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

   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/-
ASSISTA

NT REGISTRAR (G&A-IV)

To
REGISTRAR

For

Forwarded/By Order

Sd/-

SECTION OFFICER

Copy to:
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)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Code</th>
<th>Semester</th>
<th>Title of the Course</th>
<th>Contact Hrs/Week</th>
<th>No. of Credit</th>
<th>Weightage</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>MM1B01</td>
<td>1</td>
<td>Foundations of Mathematics</td>
<td>4</td>
<td>4</td>
<td>30</td>
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<tr>
<td>2</td>
<td>MM2B02</td>
<td>2</td>
<td>Informatics and Mathematical Softwares</td>
<td>4</td>
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<td>3</td>
<td>MM3B03</td>
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<td>Calculus</td>
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<td>4</td>
<td>MM4B04</td>
<td>4</td>
<td>Calculus and Analytic Geometry</td>
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<td>5</td>
<td>MM5B05</td>
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<td>Vector Calculus</td>
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<td>6</td>
<td>MM5B06</td>
<td>5</td>
<td>Abstract Algebra</td>
<td>5</td>
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<td>7</td>
<td>MM5B07</td>
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<td>Basic Mathematical Analysis</td>
<td>5</td>
<td>4</td>
<td>30</td>
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<td>8</td>
<td>MM5B08</td>
<td>5</td>
<td>Differential Equations</td>
<td>5</td>
<td>4</td>
<td>30</td>
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<td>9</td>
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<td>5</td>
<td>Open Course offered by other department</td>
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<td>4</td>
<td>30</td>
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<tr>
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<td>5</td>
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<td>11</td>
<td>MM6B09</td>
<td>6</td>
<td>Real Analysis</td>
<td>5</td>
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<td>MM6B10</td>
<td>6</td>
<td>Complex Analysis</td>
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<td>13</td>
<td>MM6B11</td>
<td>6</td>
<td>Numerical Methods</td>
<td>5</td>
<td>4</td>
<td>30</td>
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<td>14</td>
<td>MM6B12</td>
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<td>Number Theory and Linear Algebra</td>
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<td>4</td>
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<tr>
<td>Sl. No.</td>
<td>Code</td>
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<td>Title of the Course</td>
<td>Contact Hrs/Week</td>
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<td>Weightage</td>
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<td>15</td>
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<td>Graph Theory</td>
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<td>C Programming for Mathematical Computing***</td>
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<td>16</td>
<td>MM6B14(PR)</td>
<td>6</td>
<td>Project</td>
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</table>

- 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

<table>
<thead>
<tr>
<th>Code</th>
<th>Title of the Course</th>
<th>No. of contact hrs/week</th>
<th>No. of Credit</th>
<th>Duration of Exam</th>
<th>Weightage</th>
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<td>Mathematics for Social Sciences</td>
<td>3</td>
<td>4</td>
<td>3 hrs</td>
<td>30</td>
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**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.

<table>
<thead>
<tr>
<th>Part</th>
<th>No. of Questions</th>
<th>No. of questions to be answered</th>
<th>Weightage</th>
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<tbody>
<tr>
<td>I (Short Answer)</td>
<td>12</td>
<td>All</td>
<td>12x1 = 12</td>
</tr>
<tr>
<td>II (Short Essay)</td>
<td>7</td>
<td>5</td>
<td>5x2 = 10</td>
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<tr>
<td>III (Long Essay)</td>
<td>3</td>
<td>2</td>
<td>2x4 = 8</td>
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</tbody>
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B.Sc. DEGREE PROGRAMME
MATHEMATICS (CORE COURSE)
FIRST SEMESTER
MM1B01: FOUNDATIONS OF MATHEMATICS
4 hours/week  4 credits  30 weightage

Syllabus

Text Books


Module 1 (16 hours)

Set theory


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 (22 hrs.)

Basic Logic-1

Pre-requisite: Nil.


(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.


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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 1.4 of 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  

(sections 6.4 to 6.6 of the Text)  

Module III (15 hrs.)  

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/tutoria.pdf)

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

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


(5) Informatics and mathematical software-Part II
    - An Introduction to Python and Latex- Pramod C.E
    (Calicut University Central Co-op Stores)

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


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 $x \to \pm \infty$
   Assymptotes 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.

**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

Text Book

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.

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


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


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:

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
3. Artin : Algebra, PHI.
4. K. Hofman and R. Kunze : Linear Algebra, Pearson Education

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B.Sc. DEGREE PROGRAMME
MATHEMATICS (CORE COURSE)
FIFTH SEMESTER
MM5B07 : BASIC MATHEMATICAL ANALYSIS
5 hours/week
4 credits
30 weightage


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 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

B.Sc. DEGREE PROGRAMME  
MATHEMATICS (CORE COURSE)  
FIFTH SEMESTER  
MM5B08 : DIFFERENTIAL EQUATIONS  
5 hours/week  
4 credits  
30 weightage


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


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.
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:

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 interpolation
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 Tridiazenal 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.
Text Books:
1. David M. Burton : Elementary Number Theory, Sixth Edn., TMH.

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 \( ax + by = c \).
(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)
(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)
(Sections 6.1 to 6.6 and 11.1 to 11.3 and 11.11).

References
3. George E. Andrews : Number Theory, HPC.
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


**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 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**
2. J.A. Bondy & U.S.R. Murty : Graph Theory with Applications.
4. N. Deo : Graph Theory with Application to Engineering and Computer Science, PHI.
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


Module I (9 hrs)


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)


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).


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).


Reference Books


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


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
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 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 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


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


Module I : Demand and Supply Analysis (20 hrs)


(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)


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

Module IV : Economic Applications of Derivatives (22 hrs)


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.
References

1. R.G.D. Allen : Mathematical Analysis for Economists, Macmillan, ELBS.
B.Sc. DEGREE PROGRAMME
MATHEMATICAL ECONOMICS (COMPLEMENTARY COURSE)
SECOND SEMESTER
ME2C02 : MATHEMATICAL ECONOMICS
4 hours/week  3 credits  30 weightage

Text books:

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)

References
2. R.G.D. Allen: Mathematical Economics, ELBS.
3. Taro Yamane: Mathematics for Economits, 2nd ed., PHI.1
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

Text book:


Module I : Differential and Difference Equations (25 hrs)


(Chapters 16 and 17 of Text 1)

Module II : The Production function (20 hrs)


(Chapter 14 Section 14.1 to 14.9 of Text 2)

Module III : (20 hrs)


(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**


2. Taro Yamane: Mathematics for Economics, 2nd ed., PHI.


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B.Sc. DEGREE PROGRAMME
MATHEMATICAL ECONOMICS (COMPLEMENTARY COURSE)
FOURTH SEMESTER
ME4C04 : MATHEMATICAL ECONOMICS

5 hours/week  3 credits  30 weightage


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)
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

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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)
<table>
<thead>
<tr>
<th>Semester No</th>
<th>Course Code</th>
<th>Title</th>
<th>Instructional hours/week</th>
<th>Credit</th>
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<tbody>
<tr>
<td>1</td>
<td>ST1C01</td>
<td>PROBABILITY THEORY</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>ST2C02</td>
<td>PROBABILITY DISTRIBUTIONS</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>ST3C03</td>
<td>STATISTICAL INFERENCE</td>
<td>5</td>
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<tr>
<td>4</td>
<td>ST4C04</td>
<td>APPLIED STATISTICS</td>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>
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**


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)

Module 3: 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:-


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 of 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)


References:

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-ANNOVATable. (15 hours)

References:-


3. S.P.Gupta:Statistical Methods

4. E.L Grant:Statistical Quality Control.

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