property and uncountability of \mathbb{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 criterion

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.

(Sections 1 to 11 of Chapter 1 of 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.
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B.Sc. DEGREE PROGRAMME
MATHEMATICS (CORE COURSE)

FIFTH SEMESTER

MM5B08 : DIFFERENTIAL EQUATIONS

5 hours/week

4 credits

30 weightage

Text Book : W.E. Boyce & R.C. Diprima, Elementary Differential Equations and Boundary Value Problems. John Wiley & Sons, 7th Edn.

Module I (24 hrs)

(a) Introduction

- 1.1 Some Basic Mathematical Models; Direction Fields
- 1.2 Solutions of some Differential equations
- 1.3 Classification of Differential Equations
- 1.4 Historical Remarks

(Chapter 1, Sec. 1.1.1.2, 1.3, 1.4)

(b) First order differential equations

- 2.1 Linear equations with variable coefficients
- 2.2 Separable equations
- 2.3 Modeling with first order equations
- 2.4 Differences between linear and non linear equations
- 2.6 Exact equations and integrating factors
- 2.8 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

- 3.1 Homogeneous equation with constant coefficients
- 3.2 Fundamental solutions of Linear Homogeneous equations
- 3.3 Linear independence and Wronskian
- 3.4 Complex roots of characteristic equations
- 3.5 Repeated roots; Reduction of order
- 3.6 Non homogeneous equations; Method of Undetermined coefficients
- 3.7 Variation of parameters
- 3.8 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

7.1 Introduction

7.4 Basic theory of systems of first order Linear Equations

(Chapter 7 – Sec. 7.1, 7.4)

Module III : Laplace Transforms (17 hrs)

6.1 Definition of Laplace Transforms

6.2 Solution of Initial Value Problem

6.3 Step functions

6.5 Impulse functions

6.6 The Convolution Integral

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

Module IV : Partial Differential Equations and Fourier Series (20 hrs)

10.1 Two point Boundary value problems

10.2 Fourier Series

10.3 The Fourier Convergence Theorem

10.4 Even and odd functions

10.5 Separation of variables; Heat conduction in a rod

10.7 The Wave equation: Vibrations of an elastic string

(Chapter 10 – Sec. 10.1, 10.2, 10.3, 10.4, 10.5, 10.7)

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.

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

MM6B09 : REAL ANALYSIS

5 hours/week

4 credits

30 weightage

Text :

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

Module I : Continuous Functions (25 hrs)

Continuous functions (a quick review)

Continuous functions on intervals

Uniform continuity

(Sec. 5.3, 5.4)

Module II : Riemann Integral (25 hrs)

Riemann Integral

Riemann Integrable Functions

The fundamental theorem

Substitution theorem and application

(Sec. 7.1, 7.2, 7.3 (upto 7.3.9)).

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)

Module IV (20 hrs)

Improper Integrals

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

(Sections: 7.9, 7.10)

Beta and Gamma functions

Text: Narayanan & Manicavachagom Pillay : Calculus, Vol. II (Chapter IX, Sec: 2.1, 2.2, 2.3, 3, 4, 5)

References

1. J.V. Deshpande: Mathematical Analysis and Applications, Narosa Pub. House.
 2. Terence Tao : 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.
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B.Sc. DEGREE PROGRAMME
MATHEMATICS (CORE COURSE)
SIXTH SEMESTER
MM6B010 : COMPLEX ANALYSIS

5 hours/week

4 credits

30 weightage

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 Athanassios 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.

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

MM6B11 : NUMERICAL METHODS

5 hours/week

4 credits

30 weightage

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 Trapezoidal 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 Tridiagonal 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.

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

MM6B12 : NUMBER THEORY AND LINEAR ALGEBRA

5 hours/week

4 credits

30 weightage

Text Books:

1. David M. Burton : Elementary Number Theory, Sixth Edn., TMH.
2. Shanti Narayanan & Mittal : A Text Book of Matrices, Revised edn., S. Chand.

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)

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 IV (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 11.11).

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.

UNIVERSITY OF CALICUT

SCHOOL OF DISTANCE EDUCATION

**B.Sc. DEGREE PROGRAMME
CHOICE BASED CREDIT SEMESTER SYSTEM (CCSS UG)
MATHEMATICS (CORE COURSE)
ELECTIVE COURSE
(DURING THE 6TH SEMESTER)**

SYLLABUS

(effective from 2011 admission onwards)

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

MM6B01(E01) : GRAPH THEORY
(SYLLABUS TO BE REVISED)

3 hours/week

2 credits

30 weightage

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

Module I (17 hrs)

Isomorphic graphs, Ramsey numbers, Independent sets and Coverings, Intersection graphs and line graphs, Operation on graphs, Walks, Trails 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 Hamiltonian 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, Five colour 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 Theory, Allied Publishers.
4. N. Deo : Graph Theory with Application to Engineering and Computer Science, PHI.

B.Sc. DEGREE PROGRAMME
MATHEMATICS (ELECTIVE COURSE)
MM6B01(E03) : C PROGRAMMING FOR
MATHEMATICAL COMPUTING

3 hrs / week

2 credits

30 weightage

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.
2. 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).

Reference Books

1. K.R. Venugopal & Sudeer R. Prasad : Programming with C, Tata McGraw Hill.
2. Yashhant Kanetkar : 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.

UNIVERSITY OF CALICUT

SCHOOL OF DISTANCE EDUCATION

**CHOICE BASED CREDIT SEMESTER SYSTEM (CCSS UG)
MATHEMATICS (OPEN COURSE)**

(For students not having Mathematics as Core Course)

SYLLABUS

(effective from 2011 admission onwards)

CCSS UG PROGRAMME
MATHEMATICS (OPEN COURSE)
(for students not having Mathematics as Core Course)
FIFTH SEMESTER
MM5D03 : MATHEMATICS FOR SOCIAL SCIENCES
3 hours/week 4 credits 30 weightage

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 a line
- 2.5 Solving linear equations simultaneously
- 2.6 Solving quadratic equations
- 2.7 Practical applications

Functions

- 3.1 Concepts and definitions
- 3.2 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 notation
- 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 Inflexion 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

- 8.1 Antidifferentiation
- 8.2 Rules for indefinite integrals

Multivariable Calculus

- 9.1 Functions of several variables
- 9.2 Partial derivatives
- 9.3 Rules of partial differentiation
- 9.4 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.
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UNIVERSITY OF CALICUT

SCHOOL OF DISTANCE EDUCATION

**B.Sc. DEGREE PROGRAMME
CHOICE BASED CREDIT SEMESTER SYSTEM (CCSS UG)
MATHEMATICAL ECONOMICS
(COMPLEMENTARY COURSE)**

SYLLABUS

(effective from 2011 admission onwards)

B.Sc. DEGREE PROGRAMME
MATHEMATICAL ECONOMICS (COMPLEMENTARY COURSE)
FIRST SEMESTER

ME1C01 : MATHEMATICAL ECONOMICS

4 hours/week

3 credits

30 weightage

Text books:

1. H.L. Ahuja : Principles of Micro Economics, 15th Revised Edition, S. Chand
2. Edward T. Dowling: Introduction to Mathematical Economics, Schaum's Outline Series, Third edition, TMH.

Module I : Demand and Supply Analysis (20 hrs)

Utility and demand – the meaning of demand and quantity demanded – the law of demand – demand curve – market demand curve – reasons for the law of demand – slope of a demand curve – shifts in demand – demand function and demand curve – the meaning of supply – supply function – law of supply – slope of a supply curve – shifts in supply – market equilibrium – price elasticity of demand – measurement of price elasticity – arc elasticity of demand – cross elasticity of demand.

(relevant sections chapters 5 and 7 of Text 1).

Module II : Cost and Revenue Functions (15 hrs)

Cost function: Average and marginal costs, Short run and long run costs, Shapes of average cost curves in the short run and long run and its explanation, Revenue function, Marginal revenue (MR) and Average Revenue (AR) functions, Relation between MR, AR and Elasticity of demand.

(relevant sections of chapter 19 & 21 of text 1).

Module III : Theory of Consumer Behaviour (15 hrs)

Cardinal utility analysis – the Law of diminishing marginal utility – the Law of equi-marginal utility – Indifference curves – Ordinal utility – Indifference map – Marginal rate of substitution – Properties of indifference curves.

(relevant sections of chapters 9 and 11 of Text 1).

Module IV : Economic Applications of Derivatives (22 hrs)

Economic Applications of Derivatives. Marginal, average and total concepts optimizing economic functions - Functions of several variables and partial derivatives, Rules of partial differentiation, Second order partial derivatives, Optimization of multivariable functions, Constrained optimization with Lagrange multipliers, Significance of the Lagrange multiplier, Total and partial derivatives – total derivatives.

Marginal productivity, Income determination, multipliers and comparative statics, Income and cross elasticity of demand, Optimization of multivariable function in Economics constrained optimization of multivariable functions in Economics.

(chapter 4 – Sections 4.7 and 4.8; chapter 5 and chapter 6 sections 6. 1 to 6.6 – of text 2).

References

1. R.G.D. Allen : Mathematical Analysis for Economists, Macmillan, ELBS.
2. Edward T. Dowling : Introduction to Mathematical Economics, Third1 edition, Schaum's Outline Series, TMH.
3. Henderson & Quandt : Microeconomic Theory: A Mathematical Approach, 3rd Edition, TMH.
4. Taro Yamane : Mathematics for Economists: An elementary survey. Second Edition, PHI.
5. Srinath Baruah : Basic Mathematics and its Application in Economics, Macmillan.

B.Sc. DEGREE PROGRAMME
MATHEMATICAL ECONOMICS (COMPLEMENTARY COURSE)
SECOND SEMESTER
ME2C02 : MATHEMATICAL ECONOMICS

4 hours/week

3 credits

30 weightage

Text books:

1. M.L. Jhingan: Micro Economic Theory, 6th ed., Vrinda Publications.
2. Edward T. Dowling: Introduction to Mathematics, Economics, Second edition, Schaum's Outline, McGraw Hill.
3. Kothari : Quantitative Techniques, Third edition, Vikas Pub. House, Chapter 14.
4. Mehta-Madnani : Mathematics for Economists, Revised ed., S. Chand.

Module I : Inequalities in Income (10 hrs)

Inequalities in income, Causes of inequalities, Measures to reduce inequality; Measurement of inequality of income – Lorenz curve, Gini ratio.

(Chapter 47 of Text 1)

Module II : Linear Programming (22 hrs)

Mathematical Expression for Economic problems, Graphic solutions, The Extreme point theorem, Slack and surplus variables, Simpler Algorithm – Maximization – Minimization, Marginal values and Shadow pricing, The dual statement of dual theorems, Solving the primal through the dual.

(chapters 13, 14, 15 of text 2)

Module III : Game theory (20 hrs)

Meaning, characteristics, definition of various terms, two-person's zero sum game – pay off matrix, maxin strategy, minimax strategy, saddle point, mixed strategy, Dominance solution through graphic method – linear programming solution to two-persons zero sum game – limitation of game theory.

(chapter 14 of text 3)

Module IV : Input Output Analysis (20 hrs)

Introduction – assumptions – technological coefficient matrix – closed and open input output model – coefficient matrix and open model – The Hawkins – Simon conditions – Solutions for two industries – Determination of equilibrium of prices – Coefficient matrix and closed model – The Leontief production function – limitation of input-output analysis.

(chapter 19 – sections 19.1 to 19.7, 19.9, 19.11, 19.13).

References

1. A.C. Chiang & K. Wainwright : Fundamentals of Mathematical Economics, 4th ed., McGraw Hill.
2. R.G.D. Allen : Mathematical Economics, ELBS.
3. Taro Yamane: Mathematics for Economists, 2nd ed., PHI.1
4. P.K. Gupta & ManMohan : Linear Programming and Theory of Games.
5. Srinath Baruah : Basic Mathematics and its Applications in Economics, Macmillan.
6. Akinson : Distribution and Inequality Measures, TMH.

B.Sc. DEGREE PROGRAMME
MATHEMATICAL ECONOMICS (COMPLEMENTARY COURSE)
THIRD SEMESTER

ME3C03 : MATHEMATICAL ECONOMICS

5 hours/week

3 credits

30 weightage

1

Text book:

1. Edward T. Dowling : Introduction to Mathematical Economics, Third edition, TMH.
2. S.P. Singh, A.K. Parashar & H.P. Singh : Econometrics and Mathematical Economics, S. Chand.
3. C.R. Kothari : An Introduction to Operations Research, Third edition, Vikas Publishing House.

Module I : Differential and Difference Equations (25 hrs)

Differential equations: Definitions and concepts. First order linear differential equations. Exact differential equations – integrating factors. Separation of variables. Economic applications – Use of differential equations in economics. Difference equations: definitions and concepts. First order linear difference equations. Economic applications – the Cobweb model, the Harrod model.

(Chapters 16 and 17 of Text 1)

Module II : The Production function (20 hrs)

Meaning and nature of production functions. The law of variable proportions – isoquants marginal rate of technical substitution (MRTs). Producer's equilibrium. Expression path. The elasticity of substitution. Ridge lines and economic region of production.

(Chapter 14 Section 14.1 to 14.9 of Text 2)

Module III : (20 hrs)

Euler's Theorem (Statement only). Euler's Theorem and Homogeneous production function. Cobb Douglas Production function. Properties. Economic significance – Limitations. CES production function – Properties – Advantages – Limitations – Returns to scale – Cobweb Theorem.

(Chapter 14, Section 14.10 to 14.13 of Text 2).

Optimization of Cobb Douglas production functions – Optimization of constant elasticity of production function.

(Chapter 6; Sections 6.9 and 6.10 of Text 1).

Module IV : Investment Decisions and Analysis of Risk (25 hrs)

Nature of investment decisions; Appraisal necessary; Needed information; Appraisal techniques; Payback method; Average Rate of Return (ARR) method; Net Present Value (NPV) Method; Internal Rate of Return (IRR) Method; Net

Terminal Value Method; Profitability Index (P.I); Analysis of Risk / Uncertainty; The Risk Concept; Risk and Uncertainty Situations; Measurement of Risk in Precise Terms; Incorporating Risk in Investment decisions; Risk-adjusted discount rate (RAD) approach; Certainty-Equivalent Approach; Probability Distribution Approach (The Hillier Models); Decision Trees Approach; Simulation Approach (Hertz's Model); Sensitivity Analysis.

(Chapter 16 of Text 3).

References

1. A.C. Chiang & K. Wainwright : Fundamentals of Mathematical Economics, 4th ed., McGraw Hill.
 2. Taro Yamane: Mathematics for Economics, 2nd ed., PHI.
 3. Srinath Baruah : Basic Mathematics and its Applications in Economics, Macmillan.
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B.Sc. DEGREE PROGRAMME
MATHEMATICAL ECONOMICS (COMPLEMENTARY COURSE)
FOURTH SEMESTER
ME4C04 : MATHEMATICAL ECONOMICS

5 hours/week

3 credits

30 weightage

Text book: Damodar N. Gujarati & Sangeetha : Basic Econometrics, 4th ed., TMH Indian Reprint, 2008.

Module I (20 hrs)

Introduction to Econometrics – The nature of regression analysis – Two variable regression analysis (pages 1 to 59 of the text).

Module II (25 hrs)

Two variable regression model (Section 3.1 to 3.9 of the text pages 60-103).

Module III (25 hrs)1

Classical normal linear regression model – two variable regression – Internal Estimation and Hypothesis testing (Sections 4.1 to 4.5 and 5.1 to 5.13 of the text).

Module IV (20 hrs)

Extensions of the two variable linear regression model (Sections 6.1 to 6.10 of the text).

References

1. S.P. Singh, A.K. Parashar and H.P. Singh : Econometrics and Mathematical Economics, S. Chand.
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UNIVERSITY OF CALICUT

SCHOOL OF DISTANCE EDUCATION

**B.Sc. DEGREE PROGRAMME
CHOICE BASED CREDIT SEMESTER SYSTEM (CCSS UG)
STATISTICS
(COMPLEMENTARY COURSE)**

SYLLABUS

(effective from 2011 admission onwards)

STATISTICS: COMPLEMENTARY

Semester No	Course Code	Title	Instructional hours/week	Credit
1	ST1C01	PROBABILITY THEORY	4	3
2	ST2C02	PROBABILITY DISTRIBUTIONS	4	3
3	ST3C03	STATISTICAL INFERENCE	5	3
4	ST4C04	APPLIED STATISTICS	5	3

Semester I

COURSE I PROBABILITY THEORY

Module 1: Probability Concepts: Random experiment, sample space, event, classical definition, axiomatic definition, and relative frequency definition of probability. Concept of probability measure. Addition and multiplicative theorem (limited to three events). Conditional probability, Baye's theorem-numerical problems. (25 hours)

Module 2: Random Variables: Definition- probability distribution of a random variable, probability mass function (pmf), probability density function (pdf) and (cumulative) distribution function (df) and their properties. (15 hours)

Module 3: Mathematical Expectations: Expectation of a random variable, moments, relation between raw and central moments, moment generating function (mgf) and its properties. Measures of skewness and kurtosis in terms of moments. Definition of characteristic function and its simple properties. (20 hours)

Module 4: Change of variables: Discrete and continuous cases (univariate only), simple problems. (12 hours)

References

1. V.K. Rohatgi : an Introduction to Probability theory and Mathematic Statistics, Wiley Eastern.
2. S.C. Gupta and V.K.Kapoor : Fundamentals of Mathematical Statistics, Sultan Chand and sons.

3. Mood A.M., Graybill. F.A and Boes D.C : Intoduction to Theory of Statistics McGraw Hill.
4. John E Freund : Mathematical Statistics (Sixth Edition), Pearson Education (India),New Delhi.

Semester II

COURSE II: PROBABILITY DISTRIBUTION

Module 1: Bivariate random variable: Definition(discrete and continuous type), Joint probability mass function and probability density function, marginal and conditional distributions,independence of random variables. (15 hours)

Module 2: Bivariate moments: Definition of raw and central product moments, conditional mean and conditional variance, covariance, correlation and regression coefficients. Mean and variance of a random variable in terms of conditional mean and conditional variance. (15 hours)

Module3: Standard Distributions : Discrete type-Bernoulli, Binomial, Poisson distributions (definition,properties and applications)- Geometric and Discrete Uniform (definition,mean,variance and mgf only). Continuous type – Normal (definition,properties and applications)- Rectangular,Exponential,Gamma,Beta,(definition,mean,variance and mgf only). Lognormal, Pareto and Cauchy Distributions(definition only) (30 hours)

Module 4: Law of large Numbers: Chebychev's inequality,convergence in probability, Weak Law of Large

Numbers for iid random variables, Bernoulli Law of Large Numbers, Central Limit Theorem for independent and identically distributed random variables (Lindberg-Levy form) (12 hours)

References:-

- 1.V.K. Rohatgi : an Introduction to Probability theory and Mathematic Statistics, Wiley Eastern.
- 2 S.C. Gupta and V.K.Kapoor : Fundamentals of Mathematical Statistics, Sultan Chand and sons.
- 3.Mood A.M., Graybill. F.A and Boes D.C : Intoduction to Theory of Statistics McGraw Hill.
- 4.John E Freund : Mathematical Statistics (Sixth Edition), Pearson Education (India),New Delhi.

Semester III

COURSE III: STATISTICAL INFERENCE

Module 1: Sampling Distributions: Random sample from a population distribution, sampling distribution of a statistic,standard error,sampling from a normal population,sampling distributions of the sample and variance.Chi-square,student's t and F distributions-derivations,simple properties and inter relationships. (25 hours)

Module 2: Theory of Estimation:Point estimation,desirable properties of a good estimator,unbiased consistency,sufficiency,statement of Fisher Neyman factorization

criterion,efficiency. Method of estimation,method of moments,method of maximum likelihood,-Properties estimators obtained by these methods. (25 hours)

Module 3:Interval Estimation: Interval estimates of mean,difference means,variance,proportions and difference of proportions Large and small sample cases. (10 hours)

Module 4: Testing of Hypotheses: Concept of testing hypotheses, simple and composite hypotheses,null and alternative hypotheses,type I and type II errors,critical region,level of significance and power of a test. Neymann-Pearson approach-Large samples tests concerning mean,equality of means,proportions. Small sample tests base on t distribution for mean,equality of means and paired mean for paired data. Tests based on F distribution for ratio of variances. Test based on chi square-distribution for variance,goodness of fit and for independence of attributes.

References:-

1. V.K. Rohatgi : an Introduction to Probability theory and Mathematic Statistics, Wiley Eastern.
- 2.S.C. Gupta and V.K.Kapoor : Fundamentals of Mathematical Statistics, Sultan Chand and sons.
- 3.Mood A.M., Graybill. F.A and Boes D.C : Intoduction to Theory of Statistics McGraw Hill.
- 4.John E Freund : Mathematical Statistics (Sixth Edition), Pearson Education (India),New Delhi.

Semester IV

COURSE IV: APPLIED STATISTICS

Module 1: Univariate data: Skewness and kurtosis- Pearson's and Bowley's coefficient of skewness- moment measures of skewness and kurtosis. (5 hours)

Module 2: Analysis bi-variate data: Curve fitting-fitting of straight lines, parabola, power curve and exponential curve. Correlation- Pearson's correlation coefficient and rank correlation coefficient – partial and multiple correlation-formula for calculation in 3 variable cases-Testing the significance of observed simple correlation coefficient. Regression-simple linear regression, the two regression lines, regression coefficients and their properties. (30 hours)

Module 3: Time series: Components of time series-measurement of trend by fitting polynomials-computing moving averages-seasonal indices-simple average-ratio to moving average. (15 hours)

Module 4: Statistical Quality control: Concept of statistical quality control, assignable and chance causes, process control. Construction of control charts, 3 sigma limits. Control chart for variables-X-bar chart and R chart. Control chart for attributes -p chart, d chart and c chart. (25 hours)

Module 5: Analysis of variance : One way and two way classifications. Null hypotheses , total, between and within sum of squares. Assumptions-ANNOVA Table. (15 hours)

References:-

1. Goon A.M ,Gupta M.K.&Das Gupta:Fundamentals of Statistics .Vol.I The World Press,Calcutta
2. S.C.Gupta &V.K.Kapoor:Fundamentals of Applied Statistics

Sultan Chand & Sons

3. S.P.Gupta:Statistical Methods
4. E.L Grant:Statistical Quality Control.
