Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for M. Sc. In Applied Mathematics

(Effective from Academic Session 2018-2019)

FOURTH SEMESTER

MAM 401 : INTEGRAL TRANSFORMS AND INTEGRAL EQUATION

(40 Classes)

Integral transformation :Laplase transformation (L.T): Defination and basic properties, Laplase integral lerch's theorem (statement only), L.T of elementary function of derivatives and direc-delta function. Differentiation and integration, convolution of L.T. Inverse L.T.

Fourier transformation(F.T): Definition and basic properties.F.T of some elementary function of derivatives. Inverse F.T. convolution theorem, Perseval's relation. Application of Fourier inversion and convolution theorem. Fourier sine and cosine transformation.

Application of integral transforms of solve two-dimensional Laplase and one dimensional diffusion and wave equation.

Integral Equation :Definition and classification. Linear Integral Equation (I.E) of first and second kind of Fredholm and Voltera type.Relation of boundary value problem of ordinary Differential Equations of integral equations.

Fredholm equation: solution by the method of successive approximation, resolvent karnel . solution in terms of resolvent Karnel , separable karnel, iterative scheme.

Voltera equation : Solution by successive approximation and resolvent karnel.

Hilbert-Schmidt theory : Symmetric kernels, orthogonal system of function, fundamental properties of eigen values and eigen function for symmetric karnels, Hilbert-Schmidt theorem.

Reference Books

1. Integral Transformation – D.V Wider
2. Operation calculus – N.V Mclachar
3. Operational Mathematics- R.V Churchill
4. The use of Integral Transforms- I.N Sneddon
5. Linear Integral Equation- W.V Lovitt
6. Integral Equation- F.G Tricomi
7. Linear Integral Equation- S.G Mikhlin
8. Linear Integral Equation- R.P Kenwa

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MAM E 402: Elective II

MAM E 402 A: MATHEMATICAL BIOLOGY
(40 Classes)

Microbial population model: Microbial growth in chemostat stability of steady states growth of microbial population,product formation due to microbial action,competition for a growth of microbial population,product formation due to microbial action,competition for a growth rate limiting substrate in chemostat.

Models in ecology:single-species population model-Malthus,logistic,Gompertz models,Allee effect,qualitative analysis of model equation,Hervest model,discrete-time models,density independent growth,delay population models.Two species models-Lotka-Volterra,predator-prey,competition and mutualism models.

Elementary dynamics of exploited populations: constant rate harvesting,fishing effort,generalised logistic models depensation,yield-effort curves,critical depensation.

Open-Access Fishery: Gordan's static model,opportunity cost,economic fishing,production function,cobb-Dougles production function,discounting,Schaefer model,effect of discounting.

Multi –species models in fishery management: combined harvesting of two ecologically independent fish species following logistic growth,Bionomic equilibrium,optimal harvest policy,combined harvesting of two competing fish species following logistic growth.

Epidemic models:Deterministic andstochastic models without and with removal,control of epidemic

Genetic models: Genetic matrices ,Hardy-Weinberg law,application of Baye's theorem in genetics,model for inheritance of genetic characteristic,e.g. phenotype ratios,bold groups,inheritance if sex link.

Reference Books:

1. Mathematical Bioeconomics,The optimal Management at renewable Resources,John Wiley & sons,New York- C.W.Clark
2. Bioeconomic Modelling and Fisheries Management- C.W.Clark
3.Mathematical Biology- J.D Murry
4.The Mathematical approach to Biology and Medicine- J.N. Kanpur
5.Element of Mathematical Biology- J.Lotka
6.Models in Ecology- S.T Maynerd

MAM E 402 B:SOFTWAREENGINEERING

(40 CLASSES)

Introduction, Software product, Software Characteristics, Software Crisis, SDLC models: Water Fall Model, Prototype Model, Spiral Model, Evolutionary Development Models.

Software Requirement Specifications (SRS): Feasibility Study, Decision Tables,Decision Tree, SRS Document and characteristics.

Software Design: Basic Concept of Software Design, Modular approach: Coupling and Cohesion,Data Flow Diagrams,Flow Charts.

Software Testing: Testing Objectives, Unit Testing, Integration Testing, Acceptance Testing,system testing, Regression Testing,White Box Testing, Control Flow Graphs, Black Box Testing, Verification and Validation, Static Testing Strategies: Formal Technical Review, Walk Through, Code Inspection.

Software Quality: Software Quality Assurance (SQA), SQA Plans, ISO 9000 standards, SEI-CMM Model.

Software Project Management: . Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration, Function Point (FP) Based Measures, Constructive Cost Models (COCOMO), Software Risk Analysis and Management.Reverse Engineering. An Overview of CASE Tools.

Reference Books:

1. Software Engineering, Rogers G. Pressman, MH

2. Fundamentals of Software Engineering, Rajib Mall, PHI.

3. An Integrated Approach to Software Engineering, p. Jalote, Narosa Publication House.

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MAM E 402 C :NETWORK SECURITY

(40 classes)

Need for Security, Types of security Attack, Security Services, Information Security, Methods of Protection, principles of security.

Terminologies used in Cryptography, Substitution Techniques, Transposition Techniques.Basics of cryptography: symmetric and asymmetric key, digital signature, digital certificate, KDC.

Network Concepts : Network Reference Models: OSI and TCP/IP Models, Threats in Networks, Network Security Controls, Overview of IP Security (IPSec), IP Security Architecture, Modes of Operation, Security Associations (SA), Authentication Header (AH), Encapsulating Security Payload (ESP), Internet Key Exchange.

Web Security Requirements, Secure Socket Layer (SSL), Transport Layer Security (TLS), Secure Electronic Transaction (SET).

Threats to E-Mail, Requirements and Solutions, Encryption for Secure E-Mail, Secure E-Mail System.

Firewalls – Types, Comparison of Firewall Types, Firewall Configurations. VPN.

Reference Books:

1. AtulKahate, Cryptography and Network Security, McGraw Hill

2. Cryptography and Network Security; McGraw Hill; Behrouz A Forouzan

3. Stallings, W.,.Cryptography and Network Security: Principles and Practice, 3rd ed., Prentice Hall PTR.,2003

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MAM E 402 D:DYNAMICAL SYSTEM

(40 Classes)

Phase space and orbits:definition.Autonomous and non –autonomous system.Critical points and linearization.Periodicsolutions.Integralmanifolds.Critical points of nonlinear equations.
Nonlinear oscillation:Conservativesystem,energyintegra,parameter dependent conservative system.Hamiltonian system.
Periodic solution:Bendixoncriterion.Periodicorbit,limitpoint,limitsets.Poincre-Bendixontheorem,limitcycle,existence of periodic solution for Lienardequation.Periodic solution in R^n.

Theory of stability:Stability of equilibrium solutions,stability of periodic solutions,Flocquet'stheorem.Stability by linearization-poincare-Lypunovtheorem.Orbitalstability.Lyapunovfunctions,stability by direct methods.Hamiltonian systems.
Perturbation theory:Basicmaterials,timescale,Naïveexpansion.Poincare'stheorem.Poincare-Lindsted method for periodic solutions of autonomous second –order equations.

Bifurcation theory :Bifurcation,normalization,Poincare theorem on transformation,centremanifolds.Bifurcation of equilibrium solutions and Hofp bifurcation.

Chaos:Lorentz equation and their characteristics,mapping of R into R as a dynamical system,periodicpoint,fixed point of mapping.

Reference Books:

1.Nonlinear Ordinary Differential euation-D.W. Jordan &smith
2.Nonlinear Differential equation and Dynamical system-F.Verhulst
3.An introduction to Chaostic Dynamical system-R.L.Davaney
4.Nonlinear Systems-P.G.Drazin
5.Intrduction to Dynamical system- D.K.Arrowsmith
6.Nonlinear Dynamics and Chaos-Strogatz

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MAM E 402 E:CRYPTOGRAPHY

(40 Classes)

Probability theory:Bernoulli and binomial random variables,geometricdistribution,Markov and Chebyshev'sinqualities,Chernoff's bound
Complexity theory:P,N,PPpolynomial-timereduction,NP-complete problems,randomizedalgorithms,probabilistic polynomial time,non uniform polynomial time
Basic algorithm number theory:Fester integer multiplication,extended E uclid'salgorithms,quadraticresidues,Legendre and jacobysymbols,Chinese remainder theorem,fast molecular exponentiation,choosing random group element,finding a generator of a cyclic group,finding square roots modulo a prime p.polynomial arithmetic in finite fields,factoring polynomial over finite field,isomorphisms between finite fields,computing order of an element,primitiveroots,fastevaiuation of polynomials at multiple points primality testing,Miller-Rabin test,generating random primes,primalitycertificates,algorithms for factorizing computing discrete algorithms.

Publi key cryptography: Diffe-Hellman key exchange,RSA,EL-gamal,Rabin
Algebricgeometry:affine algebraic sets,parametrizations of affine varieties,ordering of the monomials K[X1,…….]division algorithm in K[X……X].Monomial ideas and Dickson's lemma ,Hilbert basic theorem,Grobner basic properties,Buchberger's algorithm.

Private key cryptography:Private key encryption,perfectly secure encryption and its limitation,security,pseudo-random number generator.
Computer approaches to cryptography:basic ideas of computer security,efficient algorithm and negligible success probability,proof by induction,securitynotation CPA,CCA CCA2.
Hash function:Security property of hash function,birth day attack,MAC, construction of hash function number theoretic Hash function,Merkle-Damgard construction.

Reference Books:

1.Mathematics of public key Cryptography-S.DGalbrith
2.Cryptography-Theory & practice-D.R.Stinson
3.An introduction to Mathematical Cryptography –J.Hoffstein,J.H..SILVERMAN
4.Introduction to Modern Cryptography-J.Katz,Y.Lindell

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