DEGREE OF BACHELOR OF SCIENCE

CHOICE BASED CREDIT SYSTEM

Syllabus for

B.SC. MATHEMATICS

(ACTUARIAL SCIENCE)

(SEMESTER PATTERN)

(For Candidates admitted in the Colleges affiliated to Periyar University from 2019 - 2020 onwards)
OBJECTIVES OF THE COURSE

Mathematics is a key to success in the field of science and engineering. Mathematics plays an important role in the context of globalization of Indian economy, modern technology, and computer science and information technology. Today, students need a thorough knowledge of basic principles, methods, results and a clear perception of the power of mathematical ideas and tools to use them effectively in modeling, interpreting and solving the real world problems. The syllabus of this program is aimed at preparing the students with the latest developments and put them on the right track to fulfill the present requirements.

COMMENCEMENT OF THIS REGULATION

This regulation shall take effect from the academic year 2019 – 2020, i.e, for the students who are admitted to the first year of the course during the academic year 2019 – 2020 and thereafter.

ELIGIBILITY


DEFINITIONS

Programme: Program means a course of study leading to the award of the degree in a discipline.

Course: Course refers to the subject offered under the degree programme.
SYLLABUS

The syllabus of the UG degree has been divided into the following four categories:

Part I: Tamil / Other Languages.
Part II: English Language.
Part III: Core Courses, Elective Courses and Allied Courses.
Part IV: Skill Based Elective Courses, Non-Major Course, Environmental Studies and Value Education.

- **Elective Course:** There are 6 Elective Courses offered for B.Sc. Mathematics (Actuarial Science) students.

- **Skill Based Elective Course:** This course aims to impart advanced and recent developments in the concerned discipline.

- **Non-Major Elective Course:** Irrespective of the discipline the student can select papers that are offered by other disciplines as non-major course.

CREDITS

Weightage given to each course of study is termed as credit.

CREDIT SYSTEM

The weightage of credits are spread over to different semester during the period of study and the cumulative credit point average shall be awarded based on the credits earned by the students. A total of 140 credits are prescribed for the under graduate programme.

DURATION OF THE COURSE

The candidates shall complete all the courses of the programme within 5 years from the date of admission. The programme of study shall consist of six semesters and a total period of three years with 140 credits. The programme of study will comprise the course according to the syllabus.
EXAMINATIONS

The course of study shall be based on semester pattern with Internal Assessment under Choice Based Credit System.

The examinations for all the papers consist of both Internal (Continuous Internal Assessment-CIA) and External (end semester) theory examination. The theory examination shall be conducted for three hours duration at the end of each semester. The candidates failing in any subjects(s) will be permitted to appear for the same in the subsequent semester examinations.

STRUCTURE OF THE COURSE

<table>
<thead>
<tr>
<th>Semester - I</th>
<th>Part</th>
<th>Paper Code</th>
<th>Title</th>
<th>Hours</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Language</td>
<td>19UFTA01</td>
<td>Tamil -I</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>II</td>
<td>Language</td>
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<td>English - I</td>
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<td>3</td>
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<tr>
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<td>Core- I</td>
<td>19UMAASC01</td>
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<td>19UMAASC02</td>
<td>Calculus</td>
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<td></td>
<td>Allied - I</td>
<td>19UMAASA01</td>
<td>Mathematical Statistics -I</td>
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<tr>
<td>IV</td>
<td>Value Education -</td>
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<table>
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<tbody>
<tr>
<td>I</td>
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<tr>
<td>IV</td>
<td>EVS</td>
<td>19UMAASES</td>
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<table>
<thead>
<tr>
<th>Semester - III</th>
<th>Part</th>
<th>Paper Code</th>
<th>Title</th>
<th>Hours</th>
<th>Credit</th>
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<tbody>
<tr>
<td>III</td>
<td>Core- V</td>
<td>19UMAASC05</td>
<td>Differential Equations and Laplace Transformations</td>
<td>6</td>
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<td>Core - VI</td>
<td>19UMAASC06</td>
<td>Basic Accounting Concepts</td>
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<tr>
<td></td>
<td>Core - VII</td>
<td>19UMAASC07</td>
<td>Sampling Theory</td>
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<td>Life Insurance &amp; General Insurance</td>
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<table>
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<tr>
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<th>Title</th>
<th>Hours</th>
<th>Credit</th>
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<tr>
<td>III</td>
<td>Core - VIII</td>
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<td>5</td>
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<td></td>
<td>Core - IX</td>
<td>19UMAASC09</td>
<td>Basics of Life Contingencies</td>
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<td>4</td>
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<td></td>
<td>Core - X</td>
<td>19UMAASC10</td>
<td>Mortality and Markov Chains</td>
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<td></td>
<td>Elective - II</td>
<td>19UMAASE02</td>
<td>Operation Research</td>
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## Allied Subjects for B.Sc. Mathematics (A.S):

<table>
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<th>CODE</th>
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<tbody>
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</tr>
<tr>
<td>Mathematical Statistics - II</td>
<td>19UMAASA02</td>
</tr>
<tr>
<td>Practical – ‘R’ Programming</td>
<td>19UMAASA03</td>
</tr>
<tr>
<td>Physics – I</td>
<td>19UMAASA04</td>
</tr>
<tr>
<td>Physics – II</td>
<td>19UMAASA05</td>
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<tr>
<td>Practical - Physics</td>
<td>19UMAASA06</td>
</tr>
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## Skill Based Elective Courses:

<table>
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<tr>
<th>SUBJECT</th>
<th>SUBJECT CODE</th>
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</thead>
<tbody>
<tr>
<td>Group Insurance</td>
<td>19UMAASS01</td>
</tr>
<tr>
<td>Latex Practical</td>
<td>19UMAASS02</td>
</tr>
<tr>
<td>Retirement Benefits</td>
<td>19UMAASS03</td>
</tr>
</tbody>
</table>
UNIFORMITY IN THE NUMBER OF QUESTIONS IN EACH PAPER:

Each theory paper shall consist of five units. The Question paper shall consist of questions uniformly distributed among all the units.

1. QUESTION PAPER PATTERN FOR THE THEORY PAPERS

   Duration: **Three Hours**

   Maximum Marks: **75**

   **Part A: (10 X 2 = 20 marks)**
   
   Answer ALL Questions
   
   (Two Questions from Each Unit)

   **Part B: (5 X 5 = 25 marks)**

   Answer ALL Questions

   (One Question from Each Unit with internal choice)

   **Part C: (3 X 10 = 30 marks)**

   Answer Any THREE Questions out of Five Questions

   (One Question from Each Unit)

2. MARKS AND QUESTION PAPER PATTERN FOR PRACTICAL PAPERS

   **MARKS**

   MAXIMUM: **100 Marks**

   **INTERNAL MARK: 40 marks**

   **EXTERNAL MARK: 60 marks**

   (Practical Exam -45 marks+ Record - 15 marks )

   **QUESTION PATTERN FOR THE PRACTICAL EXAM PAPERS**

   Answer any THREE questions out of 5 questions (3 x 15 = 45 marks)

   **PASSING MINIMUM**
i) The Candidates shall be declared to have passed the examination if he/she secures not less than 40 marks in total (CIA mark + Theory Exam mark) with minimum of 30 marks in the Theory Exam conducted by the University.

ii) The Candidates shall be declared to have passed the examination if he/she secures not less than 40 marks in total (CIA mark + Theory Exam mark) with minimum of 18 marks out of 45 marks Practical Exam conducted by the University.

CLASSIFICATION OF SUCCESSFUL CANDIDATES

Candidates who secure not less than 60% of the aggregate marks in the whole examination shall be declared to have passed the examination in the First class. All other successful candidates shall be declared to have passed in the second class. Candidates who obtain 75% of the marks in the aggregate shall be deemed to have passed the examination in First Class with Distinction provided they pass all the examinations, prescribed for the course at the first appearance. Candidates who pass all the examinations prescribed for the course in the first attempt and within a period of three academic years from the year of admission to the course only eligible for University Ranking.

CONVERSION OF MARKS TO GRADE POINTS AND LETTER GRADE (Performance in a Course/Paper)

<table>
<thead>
<tr>
<th>RANGE OF MARKS</th>
<th>GRADE POINTS</th>
<th>LETTER GRADE</th>
<th>DESCRIPTION</th>
</tr>
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<tbody>
<tr>
<td>90-100</td>
<td>9.0-10.</td>
<td>O</td>
<td>Outstanding</td>
</tr>
<tr>
<td>80-89</td>
<td>8.0-8.9</td>
<td>D+</td>
<td>Excellent</td>
</tr>
<tr>
<td>75-79</td>
<td>7.5-7.9</td>
<td>D</td>
<td>Distinction</td>
</tr>
<tr>
<td>70-74</td>
<td>7.0-7.4</td>
<td>A+</td>
<td>Very Good</td>
</tr>
<tr>
<td>60-69</td>
<td>6.0-6.9</td>
<td>A</td>
<td>Good</td>
</tr>
<tr>
<td>50-59</td>
<td>5.0-5.9</td>
<td>B</td>
<td>Average</td>
</tr>
<tr>
<td>40-49</td>
<td>4.0-4.9</td>
<td>C</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>00-39</td>
<td>0.0</td>
<td>U</td>
<td>Re-appear</td>
</tr>
<tr>
<td>ABSENT</td>
<td>0.0</td>
<td>AAA</td>
<td>ABSENT</td>
</tr>
</tbody>
</table>

Ci= Credits earned for course i in any semester  
Gi = Grade Point obtained for course i in any semester  
n = refers to the semester in which such course were credited

Grade point average (for a Semester):
Calculation of grade point average semester-wise and part-wise is as
follows:

**GRADE POINT AVERAGE [GPA]** = \( \frac{\sum CiGi}{\sum Ci} \)

Sum of the multiplication of grade points by the credits of the entire programme under each part

CGPA = \( \frac{\sum CiGi}{\sum Ci} \)

-Sum of the credits of the courses of the entire programme under each part

**Calculation of Grade Point Average (CGPA) (for the entire programme):**

A candidate who has passed all the examinations under different parts (Part-I to V) is eligible for the following part wise computed final grades based on the range of CGPA.

**CUMULATIVE GRADE POINT AVERAGE [CGPA]** = \( \frac{\sum CiGni}{\sum Ci} \)

Sum of the multiplication of grade points by the credits of the entire programme under each part

CGPA = \( \frac{\sum CiGni}{\sum Ci} \)

-----

Sum of the credits of the courses of the entire programme under each part

<table>
<thead>
<tr>
<th>CGPA</th>
<th>GRADE</th>
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</thead>
<tbody>
<tr>
<td>9.5 – 10.0</td>
<td>O+</td>
</tr>
<tr>
<td>9.0 and above but below 9.5</td>
<td>O</td>
</tr>
<tr>
<td>8.5 and above but below 9.0</td>
<td>D++</td>
</tr>
<tr>
<td>8.0 and above but below 8.5</td>
<td>D</td>
</tr>
<tr>
<td>7.5 and above but below 8.0</td>
<td>D</td>
</tr>
<tr>
<td>7.0 and above but below 7.5</td>
<td>A++</td>
</tr>
<tr>
<td>6.5 and above but below 7.0</td>
<td>A+</td>
</tr>
<tr>
<td>6.0 and above but below 6.5</td>
<td>A</td>
</tr>
<tr>
<td>5.5 and above but below 6.0</td>
<td>B+</td>
</tr>
<tr>
<td>5.0 and above but below 5.5</td>
<td>B</td>
</tr>
<tr>
<td>4.5 and above but below 5.0</td>
<td>C+</td>
</tr>
<tr>
<td>4.0 and above but below 4.5</td>
<td>C</td>
</tr>
<tr>
<td>0.0 and above but below 4.0</td>
<td>U</td>
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</tbody>
</table>

**Classification of Successful candidates**

A candidate who passes all the examinations in Part I to Part V securing following CGPA and Grades shall be declared as follows for Part I or Part II or Part III:

<table>
<thead>
<tr>
<th>CGPA</th>
<th>GRADE</th>
<th>CLASSIFICATION OF FINAL RESULT</th>
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</thead>
<tbody>
<tr>
<td>9.5 – 10.0</td>
<td>O+</td>
<td>First Class – Exemplary</td>
</tr>
<tr>
<td>9.0 and above but below 9.5</td>
<td>O</td>
<td>First Class with</td>
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<tr>
<td></td>
<td>Distinction*</td>
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<td>----------------</td>
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<td></td>
</tr>
<tr>
<td>8.5 and above</td>
<td>D++</td>
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<tr>
<td>but below 9.0</td>
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<td></td>
</tr>
<tr>
<td>8.0 and above</td>
<td>D+</td>
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<tr>
<td>but below 8.5</td>
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<td></td>
</tr>
<tr>
<td>7.5 and above</td>
<td>D</td>
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<tr>
<td>but below 8.0</td>
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<td></td>
</tr>
<tr>
<td>7.0 and above</td>
<td>A++</td>
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<tr>
<td>but below 7.5</td>
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<tr>
<td>6.5 and above</td>
<td>A+</td>
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<td>but below 7.0</td>
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<tr>
<td>6.0 and above</td>
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<td>but below 6.5</td>
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<tr>
<td>5.5 and above</td>
<td>B+</td>
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<td>but below 6.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.0 and above</td>
<td>B</td>
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<tr>
<td>but below 5.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.5 and above</td>
<td>C+</td>
<td></td>
</tr>
<tr>
<td>but below 5.0</td>
<td></td>
<td></td>
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<tr>
<td>4.0 and above</td>
<td>C</td>
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<tr>
<td>but below 4.5</td>
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</table>

**Conferment of the Degree**

No candidate shall be eligible for conferment of the Degree unless he / she

i. Has undergone the prescribed course of study for a period of not less than six semesters in an institution approved by/affiliated to the University or has been exempted from in the manner prescribed and has passed the examinations as have been prescribed therefor.

ii. Has completed all the components prescribed under Parts I to Part V in the CBCS pattern to earn 140 credits.

iii. Has successfully completed the prescribed Field Work/ Institutional Training as evidenced by certificate issued by the Principal of the College.

**Ranking**

A candidate who qualifies for the UG degree course passing all the examinations in the first attempt, within the minimum period prescribed for the course of study from the date of admission to the course and secures I or II class shall be eligible for ranking and such ranking shall be confined to 10 % of the total number of candidates qualified in that particular branch of study, subject to a maximum of 10 ranks.

The improved marks shall not be taken into consideration for ranking.

**NOTE:**

- All the Papers (including computer papers) specified in this syllabus should be handled and valued by faculty of Mathematics Department only.
Both Internal and External Examiners for University Practical Examination should be appointed (including computer papers) from faculty of Mathematics only.

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**PART - III**

**CORE COURSES SYLLABUS**

<table>
<thead>
<tr>
<th>19UMAASC01</th>
<th>CLASSICAL ALGEBRA</th>
<th>L</th>
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<td>4</td>
<td>1</td>
<td>0</td>
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</table>

**Unit – I: Binomial Series**
Binomial theorem for a positive integral index – Binomial theorem for a rational index – Summation of Binomial series. Exponential series – Exponential series for all real Values of x – Standard results for the Exponential series – Logarithmic series – Problems. (Chapter -2, Chapter-3 and Chapter-4)

**Unit – II: Matrices**
Test for consistency of linear equations – Characteristic equation – Characteristic roots and characteristic vectors of a matrix – Cayley–Hamilton theorem - Similarity of matrices - Diagonalizable matrix – Problems. (Chapter -6 (Page 6.38 to Page 6.82))

**Unit – III: Theory of equations**
Fundamental theorem in the theory of equations – Relation between the roots and coefficients of an equation – Imaginary and irrational roots – Symmetric functions of the roots of an equation interms of its coefficients – Problems. (Chapter -7 (Page 7.1 to Page 7.30))

**Unit – IV: Theory of equations**
(Chapter 7 (page 7.30 to page 7.56)).

**Unit V: Roots of Polynomial Equations**


(Chapter – 7 (Page 7.57 to Page 7.67) )

**Text Book:**

**Reference Books:**

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**19UMAASC02***

**CALCULUS**

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<tr>
<td>4</td>
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**Subject description:**
This course presents the idea of curvatures, integration of different types of functions, its geometrical applications, double, triple integrals and improper integrals.

**Goal:**
To enable the students to learn and gain knowledge about curvatures, integrations and its geometrical applications.

**Objectives:**
On successful completion of course the students should have gain about the evolutes and envelopes, different types of integrations, its geometrical application, proper and improper integration.

**UNIT I: Differentiation**
Curvature-radius of curvature in Cartesian and polar forms-evolutes and
envelopes- pedal equations- total differentiation- Euler”s theorem on homogeneous functions.

UNIT II: Integration
Integration of \( f'(x)/f(x), f(x)\sqrt{f(x)}, (px+q)/\sqrt{ax^2+bx+c}, [\sqrt{(x-a)/(b-x)}], \sqrt{(x-a)(b-x)}, 1/\sqrt{(x-a)(b-x)}, 1/(acosx+bsinx+c), 1/(acos^2x+bsin^2x+c) \), Integration by parts.

UNIT III: Multiple Integrals
Reduction formulae- problems- evaluation of double and triple integrals- applications to calculations of areas and volumes-areas in polar coordinates.

UNIT IV: Multiple Integrals
Change of order of integration in double integral- Jacobions.- change of variables in double and triple integrals.

UNIT V: Beta and Gamma functions
Beta and Gamma integrals-their properties, relation between them-evaluation of multiple integrals using Beta and Gamma functions.

Treatment as in

Reference:

Objective: To make the students understand the expansion of trigonometric functions, line integral, surface integral and volume integral.

UNIT I: Expansions and Hyperbolic Functions
Expansion of $\cos n\phi, \sin n\phi, \cos^n\phi, \sin^n\phi$ – Hyperbolic functions – Separation of real and imaginary parts of $\sin(\alpha + i\beta), \cos(\alpha + i\beta), \tan(\alpha + i\beta), \sinh(\alpha + i\beta), \cosh(\alpha + i\beta), \tanh(\alpha + i\beta), \tan^{-1}(\alpha + i\beta)$.

**UNIT II: Logarithm of a complex number and Summation of Series**


**UNIT III: Differentiation of Scalar and Vector Point Functions**


**UNIT IV: Integration of Scalar and Vector Point Functions**


**UNIT V: Integral Theorems**

Integral theorems – Gauss’ Divergence theorem – Integral theorems derived from the Divergence theorem – Green’s theorem in plane – Stoke’s theorem – Integral theorems derived from Stoke’s theorem – Operational meanings of in terms of surface integrals – Problems.

**TEXT BOOKS**


**REFERENCE BOOKS**

Objectives: To study the concept and nature of economics, to study the utility concept and cost and revenue, to learn Concept of market structure

Unit-I: DEFINITION AND SCOPE OF ECONOMICS
Definitions of microeconomics and macroeconomics - Differences between Micro and Macroeconomics – Basic economic problems – economic system.

Unit-II: UTILITY ANALYSIS

Unit-III: DEMAND AND SUPPLY

Unit-IV: COST AND REVENUE

Unit-V: MARKET STRUCTURE
Profit – Features- Price and output determination – Interaction of demand and
supply - Market period – Short and long run – Impact of tax and subsidies.

**Text Book:**

**References:**

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### 19UMAASC05

**DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS**

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**Unit – I:**

Ordinary Differential Equations – Second order Differential Equations with constant co-efficients – Particular Integrals of the form $e^{xV}$, where $V$ is of the form $x$, $x^2$, $\sin ax$, $\cos ax$, $x\sin ax$ and $x\cos ax$.

**Unit – II**

Second order differential Equations with variable co-efficients- both homogeneous linear equations and homogeneous non-linear equations.

**Unit – III: Partial Differential Equations**

Partial Differential Equations –Definition – Complete solution, Singular solution and general solution – Solution of equations of standard types $f(p,q)=0$, $f(x,p,q)=0$, $f(y,p,q)=0$, $f(z,p,q)=0$ and $f_1(x,p)= f_2(y,q)$ – Clairaut’s form – Lagrange’s equation $Pp+Qq=R$.

**Unit – IV**

**Unit – V**

Inverse Laplace transforms – Standard formulae – Elementary Theorems – Applications to Second order linear differential equation (Problems with only one differential equation).

**Text Books**


**Reference Books**


***

**Objectives:** To study the concepts of accounting and its recording procedures, to study the basics of financial statements and ration analysis

**Unit – I: Accounting**


**Unit – II: Accounting records and systems**

Accounting equation - Accounting mechanics I: Journals Ledger posting and trial balance.

**Unit – III: Accounting mechanics II**
Preparation of financial statements – Trading account - Profit and loss account and Balance sheet.

**Unit – IV: Cash book and Subsidiary books**


**Unit – V: Bank reconciliation statement**

Rectification of errors - Depreciation accounting- Straight line method-Written down value method.

**Text:**
Dalston L. Cecil and Jenitra L Merwin by “Principles of Accountancy”

**Reference:**
Jawaharlal and SeemaSrivastava “Financial accounting”

---

**Objectives:**
(I) Explain the concepts of random sampling, statistical inference and sampling distribution, and state and use basic sampling distributions. (II) Describe the main methods of estimation and the main properties of estimators, and apply them. (III) Construct confidence intervals for unknown parameters. (IV) Test hypotheses. (V) Explain the concepts of analysis of variance and use them.

**Unit I: Sampling**


**Unit II:**
Testing of Hypothesis – Test of Significance of Large Samples – Sampling of
Attribute – Test for Single proportion – Test for Difference of Proportion – Unbiased estimates for population mean and population variance – Standard error of sample mean – Test of significance for single mean - Test of significance foe difference of means – test of significance of standard deviation

**Unit III:**
Chi square Distribution: Introduction – MGF of Chi square distribution – Cumulative Generating Function of chi square distribution – Limiting form of chi square distribution – Mode and skewness of chi square distribution – Application of chi square distribution – Chi Square for population variance – Chi square test for Goodness of fit – Independence of Attribute

**Unit IV:**
Students “t” Distribution introduction – Deviation of Student’s “t” Distribution – Application of t-test – t-test for single mean – t-test for difference of means

**Unit V:**

**Text Book:**
Fundamentals of Mathematical Statistics by S.C. Gupta and V. K. Kapoor
Unit I: Chapter 12 (12.1 – 12.7)  Unit II: Chapter 12 (12.7.1 – 12.1.15)
Unit III: Chapter 13 (13.1 – 13.7.3)  Unit IV: Chapter 14 (14.1 – 14.2.10)
Unit V: Chapter 14 (14.5 – 14.8)

***
Objectives:

Describe how to use a generalized cash-flow model to describe financial transactions. Describe how to take into account the time value of money using the concepts of compound interest and discounting. Define and use the more important compound interest functions, including annuities certain.

Unit I: Cash flow Model


Unit II: The Time Value of Money


Unit III: Discounting and accumulating

Present Values – Accumulated values – The Basic Compound Interest Functions.

Unit IV: Level Annuities

Present Values – Payments Made in Arrear, Payment Made in Advance – Accumulations – Perpetuities.

Unit V: Investments

Characteristics of Fixed interest Govt. bonds – Index linked Govt. bonds- Govt. bills – Ordinary Shares – Property – Certificate of deposit.

Text Books:

1. ActEd Study Material: Subject - CT1
2. Mathematical basis of life insurance – IC81 – Insurance Institute of India material

REFERENCE:

Objectives:

(i) Define simple assurance and annuity contracts, and develop formulae for the means and variances of the present values of the payments under these contracts, assuming constant deterministic interest.
(ii) Describe practical methods of evaluating expected values and variances of the simple contracts defined in objective (i).
(iii) Describe and calculate net premiums and Gross premium of simple insurance contracts.

Unit I: Assurance Benefits

Introduction – Whole life assurance – Term Assurance- Pure endowment Assurance- Endowment Assurance – Commutation Functions Dx, Cx,Mx and Rx

Unit II: Annuity Benefits

Introduction – Whole life annuity (due and arrear)-Temporary annuity (Due and Arrear)-deferred whole life annuity- Variable life annuity-Increasing life annuity- Commutation functions Nx and Sx.

Unit III: Net Premiums for Assurance Plans

Natural premiums- Level Annual Premiums-Actuarial Notations- Mathematical expressions for level annual premium under various Assurance plans – Net Premiums- Problems on net Premiums.

Unit 4: Net Premiums for Annuity Plans

Actuarial Notations-Mathematical expressions for level annual premium under various Annuity plans – Net Premiums- Numerical Illustrations on net Premiums

Unit 5: Office Premiums

Text Book:

“Mathematical Basis of Life assurance” – IC -81 - Insurance Institute of India

Reference:

1. “Actuarial Mathematics for Life Contingent Risks” – Author: David C. M. Dickson, Mary R. Hardy, Howard R. Waters

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Unit I:
Definition of \( l_x, p_x, q_x, n\rho_x, n\sigma_x, m/ nq_x \). concept of force of mortality \( \mu_x \), Derivation of \( n\rho_x \) in terms of \( \mu_x \) ie, \( n\rho_x = \exp(-\mu_x t) \) – Laws of mortality.

Unit II:
Future life time random variables \( T_x, K_x \) – Definitions of and in terms of expectations of \( K_x \) and \( T_x \), Relation between \( e_x \) and \( e_{x+1} \) – Simple problems.

Unit III:
Select and ultimate lives – Select period – Definitions of \( l[x], n\rho[x], n\sigma[x] \) – Simple problems.

Unit IV:

Unit V:

Text Books:
1. “Actuarial Mathematics for Life Contingent Risks” – Author: David C. M. Dickson, Mary R. Hardy, Howard R. Waters.

2. Models – IAI Material – CT- 4 (Unit IV and V – Chapter 8)

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**Unit I**

**Unit II**
Cyclic groups – generators of a cyclic group – Number of generators of a cyclic groups – Cosets – Partitioning of a group by Cosets – Lagrange’s theorem – Euler’s theorem – Fermat’s theorem.

**Unit III**
**Normal subgroups:** Quotient groups – Group Homomorphis – Canonical homomorphism – kernel of a homomorphism – Isomorphism – Automorphism – Inner automorphism – Permutation groups – Cayley’s theorem.

**Unit IV**

**Unit V**
Homomorphism of rings – Isomorphism – kernel of a homomorphism –
Fundamental theorem – Field of quotients of an integral domain – polynomial rings – Division algorithm

**Text Book:**

**Books for Reference :**


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**Unit I: Real number system :**
The field of axioms, the order axioms, the rational numbers, the irrational numbers, upper bounds, maximum element, least upper bound (supremum). The completeness axiom, absolute values, the triangle inequality. Cauchy – schwartz”s inequality.

**Unit II: Sequences**

**Unit III**
Behaviour of monotonic sequences – Cauchy”s first limit theorem – Cauchy”s second limit theorem – Cesaro”s theorem – subsequences - Cauchy sequence – Cauchy”s general principle of convergence.

**Unit IV**
Series : Infinite series – n th term test – Comparison test – Kummer”s test – D”Alemerberls ratio test – Raabe”s test - Gauss test – Root test – Canchy”s
condensation test (without proof)

**Unit V**

**Text Books:**

**Book for Reference :**

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**Objectives:**
Define an equation of value, Describe how a loan may be repaid by regular installments of interest and capital

**Unit I:**
Deferred and increasing annuities: - Introduction - Deferred annuities - Annual payments (arrear and Advance) - Increasing annuities- Annual payments (arrear and Advance) - Decreasing payments

**Unit II:**
Equations of value:-The equation of value and the yield on a transaction- The theory -Solving for an unknown quantity -Solving for the amount of a payment (I or R)- Solving for the timing of a payment (n)- Solving for the interest rate (i)

**Unit III:**
Loan schedules-Introduction-An example- Calculating the capital outstanding – Introduction-The theory - Prospective loan calculation -Retrospective loan
calculation

**Unit IV:**
Calculating the interest and capital elements of the Loan schedule:- single payment – series of payments – Forming the loan schedule - Consumer credit: flat rates and Annual Percentage Rate

**Unit V:**
Project appraisal: - MWRR, TWRR, LIRR

**Text Books:**
1. *ActEd Study Material*: Subject - CT1

**REFERENCE:**

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**Unit I: Vector Spaces**

**Unit II**
Span of a set – linear dependence and independence – basis and dimension - theorems

**Unit III**
Rank and nullity Theorem – matrix of a linear transformation *Inner product space*: Definition and examples – orthogonality – orthogonal complement –
Gram Schmidt orthogonalisation process.

**Unit IV: Matrices**


**Unit V**


**Text Book:**

1. Arumugam & others – Modern Algebra

**Books for Reference :**


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**19UMAASC15**

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**Unit I**


**Unit II**

Closed sets – closure – Limit points – Dense sets – complete metric space – Cantor”s intersection theorem – Baire”s Category Theorem.
Unit III
Continuous functions on metric spaces: Functions - continuous at a point on the real line – Functions - Continuous – uniform continuous in a metric space – Discontinuous function or R₁.

Unit IV

Unit V: Riemann Integral:

Text Books:
Arunugam & Others – Modern Analysis

Books for Reference:

***

19UMAASC16 | COMPLEX ANALYSIS | L | T | P | C
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Unit I: Analytic functions

Unit II: Integrals
Definite integrals – Contours – Cauchy – Goursat theorem – antiderivatives and independence of path – Cauchy Integral formula – Morera”s theorem.

**Unit III: Series**

**Unit IV: Evaluation of Integrals**
Evaluation of improper real integrals – improper integrals involving sines and cosines – Definite integrals involving sines and coines.

**Unit V: Transformations**
Conformal mappings – basic properties – Bilinear maps – fixed points Applications

**Text Book :**

**Books for Reference :**


***
PART - III

ELECTIVE COURSES SYLLABUS
Objectives:
To understand the concepts of risk and its types, to learn insurance market and its contracts

Unit I: The concept of insurance and its evolution
Concept of insurance – Insurance (evolved and works) – Types of insurance – Importance of insurance industry - The Business of Insurance: how risk is managed by individuals and insurers – Premium – Importance of reinsurance- Role of insurance in economic and social development.

Unit II: The insurance contract

Unit III: Life insurance products
Traditional products – Linked products – Annuities and group policies.

Unit IV: General Insurance

Unit IV: Types of General Insurance
Fire insurance – Definition – Causes of fire – Essential characteristics of fire insurance contracts – Procedures – Rate fixation – Kind of fire insurance policies – Policy conditions - Claim settlement.

Text Book:
1. “Principles of Insurance” – IC 01 – III.

Reference:
1. Dorfman S. Mark, introduction to risk management and insurance Prentice hall India 2005
Unit - I
Introduction - Definition of O.R. - Scope, phases and Limitations of O.R. - Linear Programming Problem - Graphical Method - Definitions of bounded, unbounded and optimal solutions - procedure of solving LPP by graphical method - problems - Simplex technique - Definitions of Basic, non-basic variables - basic solutions - slack variables and optimal solution, simplex procedure of solving LPP - Problems.

Unit – II

Unit – III
Introduction - Definition - Basic assumptions - n jobs to be operated on two machines - problems - n-jobs to be operated on three machines - problems - n-jobs to be operated on m machines - problems. Definition of Inventory models-Type of inventory models: (i) Uniform rate of demand, infinite rate of production with no shortage (ii) Uniform rate of demand, finite rate of replacement with no shortage Book Works - Problems.
Unit – IV

Definitions - Newspaper boy problem - Inventory model with one and more price break problems. Introduction- definition of steady state, transient state and queue discipline, characteristics of a queuing model - Applications of queuing model - Little's formula - Classification of queues - Poisson process - properties of Poisson process. Models (i) (M/M/1): (∞ /FCFS) (ii) (M/M/1) : (N/FCFS) (iii) (M/M/S) : (∞ /FCFS) - formulas and problems only.

Unit - V

Introduction - definition of network, event, activity, Three time estimates (optimistic, pessimistic & most likely), critical path, total float and free float - difference between CPM and PERT – Problems.

Text Book


Reference Books


****
Objective: The students will be able to understand time series models and apply them in forecasting.

UNIT I 15 Hrs.
Exploratory Time Series Analysis: Forecasting trend and seasonality based on smoothing. Methods of Exponential and moving average smoothing; Types and implications of interventions; Outliers, additive and innovational outliers, procedure for detecting outliers

UNIT II 15 Hrs.
Stationary Stochastic models: Weak and strong stationarity, Deseasonalising and detrending an observed time series, Auto-covariance, autocorrelation function (ACF), partial auto correlation function (PACF) and their properties, Conditions for stationarity and invertibility,

UNIT III 15 Hrs.
Models for Time Series: Time series data, Trend, seasonality, cycles and residuals, Stationary, White noise processes, Autoregressive (AR), Moving Average (MA), Autoregressive and Moving Average (ARMA) and Autoregressive Integrated Moving Average (ARIMA) processes, Choice of AR and MA periods

UNIT IV 15 Hrs.
Spectral analysis and decomposition: Spectral analysis of weakly stationary process, Periodogram and correlogram analysis, Spectral decomposition of weakly AR process and representation as a one-sided MA process – necessary and sufficient conditions, implication in prediction problems.

UNIT V 15 Hrs.
Modeling Seasonal Time Series: Seasonal ARIMA models, estimation and forecasting, Fitting ARIMA models with Box-Jenkins procedure, Identification, Estimation, Verification, Test for white noise, Forecasting with ARMA models.
Text Books


Reference Books


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Unit I:

Unit II: Financial Underwriting:
Purpose of financial underwriting - Objectives of financial underwriting - Concept of Insurable interest & Insurable value - Personal Insurance Cover-Human Life Value.

Unit – III:
Role of surveyors in non-life insurance – Operational risks – Disaster risk
financing – Non insurance transfers.

Unit – IV:

Unit – V:
Introduction- Forms of reinsurance – Methods of reinsurance – Reinsurance arrangement – Excess of loss reinsurance with insurer and reinsurer – Proportional reinsurance with insurer and reinsurer.

Text Book:
Elements of Insurance by Dr E. Dharmaraj, SIMERS Publication

Reference:
Reinsurance management IC- 85 by III.
****

UNIT – 1: Financial Functions of Management

UNIT – 2: Cost of capital

UNIT – 3: Dividend Policy
Introduction – Forms of dividend – Dividend theories – Relevance concept as dividend – Irrelevance concept of Dividend

UNIT – 4: Risk of return and rates
Mean - Variance - Standard Deviation - Expected rate of return and risk - Beta Value - Capital Asset Pricing Model ( CAPM )
UNIT – 5: Leverages

Meaning – Types – Operating Leverages - Financial Leverages - Combined Leverages

Text Book:
“Fundamentals of financial Management” by D Chandra Bose

Objectives: To introduce the basic concepts of modeling, to study the different mathematical models involving differential equations, graph theory etc.

Unit I:
Ordinary differential equation – Linear growth model – Growth of science and scientists – Non-linear growth and decay models – Diffusion of glucose or a medicine in the bloodstream.

Unit II:

Unit III:
Modeling through difference equations – Linear difference equation – Obtaining complementary function by use of matrices – Harrods model – cob-web model – Applications of actuarial science.

UNIT – IV:
Cash flow process – Net present value and accumulated profit – Internal rate of return – Payback period – Discounted payback period.

Unit – V:
Models for short term insurance contracts - Collective risk model- Compound distribution - Surplus process – Linear predictor model.
Text Book:

Unit I: Chapter 2 § 2.1 – 2.3, 2.4.2
Unit II: Chapter 3 - 3.1.1 – 3.1.3, 3.2.1 & 3.5.1
Unit III: Chapter 5 § 5.2.1 – 5.2.6, 5.3.1, 5.3.2 & 5.3.4
Unit IV: Chapter 10 – CT1
Unit V: CT6 – Risk models, Ruin theory, generalized linear models.

Reference Books
3. CT1, CT6

****
PART - III

ALLIED COURSES SYLLABUS
Objectives:

(i) Summarize the main features of a data set (exploratory data analysis).

(ii) Explain the concepts of probability.

(iii) Explain the concepts of random variable, probability distribution, distribution function, expected value, variance and higher moments, and calculate expected values and probabilities associated with the distributions of random variables.

Unit 1: Introduction:


Unit 2: Diagrammatic and Graphical Representation:

Advantages-construction-rules-Diagram - Simple Bar Diagram – Multiple Bar Diagram – Clustered Bar Diagram - Line Diagram – Pie Chart – Graph histogram - Frequency (polygon, curve, ogive) – (time series, z curve, horizontal line, false base lines, component or band graph)

Unit 3: Measures of central tendency (Averages):

Introduction - Meaning – Definition-Functions – Characteristics – Arithmetic mean – Median – Mode – Geometric Mean - Harmonic Mean

Unit 4: Measures of Dispersion and skewness, kurtosis, moments:

Introduction – Meaning -Range – Mean Deviation - Quartile Deviation – Standard Deviation- Skewness - Kurtosis

Unit 5: Probability :

Introduction - History – Meaning – Mathematical properties- Permutation – Combination – Trial – Event- Sample space- Mutually exclusive cases-
Exhaustive events- Dependent and independent events- Simple and compound events - Measurement – Classical – Relative frequency theory – Limitations- Personalistic view of probability and axiomatic approach of probability – Addition and multiplication theorem – odds – practical problems

Text Book:


Unit I : Chapter 1 Sections -1.1, 1.5 chapter3- sections 3.1 to 3.4; 3.6 to 3.10
Unit-II: Chapter -3 section 3.12
Unit III: Chapter 4  [ except sections 4.9 and 4.9]
Unit IV: Chapter 5 and chapter 6 Unit V: Chapter 8 Sections 8.1 to 8.3

Reference Book:


19UMAASA02 MATHEMATICAL STATISTICS - II L T P C
   5 104

Objective:

I. Define basic discrete Distributions.
II. Explain the concepts of independence, jointly distributed random variables and conditional distributions, and use generating functions to establish the distribution of linear combinations of independent random variables.
III. Explain the concepts of conditional expectation.

Unit I:

**Unit II :**

**Unit III: Mathematical Expectation and Generating Function (Basic Concepts only)**

**Unit IV: Discrete Distribution:**

**Unit V: Continuous Distribution:**

**Text Book:**
Unit I: Chapter 4&5- (4.2, 5.2, 5.4)
Unit II: Chapter 5 – (5.5.1 – 5.5.6)
Unit III: Chapter 6 – (6.1 – 6.6, 6.8, 6.9)
Unit IV: Chapter 7.1, 8.1-8.5
Unit V: Chapter 8 – (8.1 – 8.3)
Reference Books:


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19UMAASA03  PRACTICAL – ‘R’ PROGRAMMING  

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Objective: To make the students to

I. be equipped with the professional competency through learning Free Open Source Software – R
II. Create the database, visualizing and analyzing the data using R
III. Make inferences through the results obtained

List of practicals – R (30 Hours)

1. Use R as a calculator using basic Commands in R
2. Data entry, manipulation and retrieval
3. Creating frequency and relative frequency distribution in R
4. Creating data frame, matrices
5. Descriptive statistics, Graphics - pie diagram, box plot, histogram, bar plot
6. Creating functions
7. To find mean, median, geometric mean, harmonic mean of numerical data and edit the output
8. To determine standard deviation, variance and checking the consistency of the given data and edit the output
9. Bivariate data- scatter plot, correlation co-efficient, fitting linear regression line and interpreting the result
10. Multiple linear regression models
11. Computation of probabilities in various distributions. (Binomial, Poisson, Normal)
12. Drawing the graph of probability mass and density functions
13. One and two sample ‘t’ test and paired ‘t’ test
14. One way and two way Analysis of Variance tests


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PART - IV

SKILL BASED ELECTIVE COURSE SYLLABUS
Objective:
Aim of this Subject to give a brief introduction to various group insurance schemes available in Indian Financial Market.

Unit I: Group Insurance
Group Insurance - Segments of group schemes market – Origin and development of group schemes characteristics of groups.

Unit II: Group Underwriting
Group underwriting- rate making and experience rating adjustment.

Unit III: Types Of Group Insurance In India
Group Gratuity- Group Superannuation- GSLI- Group Credit Insurance - Group Insurance In Lieu Of EDLI.

Unit IV:
Group Insurance – Administration - Claims and Renewals- Reinsurance for Group Insurance.

Unit V: Social & Rural Insurance

Text Book:
1. IC 83 of Insurance Institute of India.

*****
LIST OF PRACTICALS

1. Type a Document in different alignments (Left, Right, Center, Justify).
2. Type a Letter for applying a job.
3. Type your own Bio – Data.
4. Draw a Table structure.
5. Type a given Mathematical expression using Differentiation, Integration and Trigonometry.
6. Type a given Mathematical expression using all expression.
7. Type a given expression using all inequalities.
8. Type of given Article.
10. Type a given Question paper
11. Convert one LaTeX file into power point presentation.

Text Books


Reference Books

Note

- This paper should be handled and valued by the faculty of Mathematics only.
- Both Internal and External Examiners for University Practical Examination should be appointed from faculty of Mathematics only.

19UMAASS03 RETIREMENT BENEFIT

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Objective:
Aim of this Subject to give a brief introduction to various Retirement benefits available in Indian Financial Market.

Unit I: Historical background to employee benefits in India
Provident funds - Superannuation - Gratuity schemes.

Unit II: Gratuity and Superannuation Schemes
Different ways of arranging schemes – Unfunded schemes and funded schemes – Trustee administered and insured schemes.

UNIT III: Methods of costing
Past service benefits and future service benefits – annual premium and single premium – method of costing, definite funding and indefinite funding and controlled funding.

Unit IV: Legal aspects and taxation
Treatment of retirement provisions under provident, gratuity and superannuation funds – Documentation of Trust deeds and Rules.

Unit V: Pension Products & Annuities
Defined Benefit Pension Scheme - Defined Contribution Pension Scheme - Classification Of Annuities - Life Annuity - Annuity Certain -Annuity Options - Fixed Annuity - Variable Annuity - Linked Annuity

Text Book:
IC 83 of Insurance Institute of India.

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