Some parts of the Ordinance

14. The Grading Systems:
   (a) Credit Point (CP): The credit points achieved by an examinee for 1 unit course shall be 4.
   (b) Letter Grade (LG) and Grade Point (GP): Letter Grades, corresponding Grade points
       and Credit Points shall be awarded in accordance with provisions shown below:

Table of LG, GP and CP for credit courses

<table>
<thead>
<tr>
<th>Numerical grade</th>
<th>LG</th>
<th>GP / unit</th>
<th>CP / unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>80% or its above</td>
<td>A⁺ (A plus)</td>
<td>4.00</td>
<td>4</td>
</tr>
<tr>
<td>75% to less than 80 %</td>
<td>A (A regular)</td>
<td>3.75</td>
<td>4</td>
</tr>
<tr>
<td>70% to less than 75 %</td>
<td>A⁻ (A minus)</td>
<td>3.50</td>
<td>4</td>
</tr>
<tr>
<td>65% to less than 70 %</td>
<td>B⁺ (B plus)</td>
<td>3.25</td>
<td>4</td>
</tr>
<tr>
<td>60% to less than 65 %</td>
<td>B (B regular)</td>
<td>3.00</td>
<td>4</td>
</tr>
<tr>
<td>55% to less than 60 %</td>
<td>B⁻ (B minus)</td>
<td>2.75</td>
<td>4</td>
</tr>
<tr>
<td>50% to less than 55 %</td>
<td>C⁺ (C plus)</td>
<td>2.50</td>
<td>4</td>
</tr>
<tr>
<td>45% to less than 50 %</td>
<td>C (C regular)</td>
<td>2.25</td>
<td>4</td>
</tr>
<tr>
<td>40% to less than 45 %</td>
<td>D</td>
<td>2.00</td>
<td>4</td>
</tr>
<tr>
<td>less than 40 %</td>
<td>F</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>Incomplete</td>
<td>I</td>
<td>--</td>
<td>0</td>
</tr>
</tbody>
</table>

Absence from the final examination shall be considered incomplete with the letter grade “I”.

15. Award of Degree, Promotion and Improvement of Results:
   (a) Award of Degree: The degree of Master of Science/Master of Pharmacy in any subject shall
       be awarded on the basis of GPA obtained by a candidate in M.Sc./M. Pharm. In order to qualify
       for the M.Sc./M. Pharm degree a candidate must have to obtain within 3 (three) academic years
       from the date of first admission:
       (i) a minimum GPA of 2.50
       (ii) a minimum GPA of 2.00 in the Practical/Thesis, and
       (iii) a minimum TCP of 36.
   (c) Result Improvement:
       A candidate obtaining a GPA of less than 2.75 at the examination shall be allowed to
       improve his/her result, only once as an irregular candidate within 3 academic years from
       the date of first admission.

       The year of examination, in the case of a result improvement, shall remain
       same as that of the regular examination. His/her previous grades for practical
       courses, Class assessment/Tutorial/Terminal/Home assignment, Thesis/Dissertation/Project/In-plant
       training courses shall remain valid (except the Theory Viva voce). If a candidate fails to improve GPA,
       the previous result shall remain valid.
The M.Sc. Examination in Mathematics (General Group) of 2011 shall comprise of 1000 marks and consist of
i) a written examination of 8 theory courses of 800 marks,
ii) a Viva-Voce examination carrying 100 marks and Tutorial & Terminal/Term paper project of 100 marks
iii) a full credit is 40

The M. Sc. Examination in Mathematics (Thesis Group) of 2011 shall comprise of 600 marks and consist of
i) a written examination of 6 (six) theory courses of 600 marks,
ii) a thesis carrying 200 marks (written thesis-150 Marks and Thesis Viva-Voce-50 marks) and
iii) Tutorial & Terminal of 100 marks and Viva-Voce (on theory courses) of 100 marks.
iv) a full credit is 40.

A candidate for the M. Sc. Examination in Mathematics of 2011 shall take any eight courses (for the General Group) or any six courses (for the Thesis Group) from either of the following two streams with the approval of the department

The course distribution for Stream A : Pure Mathematics

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title of Courses</th>
<th>Full Marks</th>
<th>Duration of Exam.</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math.- 501</td>
<td>Advanced Analysis</td>
<td>100</td>
<td>4 Hours</td>
<td>4</td>
</tr>
<tr>
<td>Math.- 502</td>
<td>Functional Analysis</td>
<td>100</td>
<td>4 &quot;</td>
<td>4</td>
</tr>
<tr>
<td>Math.- 503</td>
<td>Commutative Algebra</td>
<td>100</td>
<td>4 &quot;</td>
<td>4</td>
</tr>
<tr>
<td>Math.- 504</td>
<td>Field Theory</td>
<td>100</td>
<td>4 &quot;</td>
<td>4</td>
</tr>
<tr>
<td>Math.- 505</td>
<td>Homological Algebra</td>
<td>100</td>
<td>4 &quot;</td>
<td>4</td>
</tr>
<tr>
<td>Math.- 506</td>
<td>Lattice Theory</td>
<td>100</td>
<td>4 &quot;</td>
<td>4</td>
</tr>
<tr>
<td>Math.- 507</td>
<td>Rings and Radicals</td>
<td>100</td>
<td>4 &quot;</td>
<td>4</td>
</tr>
<tr>
<td>Math.- 508</td>
<td>Fuzzy Mathematics</td>
<td>100</td>
<td>4 &quot;</td>
<td>4</td>
</tr>
<tr>
<td>Math. 509</td>
<td>Distribution Theory</td>
<td>100</td>
<td>4 &quot;</td>
<td>4</td>
</tr>
<tr>
<td>Math.- 510</td>
<td>Differentiable Manifolds</td>
<td>100</td>
<td>4 &quot;</td>
<td>4</td>
</tr>
<tr>
<td>Math.- 511</td>
<td>Category Theory</td>
<td>100</td>
<td>4 &quot;</td>
<td>4</td>
</tr>
<tr>
<td>Math.- 512</td>
<td>Topological Algebra</td>
<td>100</td>
<td>4 &quot;</td>
<td>4</td>
</tr>
<tr>
<td>Math.- 513</td>
<td>Algebraic Topology</td>
<td>100</td>
<td>4 &quot;</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>1000</td>
<td></td>
<td>40</td>
</tr>
</tbody>
</table>

The course distribution for Stream B : Physical and Computational Mathematics
<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title of Courses</th>
<th>Full Marks</th>
<th>Duration of Exam.</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math.- 521</td>
<td>Computational Stellar Astrophysics</td>
<td>100</td>
<td>4 Hours</td>
<td>4</td>
</tr>
<tr>
<td>Math.- 522</td>
<td>Relativity and Cosmology</td>
<td>100</td>
<td>4 &quot;</td>
<td>4</td>
</tr>
<tr>
<td>Math.- 523</td>
<td>Mathematical Modeling &amp; Population Dynamics</td>
<td>100</td>
<td>4 &quot;</td>
<td>4</td>
</tr>
<tr>
<td>Math.- 524</td>
<td>Interval Analysis</td>
<td>100</td>
<td>4 &quot;</td>
<td>4</td>
</tr>
<tr>
<td>Math.- 525</td>
<td>Advanced Numerical Analysis</td>
<td>100</td>
<td>4 &quot;</td>
<td>4</td>
</tr>
<tr>
<td>Math.- 526</td>
<td>Biomathematics</td>
<td>100</td>
<td>4 &quot;</td>
<td>4</td>
</tr>
<tr>
<td>Math.- 527</td>
<td>Computational Fluid Dynamics</td>
<td>100</td>
<td>4 &quot;</td>
<td>4</td>
</tr>
<tr>
<td>Math.- 528</td>
<td>Water Wave Mechanics</td>
<td>100</td>
<td>4 &quot;</td>
<td>4</td>
</tr>
<tr>
<td>Math.- 529</td>
<td>Aerodynamics</td>
<td>100</td>
<td>4 &quot;</td>
<td>4</td>
</tr>
<tr>
<td>Math.- 530</td>
<td>Geophysical Fluid Dynamics</td>
<td>100</td>
<td>4 &quot;</td>
<td>4</td>
</tr>
<tr>
<td>Math.- 531</td>
<td>Nonlinear Oscillations</td>
<td>100</td>
<td>4 &quot;</td>
<td>4</td>
</tr>
<tr>
<td>Math.- 532</td>
<td>Industrial Mathematics</td>
<td>100</td>
<td>4 &quot;</td>
<td>4</td>
</tr>
<tr>
<td>Math.- 533</td>
<td>Mathematics of Finance and Insurances</td>
<td>100</td>
<td>4 &quot;</td>
<td>4</td>
</tr>
<tr>
<td>Math.- 534</td>
<td>Quantum Mechanics</td>
<td>100</td>
<td>4 &quot;</td>
<td>4</td>
</tr>
<tr>
<td>Math.- 535</td>
<td>Applied Functional Analysis</td>
<td>100</td>
<td>4 &quot;</td>
<td>4</td>
</tr>
<tr>
<td>Math.- 536</td>
<td>Applicable Lattice Theory</td>
<td>100</td>
<td>4 &quot;</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>1000</strong></td>
<td></td>
<td><strong>40</strong></td>
</tr>
</tbody>
</table>

Chairman
Department of Mathematics
University of Rajshahi.
Course - 501
ADVANCED ANALYSIS

Abstract Integration: Measure and simple functions. Integration of positive and complex functions. The role played by sets of measure zero. Positive Borel measures. The Riesz representation theorem, regularity properties of Borel measures, Lebesgue measure, continuity properties of measurable functions.


Books Recommended:
1. W. Rudin: Real and Complex analysis
2. H. L. Royden: Real Analysis
3. P.R. Halmos: Measure theory
4. S.J. Taylor: Introductions of measure and integration

Course - 502
FUNCTIONAL ANALYSIS


Books Recommended:
1. W. Rudin: Real and Complex analysis
4. Edward: Functional Analysis
5. W. Rudin: Functional Analysis

Course - 503
COMMUTATIVE ALGEBRA


Course - 504
FIELD THEORY


Books Recommended:
2. B.L. Vander Wearden: Modern algebra. F. Blum translator, NY

**Course - 505**

HOMOLOGICAL ALGEBRA


Homology of complexes, chain transformation, Homology Exact Homology Sequence, Exact Cohomology sequence, Mapping Cone, KerCoker Sequence, Differential groups. Torsion product, 2 square lemma, Snake Lemma. Derived functors. Existence and uniqueness, Ext^n, Tor^n, (H^n, (G, A), H^f (G, A)


**Books Recommended:**

2. P.M. Cohn: Algebra.

**Course - 506**

LATTICE THEORY

1. Semi lattice, lattice, equivalence of set theoretic and algebraic definitions, complete lattice, sublattice.
2. Convex sublattice, Ideals and congruences in a general lattice, homomorphism, isomorphism, quotient lattice, homomorphism theorem, direct product.
3. Metric lattice, valuation, modular and distributive lattice, free lattice, minimax theorem.
5. Stone’s representation theorem, lattice isomorphic to sets and field of sets, prime ideals in Boolean algebra, congruences containing an ideal as a class isomorphism between I(L) and C(L).
6. Distributive lattice with pseudo-complementation stone algebras, identities and congruences.
8. Boolean functions, conjunctive and disjunctive normal forms, switching circuits, simplification of circuits, bridge circuits.

**Books Recommended:**

4. V.K. Khanna: Lattices and Boolean algebras.
Course - 507
RINGS AND RADICALS


Books Recommended:
1. I.N.J. Divinsky : Rings and radicals
2. I.N. Herstein : Non Commutative rings

COURSE - 508
FUZZY MATHEMATICS

Chapter - 1 :
Fuzzy set, Subject, Empty fuzzy set, Equality of two fuzzy sets, Complement of a fuzzy set, Union and Intersection of fuzzy sets, De Morgan's laws. Product of fuzzy sets. Fuzzy point and fuzzy singleton. Function and some basic results. Definition of fuzzy groups, rings etc.

Chapter - 2 :

Chapter - 3 :
Fuzzy continuous function and some basic results. Lower and upper semi-continuous functions. Good-extension, strong and weak $\alpha$-cut, Initial property, Weakly induced fuzzy topological spaces.

Chapter - 4 :
Separation axioms : i) $T_0$, $T_1$ and $T_2$ fuzzy topological spaces ii) $R_0$ and $R_1$ fuzzy topological spaces, iii) Regular and normal fuzzy topological spaces iv) $\alpha$-separation properties.

Chapter - 5 :
Compact fuzzy topological spaces and some theorems on compactness. Comparison of different compactness Notions. $\alpha$- compactness.

Chapter - 6 :
Connected fuzzy topological spaces, Comparison of some different fuzzy connectedness concepts. Some theorems on fuzzy connected spaces.

Chapter - 7 : Fuzzy Groups, Theorems.

Chapter - 8 : Fuzzy Rings, Theorems.

Books Recommended:
2. R. Lowen : On the Existence of Natural Non-topological Fuzzy Topological Spaces Hel derinnann verlage,
Course - 509
DISTRIBUTION THEORY

1. Test functions and distributions.
2. Convergence and differentiation of distributions.
3. Convolution of distribution.
4. Tempered distributions and Fourier Transforms.
5. Sobolev spaces.
6. Distributions on locally convex spaces.
7. Distributions on Manifolds.
8. Solutions of Elliptic, the Dirichlet, the Neumann boundary Value problems, Solutions of certain Boundary value problems in IR$^2$.

Books Recommended:

Course - 510
DIFFERENTIABLE MANIFOLDS


Books Recommended:
1. Bishop and Crittenden : Geometry of Manifolds
   Academic Press, N.Y., U.S.A.

Course - 511
CATEGORY THEORY

transformation, equivalence of categories functor categories, categories of additive functors, modules, projectives and injectives, Derived functors. Q-categories. Group valued functors.

**Books Recommended**:
1. L. Bocry Mitchell : Category Theory
2. Peter Freyd : Abelian Categories
3. Michael Barr : Category Theory in Computer Science

**Course - 512**
**TOPOLOGICAL ALGEBRA**

The classical Linear groups, GL(n, C), SL(n, C), U(n), SU(n), GL(n, R), SL(n, R), O(n), SO(n), O(n, r) Quaternions- Linear Simplicitc group. Concept of topological group, systems of neighbourhoods of the identity, Subgroup, normal subgroup, factor group, Homogeneous spaces, as homogeneous spaces. Isomorphisms, Automorphisms, Homomorphisms, Intersection and product of groups. Direct product, infinite direct product connected and olninstonal groups, Local properties, Local isomorphisms. Character groups, fundamental relations in the Theory of characters, simple examples, compact and discrete groups, direct sum for a group and its character group. Locally compact groups, Locally connected commutative group, Topologized algebraic fields.

**Books Recommended**:
2. S. Lefachets : Algebraic Topology, Princeton University Press
4. L. Pontraj again : Topological groups, Princeton University Press
7. T. Hussain : Topological groups

**COURSE - 513**
**Algebraic Topology**

Fundamental groups, Van-Kampen Theorem, computations, Covering spaces, K(G, 1) spaces and graphs of groups. Homotopy groups π(n), K(G, n) spaces (Eilenberg Maclane spaces).
Fiber-bundles, Homotopy lifting property.
Simplicial complexes, barycentric subdivision, simplicial approximation theorem, the homology of simplicial complexes, singular homology, Mayer-Victoria sequences, computations and applications. Cohomology of spaces, cup product, cohomology ring, ceah homology.

**Books Recommended**:
2. E.H Spanier : Algebraic topology, McGrow Hill.
S. Wiely : University Press.

4. W. Massey : Algebraic topology; An Introduction, Harcourt, Brace and World (re-printed by springer and Verlag)


Stream-B

COURSE - 521
COMPUTATIONAL STELLAR ASTROPHYSICS

The solar system : Two-body orbital motion, application to detection of other planetary systems, restricted three-body problem. Theories for the origin of the solar system. The 3-body problem. Lagrangian equilibrium points, effects of drag forces, theories of tides, the disturbing functions & Perturbations.


Books Recommended :
1. Baidyanath Basu : An Introduction to Astrophysics,
2. Bohm-Vitense : Stellar-Astrophysics
3. M. Schwarzschild : Stellar Structure and Evolution

COURSE - 522
RELATIVITY AND COSMOLOGY

Special Relativity : Historical background, Postulates of Special Relativity, Lorentz transformation, contraction of rods. Time dialation, Transformation of velocity, acceleration, momentum and mass, Equivalence of mass and energy.

G. Relativity : Principles of equivalence and covariance. Einstein's field equation. The Schwarzschild solution, The three tests of general Relativity; the advance of perihelion of planets, the gravitational deflection of light, Gravitation shifting spectral lines, the Blackhole concept.


Books Recommended:
2. Tolman : Relativity, Thermodynamic and Cosmology
3. S Wsinberg : Gravitation and Cosmology
4. M Wald : General Relativity
5. R. Resnick: Introduction to Special Relativity

Course: 523
MATHEMATICAL MODELING & POPULATION DYNAMICS

2. Single species linear and nonlinear population models.
3. Delay models in population, physiology & harvesting.
4. Two species linear population models (Principal matrix solution)
5. Two species nonlinear population models. (phase portrait analysis)
7. Multispecies population models.
8. Optimal population models.

Books Recommended:
1. J. C. Frauenthal: Introduction to population Modeling
2. H.I. Freedman: Deterministic Models in Population Dynamics
3. J.D. Murray: Mathematical Biology
4. J.N. Kapur: Mathematical models in Biology and Medicine

Course: 524
INTERVAL ANALYSIS

1. Interval Numbers
2. Interval Arithmetic
3. A Metric Topology for Interval
4. Matrix Computations with Intervals
5. Values and Ranges of Values of Real Functions
6. Interval Contractions and Root-Finding
7. Interval Integrals
8. Integral Equations
9. Initial-Value Problem in Ordinary Differential Equations

Books Recommended:
1. R. E. Moore, Interval Analysis,

Course: 525
ADVANCED NUMERICAL ANALYSIS

1. Error Analysis: Error Sources, Propagation and Analysis
2. Interpolation: Spline Interpolation, Hermite Interpolation, Chebyshev Interpolation.
3. Approximation of Functions: Weierstrass Theorem and Taylor's Theorem, Minimax Approximation, Approximation by Orthogonal Functionals, Non-polynomial Approximation rational and pade Approximation.
5. The solution of Nonlinear Equations: Iteration for solving \( x = g(x) \), Bracketing Methods for location a Root, Initial Approximations and convergence criteria, Newton's Method, Aitken's Process and Steffentinsen's and Mulleer's Methods, Iteration for Nonlinear systems, Newton's Methods for systems.


Books Recommended:
1. Kendall E. Atkinson: An Introduction to Numerical Analysis
2. J. Stoer, R. Bulirsch: An Introduction to Numerical Analysis
3. F.B. Hilderbrand: An Introduction to Numerical Analysis
4. Carl-Erik Froberg: An Introduction to Numerical Analysis

Course: 526
BIOMATHEMATICS


4. Diffusion and Diffusion-Reaction Models: Diffusion equation, Diffusion in artificial kidney, Oxygen diffusion through living tissues, Diffusion through membrane, epidemic model with diffusions.


Books Recommended:

Course - 527
Computational Fluid Dynamics

1. **Basic Studies**: Equations of fluid dynamics, Navier-Stokes equations, Boundary conditions, Dimensional Analysis, Euler equation.

2. **Numerical Solution**:
   c) Numerical solution of pde's; Classification of pde's; Consistency, convergence, Lax equivalence theorem, central differences. Solution of elliptic pde's.


4. **Shallow Water Equations**: Energy equation, Momentum equations for two-dimensional cases. Equations of motion in general coordinates.


**Books Recommended**:

COURSE - 528

WATER WAVE MECHANICS


3. **Finite Amplitude Wave Theory**: Perturbation method, Solitary wave, Cnoidal wave theory, Stokes wave Gursatner wave.

4. **Long Waves in shallow water**: Long wave equations, Effects of bottom friction, Surface wind stress, Geostrophic effects on long waves, Storm surge.

5. **Nonlinear Waves**: Dimensionless analysis, Water waves over mud, rigid and porous bottoms, Mass transport, Momentum flux, wave set-up/down.

**Books Recommended**:
1. B. LeMehaute, : An introduction to hydrodynamics & water waves
2. J. J. Stoker : Water Wave
6. R. M. Sorensen: Basic wave mechanics

Course: 529
AERODYNAMICS

1. **Thermodynamic concepts**: Equation of state, First and second laws, Entropy, Enthalpy and free Energy.
2. **One dimensional motion**: Continuity, Momentum and energy equations, Mach number, Normal shock relation, Propagating shocks wave, Acoustic equations, Propagation of finite waves.
3. **Two dimensional Motion**: Oblique shocks, Flow over wedge, Mach Lines, Prandtl Mayer Function, Reflections of oblique shocks, Mach reflections, thin aerosol theory.
5. Laminar Flow, Turbulent Flow
6. Small Perturbation theory, two dimensional flow past a wavy wall.
7. The method of characteristics.
8. Hodograph method: Menenbrook Chaplygin equation, Legendre transformation, Ringlet solution, lost solution, limit line.

Books Recommended:
1. A.M. Kuethe & J. D. Schetzer: Foundation of Aero dynamics
2. N.A.V. Picrcy: Aero dynamic
3. W.F. Durand: Aero dynamic theory
4. M. Thomson: Theoretical Hydro dynamics

Course: 530
GEOPHYSICAL FLUID DYNAMICS

1. **Introduction**: Review of basic hydrodynamics, Continuity equation, Equation of motion, Coriolis force, Distribution of atmosphere layers, Pressure gradient force.
2. **Atmosphere**: Distribution and composition of atmosphere, Physical and chemical fundamental of air and water, Greenhouse effects, Effects of air pollution on meteorological conditions, Effects of thermal pollution and its prevention.
4. **Shallow water equations**: Continuity and momentum equation in shallow water, Normal modes (Stunn-Liouville equations), Boundary conditions, Solution of vertical modes, High and low frequency shallow water equations.
5. **Waves**: Gravity waves with rotation, Kelvin wave, Potential vorticity, Inertial motion, Particle orbit, Internal waves, WKB solution, Rossby wave, Lee wave, dispersion relation, Salt disturbances.
6. **Quasi-geostrophic**: Vorticity equation, Circulation, Barotropic instability, Baroclinic instability, Perturbation vorticity equation, instability criterion, Fano and Rayleigh line.

Books Recommended:
Course: 531

NONLINEAR OSCILLATIONS

1. Nonlinear physical systems
2. Asymptotic expansions
3. Perturbation methods
4. Singular perturbation problems
5. Method of slowly Varying amplitude and Phase
6. The method of multiple scales
7. Forced Oscillations
8. Linear systems

Books Recommended:
1. Ronald E. Mickens: An Introduction to Nonlinear Oscillations.

Course: 532

INDUSTRIAL MATHEMATICS

2. Data Acquisition and Manipulation: The z-transform, Linear recursions, Filters, Stability, Polar and Bode plots, Aliasing, Closing the loop.
3. The Discrete Fourier Transform: Real time processing, Properties of DFT, Filter design, The fast, Fourier transform, Image processing.
7. Partial Differential Equations: Lumped versus distributed, the big six PDEs, Separation of variables, Unbounded spatial domains, Periodic steady state. Other distributed models.

Books Recommended:
Course: 533
MATHEMATICS OF FINANCE AND INSURANCE

Prerequisite knowledge of Application of Mathematics to Finance as taught in an optional paper at Graduate level UGC curriculum, 2002.

Financial Derivatives - An Introduction. Types of Financial Derivatives-Forwards and Futures; Options and its kinds; and SWAPS. The Arbitrage Theorem and Introduction of Portfolio Section and Capital Market Theory; Static and Continuous-Time Model.
Pricing by Arbitrage- A Single-Period option Pricing Model; MultiPeriod Pricing Model-Cox-Ross-Rubinstein Model; Bounds on Option Prices,
The Ito's Lemma and the Ito's Integral.
The Dynamics of Derivative Prices-Stochastic Differential Equations (SDEs)-Major Models of SDEs; Linear Constant Coefficient SDEs; Geometric SDEs; Square Root Process, Mean Reverting Process and Ornstein-Uhlenbeck Process.
Martingale Measures and Risk-Neutral Probabilities; Pricing of Binomial Options with equivalent Martingale Measures.
Concepts from Insurance-Introduction; The Claim Number Process; The Claim Size Process; Solvability of the Portfolio; Reinsurance and Ruin Problem.
Premium and Ordering of Risks-Premium Calculation Principles and Ordering Distributions.
Distribution of Aggregate Claim Amount-Individual and Collective Model; Compound Distributions; Claim Number of Distributions; Recursive Computation Methods; Lundberg Bounds and Approximation.
Risk Processes-Time-Dependent Risk, Models; Poisson Arrival Processes; Ruin Probabilities and Bounds Asymptotics and Approximation by Compound Distributions.
Time Dependent Risk Model-Ruin Problems and Computations of Ruin Functions; Dual Queuing Model; Risk Models in Continuous Time and Numerical Evaluation of Ruin Functions.

Books Recommended :
5. Robert C. Merton, Continuous-Time Finance, Basil Blackwell Inc.

Course: 534
ADVANCED QUANTUM MECHANICS

1. Wave mechanical concepts : Schrodinger wave equation, Interpretation of wave function, Interpretative postulates and energy eigenfunctions, Momentum eigenfunctions, the principles of wave mechanics.
2. Matrix theory of the harmonic oscillator: Energy representation, raising and lowering
operations, matrices for $a$, $x$ and $p$, coordinate representation.

3. **Symmetry in Quantum mechanics**: Space and time displacements, rotation, angular momentum and unitary group, space inversion and time reversal, dynamical symmetry.

4. **Collision theory**: Scattering cross section, Scattering by spherically symmetric potential, Square well potential and Coulomb potential, Phase shift and amplitude.

5. Born approximation, Perturbation method (non-degenerate case only).

6. Matrix representation of wavefunctions and operators, Eigenvalue problems, Dirac's bra and ket notations, Representation of state vectors and operators in Hilbert space.

7. Schrödinger, Heisenberg and Interaction pictures, Equations of motion.

8. Properties of Angular momentum, Zeeman effect, Identical Particles and spin.

**Books Recommended :**

1. L. I. Schiff : Quantum Mechanics
2. P. T. Mathews : Introduction to Quantum Mechanics
3. Powell & Grassmann : Quantum Mechanics
4. Gupta, Kumar & Sharma : Quantum Mechanics
5. E. E. Anderson : Modern Physics & Quantum Mechanics
6. Donald Rao : Quantum Mechanics
7. F. Mandl : Quantum Mechanics
8. P. A. M. Dirac : Quantum Mechanics
9. A. M. Harun ar Rashid : Quantum Mechanics
10. Eugen Merzba Cher : Quantum Mechanics