P.K.University
Shivpuri (M.P.)

Syllabus

For

M.Sc. MATHEMATICS

(I, II, III & IV Semester Course)

W.E.F. - Session 2023 - 2024

P.K.UNIVERSITY SHIVPURI (M.P.)

P.K.University
Shivpuri (M.P.)

M.Sc. Mathematics Examination Scheme (2023-24)

Semester	Course Code	Title of the Paper	Credit	L	T	P	T-CCE	T-UE	P-CCE	P-UE	Marks
First	MREALMA101	Real analysis	4	4	0	0	40	60	0	0	100
	MTOPOMA102	Topology	4	4	0	0	40	60	0	0	100
	MCOMPMA103	Complex analysis	4	4	0	0	40	60	0	0	100
	MALGEMA104	Algebra	4	4	0	0	40	60	0	0	100
	MMEASMA105	Measure theory and integration	4	4	0	0	40	60	0	0	100
		TOTAL	**20**				**200**	**300**	**0**	**0**	**500**
Second	MDIFFMA106	Differential equation (ordinary and partial)	4	4	0	0	40	60	0	0	100
	MNUMEMA107	Numerical method	4	4	0	0	40	60	0	0	100
	MNUMBMA108	Number theory	4	4	0	0	40	60	0	0	100
	MLINEMA109	Linear algebra	4	4	0	0	40	60	0	0	100
	MCOMMMA110	Commutative algebra	4	4	0	0	40	60	0	0	100
		TOTAL	**20**				**200**	**300**	**0**	**0**	**500**
Third	MCOMPMA201	Computer programming in C	4	4	0	0	40	60	0	0	100
	MSTATMA202	Statistics	4	4	0	0	40	60	0	0	100
	MFUNCMA203	Functional analysis	4	4	0	0	40	60	0	0	100
	MINTEMA204	Integral transforms and boundary value problems	4	4	0	0	40	60	0	0	100
	MCODEMA205	Coding theory	4	4	0	0	40	60	0	0	100
		TOTAL	**20**				**200**	**300**	**0**	**0**	**500**
Fourth	MOPERMA206	Operational research	4	4	0	0	40	60	0	0	100
	MCRYPMA207	Cryptography	4	4	0	0	40	60	0	0	100
	MDESIMA208	Design of experiments	2	0	0	4	0	0	20	30	50
	MMECHMA209	Mechanics	10	0	0		0	0	0	250	250
	MMODEMA210	Modelling and simulation	4	4	0	0	40	60	0	0	100
		TOTAL	**20**				**200**	**300**	**0**	**0**	**500**
		Total marks of all semester	**80**				**800**	**1200**	**140**	**460**	**2000**

L – Lecture T- Theory P- Practical CCE- Continuous comprehensive Exam UE- University Exam

P.K.University
Shivpuri (M.P.)

M.SC MATHEMATICS
SEMESTER I PAPER I
REALANALYSIS

UNIT-1

Introduction , ordered set, Field, The real Field, The Extended Real Number System, The complex Field, Euclidean Field, Archimedean Property, Completeness Property, Metric Spaces, Compactness, continuity and uniform continuity, Monotonic Function, Function of Bounded Variation, Absolutely Continuous Function, derivative of function and Taylor's theorem, Infinite limits and limits at infinity, Discontinuities, Limits of Functions, Perfect set,

1. Finite, countable, and Uncountable Sets.

UNIT-2 Differentiation: Functions of several variable. Derivatives in an open subset of R^n, Derivatives of Higher order, Partial Derivatives, Lagrange's Multiplier Method, Inverse Function Theorem, Implicit Function theorem, The Derivatives of Real Functions, Mean Value Theorem, L' Hospital's Rule, Differentiation Of Vector Valued Function.

UNIT-3 Riemann Integral and its property, characterization of Riemann Integreble Functions, Improper Integral, Sequences and Series of Function, Uniform Convergence and its relation to continuity, differentiation and integration, Fejer's Theorem, Weierstrass Approximation Theorem, Stokes's Theorem.

UNIT-4 Measure Theory: Measurable set; Lebesgue Measure and its properties, Measurable Functions and their Properties; Integration and Convergence Theorem, measure Spaces, Comparison with the Riemann Integral, Function of Class $Ł^2$.

BOOKS-

- T. Apostol, Mathematical Analysis, 2nd ed., Narosa Publishers, 2002
- Walter Rudin, Principles Of Mathematical Analysis, 3rd ed., McGraw- Hill, 1983
- K.Ross, Elemantary Analysis: The Theory Of Calculus, Springer Int. Edition, 2004
- H.L Royden, Real Analysis, 3rd ed., macmillion, 1988.

P.K.University
Shivpuri (M.P.)

SEMESTER I PAPER II

TOPOLOGY

UNIT-1 Set Theory and Logic and Topological spaces and continuous Functions:
def. and examples of topological spaces, Closed set, closure of a set, dense subset, Fundamental Concept, Functions, Relation, partition, Strong Induction Principle, Cartesian product, Finite Set, Countable set and Uncountable set, Infinite Sets and the Axiom of Choice, Well ordered set, The Maximum Principle, neighborhood of a point, Interior, Exterior, Frontier(Boundary), Limit and derivative set, order topology, subspace topology, closure axiom, Basis for a topology, the product Topology, The subspace topology, Closed set and Limit Point, Hausdorff Spaces, Continuous Functions, Homeomorphism, The Product Topology, The metric Topology.

UNIT-2 The Quotient Topology:
Continuous mapping and homeomorphism, Nets, Filters, Compact spaces, Compact Subspaces of the real line, Connected Spaces, The Lebesgue Number Lemma, Extreme Value Theorem.

UNIT-3
Separation axioms (T0,T1,T2,T3,T4)., Regular spaces, normal spaces, compact and locally compact spaces, continuity and compactness.

UNIT-4
Countability and separation Axioms: Countability axioms, product and quotient spaces,connected and locally connected spaces, continuity and connectedness

BOOKS-
1.James Munkres: “Topology; A first Course”, Prentice Hall
2.K.P.Gupta: “Topology” Pragati Prakashan
3.J.L. Kelly: “General Topology” von Nostrand Reinhold Co. (Affiliated East West Press)

P.K.University
Shivpuri (M.P.)

SEMESTER I PAPER III
COMPLEX ANALYSIS

UNIT-1

Analytic Functions, Differentiability of a complex valued function of a complex variable, Cauchy Riemann Partial Differential Equation, Neighbourhood preserving character of analytic mappings, domain preserving character of analytic mappings, angle preserving character of analytic mappings, Conformal mapping: introduction, conformal transform, sufficient and necessary condition for $w=f(z)$ to represent a conformal mapping, the mapping $w= e^z$, the mapping $w= z^n$, some special transformation, power, special power.

UNIT-2

Complex integration, Cauchy- Goursat Theorem, Cauchy's integral formula, higher order derivatives, Morera's Theorem of algebra, Taylor's theorem, Maximum modulus principles, Schwarz lemma.

UNIT-3

Weierstrass Theorem, Taylor series, Laurent's series, Zeroes and poles, isolated singularities, Meromorphic functions. The argument principle Rouche's theorem, Inverse Formula Theorem, Analytic continuation: by power series, radius of convergence, analytic functions.

UNIT-4

Residue, Cauchy's residue theorem, evaluation of integrals, branches of many valued functions with special references to arg z, log z and za, Bilinear transformations, their properties and classification, definition and examples of conformal mappings, conformal mapping of polygons analytic continuation, Picard's Theorem, Hadamard's three circle principle, poisson-jenson's formula, Weierstrass Factrorization theorem, Jenson's theorem, inequality.

BOOKS-

- J.B. CONWAY, function of one compex variable, 2nd ed., Narosa, New Delhi.
- L.V. ALFORS, Complex Analysis, McGraw-Hill book Company.
- B.S GREWAL, Higher Engineering Mathematics.
- T.W. GAMELIN, complex Analysis, Springer Internation Edition, 2001.
- M.J. ABLOWITZ and A.S. FOKAS, complex variables: Introduction and Applications, Foundation

P.K.University
Shivpuri (M.P.)

SEMESTER I PAPER IV
ALGEBRA

UNIT-1

Set Theory, Mapping, Group Homomorphism, Isomorphism; Natural Homomorphism, Cayley's theorem, Quotient group, Fundamental Theorem endomorphism, Subgroups, Normal Subgroups, Direct Product

UNIT-2

Finite Abelian Group, Automorphism, Sylow's Theorem, Composition Series, Jordan Holder Theorem for Finite Group, Cauchy's Theorem For Abelian Group ,Conjugate classes, Class Equation, Theorem 1^{st} : If order of group $G= p^n$, then $Z(G) \neq \{e\}$; Theorem 2^{nd} : $O(G) = P^2$,then group is abelian, Centre and Normalizer, solvable Group, Boolean algebra, Axiom of choice, . .

UNIT-3

Ring Theory: Ideals, Maximal ideals and quotient rings, Homomorphism of rings, Fundamental Theorem Of Homomorphism, Integral Domain Field, Quotient Field, Prime Field, Direct Product of rings, Polynomials of rings, Euclidean ring, Polynomials over the Rational Field, Polynomial Ring Over Commutative Rings, Some def of rings and example, Boolean ring.

UNIT-4

Vector spaces: subspaces, Linear Dependence and Independence and bases, Dual Spaces, Inner Product spaces, Dimension of Direct Sum, Quotient Spaces, Modules.

UNIT-5

Extension field, The Transcendence of e, Solvability by radicals, Nilpotent .

BOOKS-

1. Topics in Algebra, by I.N. Herstein

2.Abstract Algebra, by Gallion

3. Advance Algebra, by Dummit and Foote

P.K.University
Shivpuri (M.P.)

SEMESTER I PAPER V
MEASURE THEORY AND INTEGRATION

UNIT-1

Set theory, Topological Ideas, Sequences and Limits, Functions and Mappings, Cardinal numbers and Countability, Further properties of Open sets, Cantor- Like set

Measure on Real line: Lebesgue outer measure, measurable set, Regularity, MeasurableFunction, Borel and Measures on the Real line, Housdorff Measures on the Real Line.

UNIT-2

Integration of Non-negative function: The General Integral, Integration of Series, Riemannand Lebesgue Integrals.

Differentiation: The four derivatives, continuous Non- differentiable Function, Function of Bounded variation, Lebesgue's Differentiation theorem, Differentiation and integration, The Lévesque Set.

UNIT-3

The L^P Spaces, Convex Functions, Jension's Inequality, Completeness of $L^P(\mu)$, The inequalities of Holder and Minkowski

Convergence: in measure, Almost Uniform Convergence, Counter examples.

Signed measures and their derivatives: Hahn Decomposition, The Jordan Decomposition,The Radon – Nikodym Theorem, Bounded Linear Functionals on L^P .

UNIT-4

Libisgue-Stieltjes Integrations: application to Housdorff Measures, Absolutely continuous functions, Integrations by parts, Riesz Representation Theorem for C(*I).*, Measure and Integration Product Space, Fubini's Theorem, Lebesgue Measure in Euclidean Space, Laplace and Fourier Transforms.

Abstract measure Spaces: Measures and outer measure, Extension of a measure,Uniqueness of the extension, Completion of a measure, Measure Spaces, Integration with respect to the measure.

BOOK- 1. G.de BARRA, measure theory and integration., New Age Internation (P) Limited, Publishers

P.K.University
Shivpuri (M.P.)

M.Sc. MATHEMATICS
SEMESTER II PAPER I

DIFFERENTIAL EQUATION
(ORDINARY and PARTIAL)

UNIT-1

Classification for linear partial differential equation of second order, canonical forms, Cauchy's problem of first and second order partial differential equation.

UNIT-2

Linear homogeneous boundary value problem, Eigen values and Eigen function, sturm-Liouville value problem, orthogonality of Eigen functions, Lagrange's Identity, properties of eigen functions, important theorem of Sturm-Liouville system, Periodic function.

UNIT-3

Non- homogeneous boundary value problem, Non- Homogeneous Sturm-Liouville boundary value problem (method of Eigen function expansion).
Method of separation of variables, Laplace, Wave and diffusion equation.

UNIT-4

Green's function: Non-Homogeneous Sturm-Liouville boundary value problem (method ofgreen's function), Procedure of constructing the Green's function and solution of boundary value problem, Properties of Green's function, Inhomogeneous boundary conditions, Dirac delta function, Bilinear formula for Green's functions.

BOOK-

1. B.S.mGrewal, Higher Enginerring Mathematics
2. Coddington & Norman Levinson, Theory Of Ode, Tata Mcgraw-HillmPublishing.
3. Ian N. Sneddon, Element Of Pde, Dover Publications, Inc.

P.K.University
Shivpuri (M.P.)

SEMESTER II PAPER II
NUMERICAL METHOD

UNIT-1

Error analysis: solution of algebraic and transcendental equations in one variable by Secant, Regula-Falsi method, Newton- Raphson method, Iterative method, programs in C.

UNIT-2

Matrix inversion by the escalator method, Iterative method; Jacobi's Method, Gauss-Seidel method, Programs in C.

UNIT-3

Simple step and Multi step methods of numerical solution of ordinary differential equations, Picard's method, Taylor Series method, Euler methods, Euler's ,odified method, Runge method, Runge-Kutta method, Milene's methods, Programs in C

UNIT-4

Interpolation(Linear, Hermite, Cubic Spline) Algebraic-eigen values and vectors: Iterative method for finding eigen values and eigen vectors, Jacobi's method; complex eigen values, programming in c.

BOOK-

Numerical Methods: R.K.Jain, S.R.K. Lyengar And M.K.Jain
Numerical Method Using Matlab: Mathews And Finle
Numerical Methods: Veerarajan And Ramachandran.

P.K.University
Shivpuri (M.P.)

SEMESTER II PAPER III
NUMBER THEORY

UNIT-1

Mathematical Induction, The Binomial Theorem, **divisibility Theory in the Integers:** early number theory, the division algorithm, The Greatest Common Divisor, The Euclidean Algorithm, The Diophantine Equation ax+by=c.

Primes and their Distribution: The Fundamental Theorem of Arithmetic, the Sieve of Eratosthenes, The Goldbach Conjecture.

The Theory Congruence: Carl Friedrich Gauss, Basic Properties of Congruence, Binary and Decimal Representations of integers, Linear Congruence and the Chinese Remainder Theorem.

UNIT-2

Fermat's Theorem: Pierre de Fermat, Fermat's Little Theorem and Pseudo primes, Wilson's Theorem, The Fermat- Kraitchik Factorization Method.

Number- Theoretic Functions: The Sum an Number of Divisors, The Mobius Inversion Formula, The Greatest Integer Function, An Application to the Calendar.

Euler's Generalization of Fermat's Theorem: Leohard euler, Euler's Phi-Function, Euler's Theorem, Some properties of the phi-function.

UNIT-3

Primitive Roots and Indices: The Order of an Integer Modulo n, Primitive Roots for Primes, Composite Numbers Having Primitive Roots, The theory of indices.

The Quadratic Reciprocity Law: Euler's Criterion, The Legendre Symbol and its properties, Quadratic Reciprocity, Quadratic Congruences with Composite Moduli.

UNIT-4

Continued fraction: Srinivasa Ramanujan, Finite Continued Fractions, Infinite Continued Fractions, Farey fraction, Pell's Equation.

Some Modern Developments: An Application to Factoring: Remote Coin Flipping, The Prime Number Theorem and Zeta Function, Marin Mersenne, Perfect Numbers, Fermat's numbers.

BOOK- 1. David M. Burton, Elementary Number Theory, Mcgraw Hill Education(India) Private Limited.

2 Niven Zukerman: Elementary Number-Theory,

SEMESTER II PAPER IV
LINEAR ALGEBRA

UNIT-1

Linear Equation: Fields, System of Linear Equations, Matrices and Elementary Row Operations, Row-Reduced Echelon Matrices, Matrix Multiplication, Invertible Matrices.
Vector Spaces: vector Spaces, Subspaces, Bases and Dimension, Coordinates, Summary of Row- Equivalence, Computation Concerning Subspaces.

UNIT-2

Linear Transformation: The Algebra of linear transformation, Isomorphism, Representations of Transformations by matrices, Linear Functionals, The Double Dual, The Transpose of a linear Transformation.
Polynomial: Algebra, the Algebra of Polynomial, Lagrange Interpolation, Polynomial Ideals, The prime Factorisation of a polynomial.

UNIT-3

Determinants: Commutative Rings, Determinant Functions, Permutation and the Uniqueness of determinants, Additionals properties of Determinants, Modules, Multilinear Functions, The Grassman Ring.
Elementary Canonical Forms: introduction, characteristic Values, Annihilating Polynomials, Invariabt Subspaces, Simultaneous Triangulation; Simultaneous Diaonalisation, Direct-Sum Decompositions, Invariant Direct Sums, The Primaryu Decmposition theorem.

UNIT-4

The rational and The Jordan forms: Cyclic Subspaces and Annihilators, Cyclic Decomposition and the Rational Form, The Jordan Form, Computation of Invariant Factors, Semi- Simple Operators.
Inner Product Spaces: inner product, inner product spaces, linear functional and Adjoints, Unitary Operators, Normal operators.

UNIT-5

Operators on Inner Product Spaces: Introduction, Forms on Inner Product Spaces, Positive forms, More on Forms, Spectral Theory, Further Properties of Normal Operator.
Bilinear Form: Bilinear Forms, Symmetric Bilinear Forms, Skew- Symmetric Bilinear Forms, Group Presrving Bilinear Forms.
Appendix: Sets, Functions, Equivalence Spaces, Quotient Spaces, The Axiom Of Choice, Equivalence Relations in Linear Algebra.

BOOK- 1. Kenneth Hoffman And Ray Kunze, Linear Algebra 2nd Edition.

P.K.University
Shivpuri (M.P.)

SEMESTER II PAPER V
COMMUTATIVE ALGEBRA

UNIT-1

Rings and Ideals: Rings and ring homomorphism, Ideals, Quotient rings, Zero Divisor, Nilpotent element, Units, Prime Ideals and Maximal Ideals, Nilradical and Jacobson radical, operations on Ideals, Extension and Contraction
Modules: Modules and module homomorphism, submoduloes and quotient modules, Operations on submodules, direct sum and product, Finitely Generated modules, Exact sequences, Tensor product of modules, restriction and extension of scalars, Exactness properties of the tensor product, Algebras, Tensor product of algebras.

UNIT-2
Rings and Modules: local properties, extended and contracted ideals in rings of fractions
Primary Decomposition, Integral Dependence and Valuations: The Going-Up Theorem, Integrally Closed Integral Domains. The Going-Down Theorem, Valuation rings, **chain conditions.**

UNIT-3
Noetherian Rings: Primary decomposition in Noetherian Rings.
Artin Ring, Discrete Valuation Rings And Dedekind Domains: Discrete Valuation Ring, Dedekind Domain, Fractional Ideals.

UNIT-4
Completion: Topologies and completion, Filtrations, Graded Ring and Modules, The associated graded ring.
Dimension Theory: Hilbert functions, Dimension theory of Noetherian local ring, Regular local rings, Transcendental dimension.

BOOK-
1. M.F. Atitah And I.G. Macdonald, Introduction ToCommutativeAlgebra.
2. Zharisky and Samuel: Commutative Algebra.

P.K.University
Shivpuri (M.P.)

M.SC MATHEMATICS
SEMESTER III PAPER I

COMPUTER PROGRAMMING IN C

Chapter1. A Tutorial Introduction: getting started, Variables and Arithmetic Expressions, The For Statement, Symbolic Constants, Character Input and output, Arrays, Functions, Argument- call by value, Character Arrays, External variable and scope.

Chapter2. Types, operators, and Expenssions: Variable Names, Data Type and Sizes, Constant, Declarations, Arithmetic Operators, Relations and Logical Operator, Type conversions, Increment and Decrement Operator, Bitwise Operators, Assignment Operator and Expression, Conditional Expressions, Precedence and Order of Evaluation.

Chapter3. Control flow: statements and blocks, If- Else, Else-If, Switch, Loops- While andFor, Loops- Do-While, Break and Continue, Goto and Labels.

Chapter4. Function And Program Structure: Basics of functions, functions returning non integers, External variables, Scope Rules, Header files, Static Variable, Register Variables, Block Structure, Initialization, Recursion, C preprocessor.

Chapter5. Pointers and addresses, pointer and function arguments, pointer and array, address arithmetic, character pointer and functions, pointer Array; pointer to pointers, Multi-dimensional Arrays, Initialization of Pointer Arrays, Pointer vs Multi dimensional Arrays, Command line Arguments, Pointers to functions, Complicated Declarations.

Chapter6. Structure: basics of structures, structures and functions, Arrays of structure, pointer to structure, Self- referential structures, Table Lookup, Type def, Unions, Bit- Fields.

Chapter7. Input and output: standard input and output, Formatted output- print f, Variable-length Argument Lists, Formatted Input-Scanf, File Access, Error Handling-Strderr and Exit, Line input and output, Miscellaneous Functions.

Chapter8. The UNIX System Interface: File Descriptors, Low Level I/O- Read And Write, Open, Creat, Close, Unlink, Random Access-Lseek, examples- Listing Directories, A storage Allocator.

BOOK- 1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, 2nd ed.
2. Yashwant Kanetkar, Let Us C.

P.K.University
Shivpuri (M.P.)

SEMESTER III PAPER II
STATISTICS

Unit 1: Introduction (meaning & scope)**,** Descriptive Measure**,** Probability-I**,** Probability**,** Random Variables and Distribution Functions**,** Mathematical Expectation, Generating Function and Law Of Large Numbers

Unit 2: Special Discrete Probability Distributions, Binomial Distribution, Poisson's Distribution, fitting of distributions, Special Continuous Probability Distributions, Normal Distribution, Standard Errors,

Unit 3: Correlation**,** Linear and Curve linear regression**,** Multivariate Correlation and Regression,

Unit 4: Theory of Attributes, Large Sample Theory**,** Exact Sampling Distribution- I (X^2Disribution), Exact Sampling Distributions-II (t,F And z Distribution)

Unit 5: . Statistical Inference- I (Theory of Estimation)**,** Statistical Inference- II (Tests Of Hyphothesis)

BOOK- 1. S.C. Gupta and V.K. Kapoor, Fundamental Of Mathematical Statistics, Sultan And Sons

P.K.University
Shivpuri (M.P.)

SEMESTER III PAPER III
FUNCTIONAL ANALYSIS

UNIT-1
Normed linear space, Quotient space of normed linear spaces and its completeness. Banach spaces and examples, Bounded linear Transformations, Normed linear space of bounded linear transformations.

UNIT-2
Equivalent norms, Basic properties of finite dimensional normed linear spaces and compactness, Reisz lemma, Open mapping theorem, Closed graph theorem, Uniform boundness theorem.

UNIT-3
Continuous linear functional, Hahn-Banach theorem and its consequences, Embedding and reflexivity of normed spaces, Dual spaces with examples, Boudedness and continuity of Linear operators.

UNIT-4
Inner Product Spaces, Hilbert Space and Its Properties. Orthogonality in Hilbert spaces Phythagorean theorem, Projection Theorem, Orthonormal sets, Bessel's Inequality, Complete Orthonormal sets, Paseval's Identity.

BOOK- 1**.** G.F. Simmons: "Introduction To Topology And Modern Analysis"
2. B.K. Lahiri: "Functional Analysis"
3. J.B. Conway: "Functional Analysis"

P.K.University
Shivpuri (M.P.)

SEMESTER III PAPER IV
INTEGRAL TRANSFORM AND
BVP(BOUNDARY VALUE PROBLEM)

LAPLACE TRANSFORM: def, elementary function**,** properties, periodic functions, transform of special function, derivatives, integrals, Multiplication by t^n , Division by t, Inverse Transforms- Method Of Partial Fractions, Other Method Of finding Inverse Transform, Convolution Theorem, Application To Differential Equation, Simultaneous Linear Equation With Constant Coefficients, Unit Step Function, Unit Impulse Function,.

FOURIER TRANSFORMS: introduction, definition, Fourier Integral Transform, Fourier Transforms, Properties Of Fourier Transforms, Convolution, Parseval's Identity For Fourier Transforms, Fourier Transform Of the Derivatives Of A Function, Relation Between Fourier And Laplace Transforms, Inverse Laplace Transforms By Method Of Residues**,** Application Of Transforms To Boundary Value Problems.

Z- TRANSFORMS: introduction, definition, some standard Z- Transforms, Linearity Property, Damping Rule, Some Standard Result, Shifting UnTo The Right, Multiplication By n, Two Basic Theorem: Initial Value Theorem, Final Value Theorem, Some Useful Z-Transforms, Some Useful Inverse Z- Transforms, Convolution Theorem, Convergence Of Z-Transforms, Two- Sided Z- Transforms Of unIs Defined By, Evaluation Of Inverse Z-Transforms, Application To Difference Equations.

BOOK- 1. B.S. Grewal, Higher Engineering Mathematics.
2. R.V. Churchill, Integral Transforms And Boundary Value Problem.

P.K.University
Shivpuri (M.P.)

SEMESTER III PAPER V
CODING THEORY

Introductory Concepts: introduction, Basic Definition, Weight, Minimum Weight, and Maximum- Likelihood Decoding.

Useful Background: Syndrome Decoding, Perfect Code, Hamming Codes, Sphere Packing Bound, Packing Radius, Covering Radius, MDS Codes, and Some Bounds, Self-Dual Codes, Golay Codes, Reed- Muller Codes, Puncturing, Extending, and Shortening.

A Double Error- Correcting BSH code and a Finite Field Of 16 Elements: The problem, polynomial, A Finite Field Of 16 elements, Double Error-Correcting Bose-Chaudhuri-Hocquenghem (BCH) Code.

Finite Fields: Groups, structure of a Finite Field, Minimum Polynomials, Factoring x^n-1

Cyclic Code: Origin and definition of Cyclic Codes**,** How To Find Cyclic Codes: The Generator Polynomial, Generator Polynomial Of The Dual Code, Idempotent and Minimal Ideals For Binary Cyclic Codes.

Group Of A Code And Quadratic Residue (QR) Codes: Some Cyclic Codes We Know,Permutation Groups, Group Of A Code, Definition of Quadratic Residue(QR) Codes, Extended QR Codes, Square Root Bound Groups of QR Codes, Permutation Decoding, Decoding The Golay Code.

Bose- Chaudhuri- Hocquenghem (BCH) Codes: Cyclic code given in terms of roots,Vandermonde determinants, Definition and properties of BCH Codes, Reed-Solomon Codes, More on the Minimum Distance, Decoding BCH Codes.

Weight Distributions: Preliminary concepts and a theorem on Weights in HomogeneousCodes,Mac Williams Equation, Pless Power Moment, Gleason Polynomials.

Design and Games: Design, Design and codes, Assumes - Mattson Theorem and a design-decoding Scheme, Symmetric Codes, Games, Games and Codes, Greedy Codes.

Some Codes Are Unique: The Hamming Code and the Ternay Code Golay Code AreUnique, The Steiner System S(5,8,24) Is a Binary [24,12,8] Code, “Glue”, Residual Codes and the Griesmer Bound, Some Nonlinear Codes, Z4 Codes and Their Gray Images.

BOOK-

- Vera Pless, Introduction To The Theory Of Error-Correcting Codes.
- A First Course In Coding Theory. Raymond Hill, 1986, Oxford Applied Mathematics And Com-Puting Science Series.
- The Theory Of Error-Correcting Codes : (Fj Macwilliams And Nja Sloane)

P.K.University
Shivpuri (M.P.)

SEMESTER IV PAPER I
OPERATIONAL RESEARCH

UNIT-1
Introduction: Nature and Scope of operations research, Linear Programming: Mathematical Formulation of the problem, Graphical Solutions Methods.

UNIT-2
The Simplex Method: Fundamental Properties Of Solution, Simplex Algorithm, Artificial Variables, Two Phase Simplex Method, Big M method, Unrestricted Variable, Problems of degeneracy, Principle of duality in simplex method, Formation of dual with mixed type of constraints, Dual Simplex Method, Integer Programming.

UNIT-3
Non-Linear Programming: Mathematical Formulations, Constrained Optimizations, Khun Tucker Conditions of optimality, Quadratic Programming, Beale Method, Wolfe Method.

UNIT-4
Assignment and Transportation, Problems and Algorithm, optimal solution, Replacement Problem And Sequencing problem, Game Theory: Two Persons Zero Sum games, The Maxmin and Miunimax Principles, Games without saddle points, Dominance property, Graphical Solution of two persons game.

BOOK-
Kanti Swarup Et.Al. “Operation Research”, Sultan Chand & Sons N.P. Loomba “Linear Programming”
H.A. Taha “Operation Research: An Introduction” Kasana And Kumar “Introduction To Operations Research”Springer. ByAlfred J. Menezes, Paul C. van Oorschot, Scott A. Vanstone

SEMESTER IV PAPER II
CRYPTOGRAPHY

1. Overview of Cryptography
2. Mathematical Background
3. Number-Theoretic Reference Problems
4. Public-Key Parameters
5. Pseudorandom Bits and Sequences
6. Stream Ciphers
7. Block Ciphers
8. Public-Key Encryption
9. Hash Functions and Data Integrity
10. Identification and Entity Authentication
11. Digital Signatures
12. Key Establishment Protocols
13. Key Management Techniques
14. Efficient Implementation
15. Patents and Standards

Books: ByAlfred J. Menezes, Paul C. van Oorschot, Scott A. Vanstone

P.K.University
Shivpuri (M.P.)

SEMESTER IV PAPER III
DESIGN OF EXPERIMENTS

CHAPTER 1: Introduction :Strategy of Experimentation , Applications of Experimental DesignBasic Principles ,Guidelines for Designing Experiments , Using Statistical Techniques in Experimentation , Simple Comparative Experiments ,Differences in Means, Randomized Designs , Paired Comparison Designs ,Variances of Normal Distributions

CHAPTER 2: Experiments with a Single Factor: The Analysis of Variance , Analysis of the Fixed Effects Model , Model Adequacy Checking , Determining Sample Size , Single-Factor Experiments, The Random Effects Model , The Regression Approach to the Analysis of Variance , Nonparametric Methods in the Analysis of Variance ,

CHAPTER 3: Randomized Blocks, Latin Squares, and Related Designs : The Randomized Complete Block Design , The Latin Square Design , The Graeco-Latin Square Design , Balanced Incomplete Block Designs

CHAPTER 4: Introduction to Factorial Designs : Basic Definitions and Principles , The Advantage of Factorials , The Two-Factor Factorial Design , The General Factorial Design , Fitting Response Curves and Surfaces , Blocking in a Factorial Design

CHAPTER 5: The 2k Factorial Design :Introduction , The 22 Design , The 23 Design , The General 2k Design , A Single Replicate of the 2k Design , Unreplicated 2k Designs , 2k Designs are Optimal Designs , The Addition of Center Points to the 2k Design , We Work with Coded Design Variables

BOOK- 1. Design and Analysis of Experiments by Douglas Montgomery

P.K.University
Shivpuri (M.P.)

SEMESTER IV PAPER IV
MECHANICS

TABLE OF CONTENTS LESSON No.

Book : F Chorolton: Dynamics of a Particle.

P.K.University
Shivpuri (M.P.)

SEMESTER IV PAPER V
MODELLING AND SIMULATION

1.. Principles of Mathematical Modeling: Need for Models, Systems, models,simulations, Mathematics is the natural modeling language, Classification of mathematical models

2.**Phenomenological models:** Elementary statistics, Linear regression, Multiple linearregression, Nonlinear regression, Neural networks, Design of experiments, Otherphenomenological modeling approaches

3. **Mechanistic models I: ODE´s:** Distinguished role of differential equations, General idea of ODE´s, Setting up ODE models, Solution of ODE´s: Overview, Closed form solution, Numerical solutions, Fitting ODE´s to data.

4.**Mechanistic models II: PDE´s:** Introduction, The heat equation, Closed formsolution, Numerical solution of PDE´s, The finite difference method, The finite element method, Other mechanistic modeling approaches

Book: Gofrey Gordon: Modelling and Simulation
Reference: A CAELinux and the book software, B R (programming language and software environment), C Maxima.