KAKATIYA UNIVERSITY
M. Sc (APPLIED MATHEMATICS)
Semester I/II/III/IV
Scheme of Instruction and Examination
(With effect from 2019-2020 batch)

SEMESTER-I

Paper	Code of The paper	Title of The paper	No. of Periods (1 hr duration) per week	Internal Assess-ment Marks	Semester End Exam Marks			Credits (L+P)
					Theory	Practical	Total	
I	AM1CP1	Algebra	6	20	80	-	100	6
II	AM1CP2	Real Analysis	6	20	80	-	100	6
III	AM1CP3	Ordinary Differential Equations	6	20	80	-	100	6
IV	AM1CP4	Discrete Mathematics	6	20	80	-	100	6
V	AM1CP5	Fundamentals of Statistics	6	20	80	-	100	6
		Seminar	2				25	1
					Total Credits			31

SEMESTER-II

Paper	Code of The paper	Title of The paper	No. of Periods (1 hr duration) per week	Internal Assess-ment Marks	Semester End Exam Marks			Credits (L+P)
					Theory	Practical	Total	
I	AM2CP1	Classical Mechanics	6	20	80	-	100	6
II	AM2CP2	Mathematical Analysis	6	20	80	-	100	6
III	AM2CP3	Topology	6	20	80	-	100	6
IV	AM2CP4	Complex Analysis	6	20	80	-	100	6
V	AM2CP5	Special Functions	6	20	80	-	100	6
		Seminar	2				25	1
					Total Credits			31

SEMESTER-III

Paper	Code of The paper	Title of The paper	No. of Periods (1 hr duration) per week	Internal Assess-ment Marks	Semester End Exam Marks			Credits (L+P)
					Theory	Practical	Total	
I	AM3CP1	Measure and Integration	6	20	80	-	100	6
II	AM3CP2	Mechanics of Solids	6	20	80	-	100	6
III	AM3CP3	Partial Differential Equations	6	20	80	-	100	6
IV	AM3OP4(1)	Mathematical Programming	6	20	80	-	100	6
	AM3OP4(2)	Numerical Analysis	6	20	80	-	100	6
	AM3OP4(3)	Automata and Languages	6	20	80	-	100	6
	AM3OP4(4)	Advanced Complex Analysis	6	20	80	-	100	6
V	AM3OP5(1)	Computer fundamentals and Programming in C	7(4+3)	20	60	20	100	4(L) + 2(P)
	AM3OP5(2)	Office automation and C Language	7(4+3)	20	60	20	100	4(L) + 2(P)
	AM3OP5(3)	Numerical Analysis using C	7(4+3)	20	60	20	100	4(L) + 2(P)
		Seminar	2				25	1
					Total Credits			31

SEMESTER-IV

Paper	Code of The paper	Title of The paper	No. of Periods (1 hr duration) per week	Internal Assess-ment Marks	Semester End Exam Marks			Credits (L+P)
					Theory	Practical	Total	
I	AM4CP1	Functional Analysis	6	20	80	-	100	6
II	AM4CP2	Fluid Dynamics	6	20	80	-	100	6
III	AM4CP3	Integral Equations and Transforms	6	20	80	-	100	6
IV	AM4OP4(1)	Bio Mechanics	6	20	80	-	100	6
	AM4OP4(2)	Graph Theory						
	AM4OP4(3)	Operations Research	6	20	80	-	100	6
	AM4OP4(4)	Computational Methods for Partial Differential Equations	6	20	80	-	100	6
	AM4OP4(5)	Automata and Machines	6	20	80	-	100	6
	AM4OP4(6)	Theory of Reliability	6	20	80	-	100	6
V	AM4OP5(1)	Programming Methodology	7(4+3)	20	60	20	100	4(L) + 2(P)
	AM4OP5(2)	Programming in C++						
	AM4OP5(3)	Applied Stochastic Process with MATLAB	7(4+3)	20	60	20	100	4(L) + 2(P)
		Seminar	2				25	1
					Total Credits			31

L →Lecture, P→ Practical, AM→ Applied Mathematics, CP→ Core Paper, OP→ Optional Paper

Summary

Semester	No. of Credits	Marks
I	31	525
II	31	525
III	31	525
IV	31	525
Total	**124**	**2100**

The Scheme of 1st Internal Assessment of each paper of Semester-I to IV is as follows:

KAKATIYA UNIVERSITY
M. Sc (Applied Mathematics) (w.e.f 2019-20)
1st Internal Assessment Examination
Semester-I/II/III/IV
Papers I/ II/ III/ IV/ V

Time: 1 ½ Hours Max Marks: 15.

Answer Any five of the following questions.
All questions carry equal marks.

1. A question from unit-I
2. A question from unit-I
3. A question from unit-I
4. A question from unit-I
5. A question from unit-II
6. A question from unit-II
7. A question from unit-II
8. A question from unit-II

Note: **Five Marks will be awarded from assignments given to the students**

The Scheme of 2nd Internal Assessment of each paper of Semester-I to IV is as follows:

KAKATIYA UNIVERSITY
M. Sc (Applied Mathematics) (w.e.f 2019-20)
2nd Internal Assessment Examination
Semester-I/II/III/IV
Papers I/ II/ III/ IV/ V

Time: 1 ½ Hours Max Marks: 15.

Answer Any five of the following questions.
All questions carry equal marks.

1. A question from unit-III
2. A question from unit-III
3. A question from unit-III
4. A question from unit-III
5. A question from unit-IV
6. A question from unit- IV
7. A question from unit- IV
8. A question from unit- IV

Note: **Five Marks will be awarded from assignments given to the students**

The scheme of the examination of each paper of Semester I to IV is as follows.

KAKATIYA UNIVERSITY
M. Sc (Applied Mathematics)
(w.e.f 2019-20)
Semester-I/II/III/IV
Papers I/ II/ III/ IV/ V

Time: 3 Hours Max Marks: 80/60*

*for papers having practical examination

Answer all Questions.
All Questions carry equal Marks.

1. a) A short question From Unit-I.
   b) A short question From Unit-II.
   c) A short question From Unit-III.
   d) A short question From Unit-IV.

2. Answer any two of the following.
   a) From Unit-I.
   b) From Unit-I.
   c) From Unit-I.
   d) From Unit-I.

3. Answer any two of the following.
   a) From Unit-II.
   b) From Unit-II.
   c) From Unit-II.
   d) From Unit-II.

4. Answer any two of the following.
   a) From Unit-III.
   b) From Unit-III.
   c) From Unit-III.
   d) From Unit-III.

4. Answer any two of the following.
   a)From Unit-IV.
   b) From Unit-IV.
   c) From Unit-IV.
   d) From Unit-IV.

KAKATIYA UNIVERSITY
M.Sc. (APPLIEDMATHEMATICS) Syllabus(w.e.f. 2019-20)
Semester - I
Paper – I
Paper Code: AM1CP1
ALGEBRA

UNIT I

Isomorphism theorems on Groups - Normal Series - Solvable groups - Nilpotent groups
(Chapter 5 : Sec 2 and Chapter 6 of Text Book 1)

UNIT II

Group Action on A set : The notation of a group action on a set - Isotropy subgroups - Orbits - Application of G-sets to counting.
Sylow Theorems: P-groups - Cauchy theorem - the Sylow theorems - Application of the Sylow theorems - Application to P-groups and the class equation - Further applications.
(Sec 16,17,36,37 of Text Book 2)

UNIT III

The field of quotients of an integral domain: The construction - Uniqueness.
Rings of Polynomials: Polynomials in an indeterminate – A review – The evaluation homomorphism - Factorization of polynomials over a field - The Division algorithm in F[x] - Irreducible Polynomials - Eisenstein criterion - Uniqueness of factorization in F[x] - Prime fields - Application to unique factorization in F[x].
(Sec 21,22,23,27.17 to 27.27 of Text Book 2)

UNIT IV

Factorization: Unique factorization domains. Every PID is a UFD. If D is a UFD then D[x] is a UFD.
Euclidean Domains: Euclidean domains and Arithmetic in Euclidean domains.
Gaussian Integers and Multiplicative norms.
(Sect 45,46,47 of Text Book 2)

Text Book:

1. Basic Abstract Algebra by P.B. Bhattacharya, S.K.Jain, and S.R.Nagpaul, Second Edition , Cambridge University press.
2. A first Course in Abstract Algebra by John B.Fraleigh, Seventh Edition, Pearson education.

Reference Books:

1. Abstract Algebra by David S.Dummit, Richard M.Foote, Second edition, Wiley Student edition
2. Topics in Algebra by I.N Herstein
3. University algebra by N.Gopala Krishna.
4. Abstract Algebra by S.Lang.

Outcome:
By studying this course, students will be exposed to the concepts of normal series, solvable groups, nilpotent groups, group action on a set sylow theorems and they will get the knowledge of irreducible polynomials, PID, UFD, ED.

KAKATIYA UNIVERSITY
M.Sc. (APPLIED MATHEMATICS) Syllabus(w.e.f 2019-20)
Semester - I
Paper – II
Paper Code: AM1CP2
REAL ANALYSIS

UNIT I

Metric Spaces: Limit points – Closed sets – Open sets – Perfect Sets – Bounded Sets – Closure of a set - Compact sets – Connected sets.

Numerical sequences in metric spaces: Subsequences – Cauchy sequence – Dia-meter of a set – Definition of complete metric space.

Continuous functions in metric spaces: Characterization of continuity in terms of open sets and closed sets, Continuity and Compactness.

(Sec 2.15, 2.16, 2.18 - 2.38, 2.44 – 2.47, 3.1, 3.2, 3.5, 3.6(a), 3.7 – 3.11(a), (b), 3.12, 4.5 – 4.8, 4.13, 4.14, 4.18, 4.19, 4.22 of Text Book)

UNIT II

The Riemann-Stieltjes Integral: Definitions of partition – Refinement of partition and RS-Integral, Necessary and Sufficient condition for integrability, Integral as a limit of a sum.

Integrability of continuous, Monotonic, discontinuous and composite functions.

Properties of the Integral: Integrability of sum and product of two functions – Integrability of modulus of a function – Integrators as step functions – Conversion of RS – Integral to Riemann integral.

(Sec 6.1 – 6.17, 6.19 of Text Book)

UNIT III

Sequences and Series of Functions: Pointwise and Uniform Convergence - Cauchy criterion for uniform convergence – Weirstrass M_n – test – Uniform convergence and Continuity – Uniform convergence and Integrability –Uniform convergence and differentiability - Equi continuous families of functions

(Sec 7.1 – 7.14, 7.16 – 7.25 of Text-book)

UNIT IV

Weirstrass approximation theorem – Definition of uniformly closed algebra – Stone's generalization of the Weirstrass theorem.

Power Series: Radius of Convergence – Real Power Series – Continuity and Differentiability of Power Series – Abel's theorem – inversion in the order of summation - Taylor's theorem – Identical power series.

(Sec 3.38 – 3.40, 7.26 – 7.32, 8.1 – 8.5 of Text-book)

Text Book:

Principles of Mathematical Analysis by Walter Rudin, McGraw – Hill, 3rd Edition

Reference books :

1. Mathematical Analysis by S.C.Malik and Savita Arora, S.Chand, 4th Edition
2. Mathematial Analysis by T.Apostle, Narosa.

Outcome:

By studying this course, the student will be exposed to various concepts of real analysis and its applications.

KAKATIYA UNIVERSITY
M.Sc. (APPLIED MATHEMATICS)Syllabus(w.e.f.2019-20)
Semester – I
Paper – III
Paper Code: AM1CP3
ORDINARY DIFFERENTIAL EQUATIONS

UNIT I

Integration in series : Ordinary and singular points – power series solution at ordinary point- Frobenius method – Problems on type I , type II , type III and type IV – series solution about regular singular point at infinity.
(Chapter 8: Sec 8.1 to 8.14 of Text Book 1)

UNIT II

Linear equations with variable coefficients: Introduction – Initial value problem for homogeneous equation – The Wronskian and linear dependence – reduction of the order of homogeneous equation – The non homogeneous equation.
(Sec 3.1 to 3.6 of Text Book 2)

UNIT III

Existence and uniqueness of solution of first order equation: The method of successive approximation – The Liptsctitz condition – Sturm-Liouville problem – Orthogonality of eigen functions and Reality of eigen functions.
(Sec 5.4 to 5.5 of Text Book 2 and Sec 15.10 to 15.12 of Text Book 1)

UNIT IV

Variational problems with fixed boundaries: Euler's equation for functional containing first order derivative and one independent variable – Extremals – Functional dependent on higher order derivatives – Functions dependent on more than one independent variable – Variational problem in parametric form – Invariance of Euler's equation under coordinate transformation.
(Chapter 1 of part V of Text Book 1)

Text book

1. Advanced differential equations, M.D. Raisingania,S.Chand Company Ltd.
2. An introduction to ordinary differential equations by E.A. Coddington Prentice-Hall of India Pvt. Lted.

Referene books :

1. Differential equations with applications and Historical notes by George F. Simmons
2. Theory of ordinary differential equations by Somasundaram – Narosa.

Outcome:
After completion of this course, students will get the knowledge on solving of differential equations in series methods. They will get the techniques to find eigen values, eigen vectors of BVP and extreme values of various functionals.

KAKATIYA UNIVERSITY
M.Sc. (APPLIED MATHEMATICS) Syllabus(w.e.f. 2019-20)
Semester - I
Paper – IV
Paper code: AM1CP4
DISCRETE MATHEMATICS

UNIT I: Fundamentals of Logic

Fundamentals of logic-Logical inferences - Methods of proof of an implication – First order logic and other methods of proof - Rules of inference for propositions - Rules of inference for quantified propositions.

(Sec 1.5, 1.6, 1.7, 1.8 up to De Morgan Laws, 1.9 of Text Book)

UNIT II: Permutations and Combinations

Enumerating combinations and permutations with repetitions- Enumerating permutations with constrained repetitions- The principle of inclusion and exclusion.

(Sec 2.1 to 2.5, 2.8 of Text Book)

UNIT III: Recurrence Relations

Generating function of sequences – Calculating coefficients of generating functions- Recurrence relations- Solving recurrence relations by substitution and generating functions- the method of characteristic roots – solutions of inhomogeneous recurrence relations.

(Sec 3.1 to 3.6 of Text Book)

UNIT IV: Boolean Algebra

Introduction, Boolean algebras – Boolean polynomials – Disjunctive and Conjunctive normal forms – Switching functions.-minimijation of switching functions.

(Sec 6.1 to 6.5 of Text Book)

Text Book:

Discrete Mathematics for Computer Scientists and Mathematicians by J.L.Mott, A. Kandel, and T.P. Baker

Reference Books:

1. Discrete Mathematical structures by Roden.
2. Discrete Mathematics by Kolman.
3. A Text book of Discrete Mathematics by Tremblay and Manohar.
4. Elements of Discrete Mathematics by C.L.Liu, McGraw Hill Company

Outcome:

After studying this course, the students will understand the concept of basic, and Boolean algebra. The various applications to modelling and computer science can be learnt.

KAKATIYA UNIVERSITY
M.Sc. (APPLIED MATHEMATICS) Syllabus(w.e.f.2019-20)
Semester - I
Paper – V
Paper Code: AM1CP5
FUNDAMENTALS OF STATISTICS

UNIT I

Moments–Pearson's β and γ coefficients -Skewness and Kurtosis
Probability Definitions–Addition Theorem-Conditional probability - Multiplication Law of probability - Baye's Theorem - Random Variables - Probability mass function – Probability density function.
(Chapter 2, 3, 4.2, 5.1 to 5.5.5 of Text Book)

UNIT II

Mathematical Expectation – Expectation of a function of a random variable – Addition and Multiplication theorem of expectation - Expectation of linear Combination of random variables – Covariance – Variance of linear combination on of random variables – Moment generating function – Chebychev's inequality – Correlation –Karl Pearson's coefficient of Correlation- Linear regression.Angle between two regression lines.
(Chapter 6.1 to 6.6.1, 7.1, 7.1.2, 7.5,10.1 to 10.4.2, 11.1 to 11.2.3 of Text Book)

UNIT III

Discrete Distributions - Bernoulli distribution – Moments of Bernoulli distribution – Binomial distribution – Moments - Moment generating function of Binomial distribution – Additive property of Binomial distribution - Poisson distribution – Moments of Poisson distribution – Geometric distribution –Lack of memory property.
(Chapter 8.1 to 8.4.1, 8.4.4 to 8.4.7, 8.5, 8.5.2, 8.5.3, 8.5.5, 8.5.8, 8.7 to 8.7.3 of Text Book)

UNIT IV

Continuous Distributions -Normal Distribution – Characteristics of Normal Distribution and normal probability curve - Moments of Normal Distribution – Area property- Gamma Distribution - Moment generating function of Gamma Distribution – Exponential distribution- Moment generating function of Exponential distribution- Lack of memory property.
(Chapter 9.1, 9.2, 9.2.2 to 9.2.5, 9.2.7 to 9.2.11, 9.5, 9.5.1, 9.5.3, 9.8, 9.8.1 of Text Book)

Text Book:

Fundamentals of Mathematical Statistics by S.C. Gupta & V.K. Kapoor, 11th Edition

Outcome:
After studying this course, basics of statistics will be learnt and probability theory, theoretical probability discrete and continuous distributions will be learnt. Applications of random experiments can be understood.

K KAKATIYA UNIVERSITY
M.Sc. (APPLIED MATHEMATICS) Syllabus(w.e.f.2019-20)
Semester - II
Paper – I
Paper Code: AM2CP1

CLASSICAL MECHANICS

UNIT I

Survey of the Elementary Principles: Mechanics of a particle – Mechanics of a system of particles – Constraints – D'Alembert's principle and Lagrange's equations – Velocity-dependent potentials and the dissipation function – Simple applications of the Lagrangian formulation – Single particle in space(only cartesian coordinates), Atwood's machine
(Sec 1.1 to 1.6 of Text Book)

UNIT II

Variational Principles and Lagrange's Equations: Hamilton's principle – Derivation of Lagrange's equation from Hamilton's principle – Extending Hamilton's principle to systems with constraits – Conservation theorems and symmetry properties – Energy function and the conservation of energy
(Sec 2.1, 2.3, 2.4, 2.6, 2.7 of Text Book)

UNIT III

The Kinematics of Rigid Body Motion: The independent coordinates of a rigid body – Orthogonal transformations – Formal properties of the transformation matrix – The Euler angles – Euler's theorem on the motion of a rigid body
(Sec 4.1 to 4.4, 4.6 of Text Book)

UNIT IV

The Hamilton Equations of Motion: Legendre transformations and the Hamilton equations of motion – Cyclic coordinates and conservation theorems – Routh's procedure – Derivation of Hamilton's equations from a variational principle – The principle of least action
(Sec 8.1 to 8.3, 8.5, 8.6 of Text Book)

Text book:

Classical Mechanics by Herbert Goldstein, Charles P.Poole, John Safko**,** 3rd Edition, Pearson Publishers

Outcome:
After doing this course, students would understand how the variational principles are useful in the derivation of governing equations in mechanics

KAKATIYA UNIVERSITY
M.Sc. (APPLIED MATHEMATICS) Syllabus(w.e.f.2019-20)
Semester – II, Paper – II
Paper Code: AM2CP2
MATHEMATICAL ANALYSIS

UNIT I: Fourier Series, Beta and Gamma Functions

Definition of Fourier Series and orthogonal systems of functions – Minimum property of partial sums – Bessel's inequality – Dirichlet kernel – A theorem on point wise convergence of Fourier Series – Perseval's theorem – The Gamma Function: Definition of Gamma function and its properties – Beta function and its connection with Gamma function
(Chapter 8: Sec 8.9 to 8.14 and 8.16 to 8.21 of Text Book 1)

UNIT II: Improper Integrals

Convergence at the left and right end – Convergence at both the end point – General case – Convergence at ∞ and $-\infty$ - General case – The necessary and sufficient condition for the convergence of the improper integral $\int_a^b f(x)dx$ - Comparison test – A useful comparison integral – Convergence of Beta function – General test for convergence – Absolute convergence. Convergence of $\int_a^\infty f(x)dx$ - A useful comparison integral – Convergence of Gamma function – General test for convergence – Absolute convergence – Abel's and Dirichlet's theorems
(Chapter 9: Sec 9.1 to 9.9.2 of Text Book 2)

UNIT III: Functions of Several Variables

Definition of Limit and Continuity of real valued functions, Uniform Continuity – Intermediate value theorem.

Partial derivatives – Existence of directional derivatives – Mean value theorem
Differentiability: Necessary and sufficient condition for differentiability – Partial derivatives of higher order. Schwarz's and Young's theorem - Taylor's theorem – Extreme values. (Chapter 12: Sec12.1 to 12.7, Chapter 13: Sec 13.1 to 13.6.1 and 13.8 to13.9 of Text Book 2)

UNIT IV : Invertible, Implicit Functions and Integrals as Functions of a Parameter

Invertible and Implicit Functions: Definition of locally invertible transformations – Jacobian of transformation – Linear transformations –Inverse function theorem(Statement only) – Implicit function theorem for the case of two variables and its applications for the existence of unique solutions of equations.

Integrals as Functions of a Parameter: Definite integral as function of a parameter – Theorems on continuity and inversion of differentiation and integration – Limits of integration as functions of y – Inversion of the order of integration - Uniform convergence of improper integrals – Test for uniform convergence – Inversion of the order of integration - Interchange of differentiation and integration
(Chapter 14: Sec 14.1 to 14.3.1, 14.5 to 14.7 and Chapter 15 of Text Book 2)

Text Book:

1. Principles of Mathematical Analysis by Walter Rudin, MgGraw Hill.
2. A Course of Mathematical Analysis by Shantinarayan and Mittal, S.Chand Publications

Reference Books:

1. Mathematical Analysis by Tom Apostle, TMH
2. Principles of Real Analysis by S.C.Malik and Savitha Arora, Newage International

Outcome:

By studying this course the student will be exposed to the knowledge and applications of Fourier series. The student can discriminate between the study of functions of a single variable and two variable concepts.

KAKATIYA UNIVERSITY
M.Sc. (APPLIED MATHEMATICS) Syllabus(w.e.f.2019-20)
Semester - II
Paper –III
Paper Code: AM2CP3
TOPOLOGY

UNIT I

Topological spaces: The definition and examples - Elementary concepts - Open bases and Open-sub bases - Weak topologies. If f and g are real or complex continuous functions defined on a topological space then f+g, f.g and αg (α, scalar) are continuous. Any uniform limit of continuous functions is continuous.
(Chapter 3 : Sec 16 to 20 of the Text Book)

UNIT II

Compactness: Compact spaces - Products of spaces - Tychnoff's theorem - Generalized Heine-Borel theorem - Compactness for metric spaces.
(Chapter 4 : Sec 21 to 24 of Text Book)

UNIT III

Separation: T_1-Spaces and Hausdorff spaces - Completely regular spaces and normal spaces - Statements of Uryshon's lemma and Tietz-extension theorem.
(Chapter 5 : Sect 26 to 28 of Text Book)

UNIT IV

Connectedness: Connected spaces - The Components of a space - Totally disconnected spaces.
(Chapter 6 : Sec 31 to 33 of Text Book)

Text Book:

Introduction to Topology and Modern Analysis by G. F. Simmons, Tata McGraw-Hill

Reference Books:

1. Topology by James R. Munkres, 2nd Edition, Pearson Education, Asia(2001).
2. Introduction to General Topology by K.D.Joshi, Wiley Eastem.
3. Topology by J.L.Kelly, Van Nostrad, Princeton.
4. Elements of General Topology by S.T. HU, Holden day Inc.;

Outcome:
After studying of this course, students will get theoretical concepts with applications on topological spaces, compact spaces, separation and connected spaces.

KAKATIYA UNIVERSITY
M.Sc. (APPLIED MATHEMATICS) Syllabus(w.e.f.2019-20)
Semester - II
Paper – IV
Paper Code: AM2CP4
COMPLEX ANALYSIS

UNIT I

Origin of complex numbers – Basic algebraic properties – Different types of representations – Conjugates – Modulus – Roots of complex numbers – Regions in complex plane
(Sec 1 to 11 of Text Book)
(No question is to be set from this part)
Functions of complex variable – Limits – Continuity – Derivatives – Differentiation formulas – Cauchy-Riemann equations – Sufficient condition for differentiability – Polar coordinates
(Sec 12, 15, 16, 18, 19, 20, 21, 22, 23 of Text Book)

UNIT II

Analytic functions – Harmonic functions – Derivatives of functions W(t) – Definite integrals W(t) – Cantours – Cantour integrals – Upper bounds for moduli of Cantour integrals – ML inequality – Anti derivatives – Cauchy-Goursat theorem – Simply and Multiply connected domains
(Sec 24, 25, 26, 37, 38, 39, 40 to 49 of Text Book)

UNIT III

Cauchy integral formula – An extension of the Cauchy integral formula – Some consequences of the extension – Liouville's theorem – Fundamental theorem of algebra – Maximum modulus principle – Convergence of sequences – Convergence of series – Taylor series – Laurent series - Isolated singular points – Residues – Cauchy Residue theorem
(Sec 50 to 63, 68, 69, 70 of Text Book)

UNIT IV

The three types of isolated singular points – Residues of Poles – Examples – Zeros of analytic functions(Theorem 1 only) – Zeros and Poles – Behaviour of functions – Near isolated singular points – Evaluation of improper integrals - Argument principle – Roche's theorem – Examples
(Sec 72 to 79, 86 to 87 of Text Book)

Text Book:

Complex Variables and Applications by J.W.Brown and R.V.Churchill, 8th Edition.

Reference Books:

1. Complex Variables by H.Silverman
2. Complex Variables by J.N.Sharma
3. Complex Variables by M.L.Khanna

Outcome:
The student will be able to understand the concepts and development of complex number system. The applications of contour integration, zeros and singularities are well understood by the student at the end of the course.

M.Sc. (APPLIED MATHEMATICS) Syllabus(w.e.f.2019-20)
Semester - II
Paper – V
Paper Code: AM2CP5
SPECIAL FUNCTIONS

UNIT I

Legendre's equation and its solution – Legendre's function of the first kind – Generating function for Legendre polynomials – Orthogonal properties of Legendre's polynomials –
Recurrence relations – Beltrami's result – Rodrigues's formula – Legendre's series for a polynomial Expansion of function f(x) in a series of Legendre's polynomial – Even and odd function
(Chapter 9: Sec 9.1 to 9.3, 9.8 to 9.10, 9.13 to 9.19 of Text Book)

UNIT II

Bessel's equation and its solution – Bessel's function of the first kind of order n – List of important results of Gamma function and beta function – Bessels's function of the second kind of order n – Recurrence relations – Generating function for Bessels's function $J_n(x)$ –
Orthogonality of Bessels's function – Bessel-sereis or Fourier Bessel expansion of f(x).
(Chapter 11: Sec 11.1 to 11.5, 11.6A, 11.7, 11.7A, 11.7B, 11.8, 11.10, 11.11A of Text Book)

UNIT III

Hermite's equation and its solution – Hermite polynomial of order n – Generating function for ermite polynomials – Alternative expressions for the Hermite polynomials – Hermite polynomials $H_n(x)$ for some special values of n – Evaluation of values of $H_{2n}(0)$ and $H_{2n+1}(0)$ – Orthogonality properties – recurrence relations
(Chapter 12 of Text Book)

UNIT IV

Laguerre's equation and its solution – Laguerre polynomial of order (or degree) n – Alternetive definition of Laguerre polynomial of order (or degree) n – Generating function for Laguerre polynomials – Alternative expression for the Laguerre polynomials – First few Laguerre polynomials – Orthogonal properties of Laguerre polynomials – Expansion of a polynomial in a series of Laguerre polynomials – Relations between Laguerre polynomials and their derivatives.
(Chapter 13 of Text Book)

Text Book:

1. Advanced Differential Equations- M.D. Raisinghania

Outcome:
By studying this course, student will get the knowledge of Legendre polynomials, Bessels function, Hermite polynomials and Laguerre polynomials and the applications of the said polynomials.

KAKATIYA UNIVERSITY
M.Sc. (APPLIED MATHEMATICS) syllabus(w.e.f. 2019-20)
Semester - III
Paper – I
Paper Code: AM3CP1
MEASURE AND INTEGRATION

UNIT I

Algebra of sets – Borel sets
Measurable Sets: Outer Measure - Properties of Outer Measure - Measurable Sets and Lebesgue Measure - Properties of Measurable Sets - Sequences of Measurable sets - A Non measurable Set.
(Sec 1.4, 2.7, Chapter 3: Sec1 to 4 of the Text Book)

UNIT II

Measurable Functions: Properties of Measurable Functions - Sequences of Measurable Functions - Almost everywhere concept - Measurability of a Characteristic Function - Simple and Step Functions - Egoroff's Theorem.
Lebesgue Integral: The Riemann Integral - The Lebesgue Integral of a Bounded Measurable Function over a Set of Finite Measure - The necessary and sufficient condition for measurability of bounded function - Properties of integral of bounded measurable functions - Bounded convergence Theorem.
(Chapter 3: Sec 5 to 6 and Chapter 4: Sec 1to 2 of the Text Book)

UNIT III

The Lebesgue in Integral of a Nonnegative Function: Properties of Integral of Nonnegative functions - Fatou's Lemma - Monotone Convergence Theorem - Some propositions related to Integrals - The General Lebesgue Integral - Properties of Lebesgue Integrals - Lebesgue Dominated Convergence Theorem.
(Chapter 4: Sec 3 to 4 of the Text Book)

UNIT IV

Differentiation and Integration: Statement of Vitali Covering lemma - The four Dini's derivatives of a function – Functions of bounded variation - A theorem on integral of a differentiable function - Differentiation of an Integral - Absolute Continuity.
(Chapter 5: Sec 1to 4 of the Text Book)

Text Book:
Real Analysis by H.L.Royden, PHI, 3rd Edition

Reference Books:
1. Measure Theory by P.R.Halmos, Vaan Nostrand, Princeton.
2. An Introduction to Measure and Integration by Inder K. Rana, Narosa Publications.

Outcome:
This course will gives theoretical knowledge with applications on Measurable sets, Lebesgue integrals of different types measurable functions and functions of Bounded variation.

KAKATIYA UNIVERSITY
M.Sc. (APPLIED MATHEMATICS) Syllabus(w.e.f. 2019-20)
Semester –III
Paper –II
Paper Code: AM3CP2
MECHANICS OF SOLIDS

UNIT I

Introduction to Tensors: Coordinate transformations - Summation Convention – Contravariant - Covariant and mixed tensors - Symmetric and skew symmetric tensor - Fundamental operations with the tensors - The line element and metric tensor - Tensor form of gradient, divergence and curl.
(Scope as in Text Book 1)
Analysis of Strain: Deformation - Affine transformations - Infinitesimal affine transformations - Geometrical interpretation of the components of strain - Strain quadric of Cauchy - Principal strain and strain invariants - Examples of strain - Equations of compatibility (a simple derivation).
(Chapter 1 of the Text Book 2)

UNIT II

Analysis of Stress: Body and surface forces - Stress tensor - Equations of equilibrium - Transformation of coordinates - Stress quadric of Cauchy - Maximum normal and shear stress - Mohr's diagram - Examples of stress.
(Chapter 2 of the Text Book 2)

UNIT III

Equations of Elasticity: Generalized Hooke's law - Homogeneous isotropic media - Elastic moduli for isotropic media - Simple tension - Pure shear and hydrostatic pressure - Equilibrium equations for an isotropic elastic solid - Dynamical equations for an isotropic elastic solid - The strain energy function and it's connection with Hooke's law - Uniqueness of solutions.
(Chapter 3 of the Text Book 2)

UNIT IV

Basic Problems of Elasticity: Statement of problem - Extension of beams by longitudinal forces - Beam stretched by its own weight - Bending of beams by terminal couples - Torsion of circular shaft - Torsion of cylindrical beams - Stress function.
(Chapter 4: Sec 29 to 35 of the Text book 2)

Text Book:

1. Vector Analysis (For Unit-I, a) Introduction to Tensors) by Murray R Spiegel, Schaum's Series.
2. Mathematical Theory of Elasticity by I.S.Sokolnikoff, TMG- New Delhi.

Reference Books:

1. Theory of Elasticity by S.P.Timoshenco, J.N.Goodier.
2. Theory of Elasticity by PDS. Verma, Vikas Publications.

Outcome:
After doing this course, students would realize the physical quantities Tensors, which are more than one direction, understand strains and stresses, and how the relations between them (constitutive relations) involve elastic constants which in turn give strength of materials.

KAKATIYA UNIVERSITY
M.Sc. (APPLIED MATHEMATICS) Syllabus(w.e.f.2019-20)
Semester –III
Paper –III
Paper Code: AM3CP3

PARTIAL DIFFERENTIAL EQUATIONS

U N I T - I: FIRST ORDER PARTIAL DIFFERENTIAL EQUATIONS

Formation of First Order Partial Differential Equations – Solution of Linear First Order Partial Differential Equations (Langrange's Method)- Integral Surfaces Passing Through a Given Curve - Surfaces Orthogonal to a Given System of Surfaces-Compatibility of First Order Partial Differential Equations – Classification of the Solutions of First Order Partial Differential Equations - Solutions of Non-Linear Partial Differential Equations of First Order – Charpit's Method - Jacobi's Method - Special Types of First Order Equations .
[Sections 1.1 to 1.9.3 of text book.]

U N I T - I I: SECOND ORDER PARTIAL DIFFERENTIAL EQUATIONS.

Second order Partial Differential Equations – Origin – Linear Partial Differential Equations with Constant Coefficients - Methods of Solving Linear Partial Differential Equations – Classification of Second Order Partial Differential Equations - Classification of Second Order Partial Differential Equations.
[Sections 2.1 to 2.4.1 of text book.]

U N I T - III : ELLIPTIC DIFFERENTIAL EQUATIONS

Boundary Value Problems – Separation of Variable method - Laplaces equation in Cylindrical and Spherical coordinates - Interior and exterior Dirichlet problem for a circle – Interior Dirichlet problem for a Sphere- Interior Neumann problem for a Circle - Miscellaneous examples.
[Sections.3.2 to 3.10 (3.10.1,3.10.2,3.10.3]

U N I T – IV: PARABOLIC DIFFERENTIAL EQUATIONS

Solution of Diffusion by Separation of Variables Method - Diffusion Equation in Cylindrical and Spherical coordinates – D'Alembert solution of one dimensional Wave Equation – Separation of Variable Method - Two Dimensional Wave Equation – Separation of Variable Method- Two Dimensional Wave Equation
[Sections 4.1, 4.2, 4.3, 4.4, 5.3, 5.4, 5.5, 5.10.]

Text Book:

Partial Differential Equations for Engineers and Scientists by J.N. Sarma and Kehar Singh Published by Narosa Publishing House.

Reference Books:

1. Elements of partial Differential Equations by I.N. Sneddon
2. Partial Equations by L.C Evans. Partial Differential Equations by Prasad & Ravindran

Outcome:

The student will be able to understand the various applications of partial differential equations in other branches of science like Physics, Engineering and allied science.

KAKATIYA UNIVERSITY
M.Sc. (APPLIED MATHEMATICS) Syllabus (w.e.f.2019-20)
Semester –III
Paper –IV (Elective)
Paper Code: AM3OP4(1)
Mathematical Programming

UNIT I

Hyper planes – Hyper spheres – Convex sets and their properties –Mathematical formulation of a LPP - Graphical solution method- General LPP - Canonical and Standard form of a LPP.
Basic solution – Degenerate solution – Basic feasible solution – Improved basic feasible solution - Optimum basic feasible solution – Fundamental properties of solutions-Reduction of a feasible solution to a basic feasible solution – Fundamental theorem of linear programming - Improved basic feasible solution - Existence of unbounded solution – Conditions of optimality – The Simplex algorithm.

UNIT II

Use of Artificial Variables – Two-Phase Method - Big M-Method – Degeneracy in linear programming - Duality – General Primal-Dual pair – Formulating a Dual problem – Primal-Dual pair in matrix form - Duality theorems – Duality and Simplex method - Dual simplex method.

UNIT III

Transportation problem- Matrix form of T.P. – special case of LPP Transportation table- Initial Basic Feasible Solution – North West Corner Rule, Matrix - Minima Method, Vogel approximation method of finding initial basic feasible solution – loops in a T.P. – Transportation Algorithm of finding optimal solution - Degeneracy in T.P. – Unbalanced T.P.

UNIT IV

Assignment problems – Hungarian method of finding optimal assignment problems – Travelling Salesman Problem.
Integer programming – all & mixed integer programming problems- Gomory's All IPP method- Gemory's mixed integer programming – branch and bound method .

Text-Book:

Operations Research by Kanti Swarup. P.K.Gupta and Manmohan.

Reference Books:

1. Operations Research by Handy A.Taha. Printice Hall of India.
2. Linear programming methods and applications by Gass. S.I

Outcome:
After studying this course, students will get the knowledge of formulation of LLP with real time applications. By getting the knowledge of transportation and assignment problems, students will be able to solve the real time problems.

KAKATIYA UNIVERSITY
M.Sc. (APPLIED MATHEMATICS) Syllabus (w.e.f.2019-20)
Semester - III
Paper – IV (Elective)
Paper Code: AM3OP4(2)
NUMERICAL ANALYSIS

U N I T I

Initial Value Problems for Ordinary Differential Equations**:** The Elementary Theory of Initial Value Problems – Euler's Method – Higher-Order Taylor Methods – Runge-Kutta Methods – Multistep Methods.

U N I T I I

Direct Methods for solving Linear Systems: Linear system of equations-Matrix Factorizatoin-Special Types of Matrices-Iterative Techniques in Matrix Algebra –The Jacobi and Gauss-Seidel Iterative Techniques.

U N I T III

Numerical Solutions of Nonlinear Systems of Equations : Fixed Points for Functions of Several Variables – Newton's Method – Quasi-Newton Methods – Steepest Descent Techniques.

U N I T IV

Boundary-Value Problems for Ordinary Differential Equations **:** The Linear Shooting Method – The Shooting Method for Nonlinear Problems – Finite-Difference Methods for Linear Problems – Finite-Difference Methods for Nonlinear Problems

Text Book :

Numerical Analysis by Richard L.Burden and J.Douglas Faires, 9th Edition, Brooks/Cole, Cengage Learning

Reference books:

1. Introductory Methods of Numerical Analysis, by S.S. Sastry, PHI
2. Numerical Methods for Scientific and Engineering Computation byM. K.Jain, S.R.K. Iyengar and R.K.Jain.

Outcome:

After study of this course, students will get an idea on solving IVP, linear systems, non-linear systems and BVP with different techniques.

KAKATIYA UNIVERSITY
M.Sc.(APPLIED MATHEMATICS) Syllabus(w.e.f. 2019-20)
Semester –III
Paper –IV(Elective)
Paper Code: AM3OP4(3)
AUTOMATA AND LANGUAGES

UNIT I

Mathematical Preliminaries: Sets, relations and functions – Graph – Trees - Strings and their properties - Principle of induction.
The theory of Automata: Definition of automation - Description of a finite automation - Transition systems.
(Chapter 1: Sec 1.1 to1.4 and Chapter 2: Sec 2.1 to 2.2 of Text Book)

UNIT II

Properties of Transition functions: Acceptability of a string by a finite automation - Non deterministic finite state machines - The equivalence of DFA and NDFA - Mealy and Moore models - Minimization of finite automata.
(Chapter 2: Sec 2.4 to 2.9 of Text Book)

UNIT III

Formal Languages: Basic definitions and examples - Chomsky classification of languages and their relations - Recursive and recursively enumerable sets - Operations on languages and automata.
(Chapter 3: Sec 3.1 to 3.6 of Text Book)

UNIT IV

Regular Sets and Regular Grammars: Regular expressions - Finite automata and Regular expressions - Pumping Lemma for regular sets - Applications of Puming Lemma - Closure properties of regular sets - Regular sets and regular grammar.
(Chapter 4: Sec 4.1 to 4.6 of Text Book)

Text Book:

Theory Computer Science (Automata, Languages and Computation) by K.L.P. Mishra and N. Chandrasekhar, PHI

Reference Books:

1.Introductory theory of computer science by E.V.Krishna Murthy, East-West Press.
2. Theory of Finite Automates with an introduction to formal languages by Carrel J and Lang D,PHI

Outcome:

Gaining knowledge and understanding the properties of languages, grammar with formal mathematical methods.

KAKATIYA UNIVERSITY
M.Sc. (APPLIED MATHEMATICS) Syllabus (w.e.f.2019-20)
Semester –III
Paper –IV (Elective)
Paper Code: AM3OP4(4)
ADVANCED COMPLEX ANALYSIS

UNIT I:

Harmonic Functions: Harmonic functions – Borel-Carathodary theorem – Poisson's integral formula – Positive harmonic functions – Harnack's functions – Harnack's inequality – Harnack's principle
(Chapter 10: Sec 10.1 to 10.3 of Text Book)

UNIT II:

Conformal mappings and Bilinear transformations: Introduction – Conformality theorem – Bilinear transformations – Special bilinear transformations – Exponential and trigonometric transformations – Normal families – Montel's theorem and Riemann mapping theorem(Statement only)
(Chapter 11 of Text Book)

UNIT III:

Univalent functions: Definition of univalent functions and elementary properties – Area theorem – Coefficient conjectures – Coefficient estimates – Growth and distortion theorems – Function with positive real part
(Chapter 12 of Text Book up to theorem 12.8)

UNIT IV:

Subclasses of S, Entire and Meromorphic Functions: Starlike functions – Convex Functions – Close to convex functions – Infinite products – Meromorphic functions – Weirstrass theorem
(Chapter 12: Sec 12.2 , Chapter 13: Sec 13.1, 13.2 of Text Book)

Text Book:

Complex Variables by H.Silverman

Reference Books:

1. Complex Variables Theory and Applications by H.S.Kasana
2. Univalent Functions by P.C.Duren
3. Univalent Functions by A.W.Goodman(Vol I & II)

Outcome:
At the end of this course the student will be motivated towards the research in complex analysis.

KAKATIYA UNIVERSITY
M.Sc. (APPLIED MATHEMATICS) Syllabus (w.e.f.2019-20)
Semester –III
Paper – V (Elective)
Paper Code: AM3OP5(1)
COMPUTER FUNDAMENTALS AND PROGRAMMING IN C

UNIT I

Major Components of a Digital Computer - Computer Classification - User Interface - Hardware Software and Firmware - LAN and WAN.
Number System (Binary, Decimal, Octal and Hexadecimal) - Conversion of one Number System to another - Floating-Point Representation.
(Chapters 1, 2 of Text Book 1)

UNIT II

Constants – Variables – Data types – Operators – Expressions – Managing input and output operations
(Chapter 2, 3, 4 of Text Book 2)

UNIT III

Decision making and branching – Decision making and looping – Arrays - User defined function
(Chapters 5, 6, 7, 9 of Text Book 2)

UNIT IV

Structures and unions – Pointers - File management in C.
(Chapters 10, 11 and 12 of Text Book 2)

Text Book:

1. Computer Fundamentals, Architecture and Organization by B.Ram, 3rd Edition, New Age International (P) Limited.
2. Programming in ANSI C by E.Balagursamy, 4th Edition, Tata McGraw-Hill Education Pvt. Ltd.

Outcome:
This course is designed to provide knowledge on computer and C language. The students will be able to develop logics which will help them to create programs and applications through C

Computer Lab Work

1. Program to print Biggest of 3 given numbers.
2. Program to print the roots of a quadratic equation
3. Program to print sum of N given numbers.
4. Program to print N prime numbers.
5. Program to check whether the given number is palindrome or not.
6. Implement functions to find whether a given number is prime or not.
7. Program to find the n^{th} Fibonacci number using recursion.
8. Program to multiply two matrices
9. Program to check whether the given string is palindrome or not.
10. Program to sort a given string.
11. Create a file of student records .
12. Program to swap two numbers using pointers.
13. Program to compute sum of elements stored in an array using pointers.
14. Program to read student records (name, roll, m1, m2, m3) as structure and sort according to name.
15. Program to read student records (name, roll, m1, m2, m3) as structure and print the result.

16. . Programs i)to create a file ii) to read the created file and display it contents..

KAKATIYA UNIVERSITY
M.Sc. (APPLIED MATHEMATICS) Syllabus (w.e.f.2019-20)
Semester –III
Paper – V (Elective)
Paper Code: AM3OP5(2)
OFFICE AUTOMATION AND C – LANGUAGE

UNIT I

MS-Office, MS-Word – Basics – Header – Footer – Tables – Graphics – Templates – Macros.
MS-Excel – Worksheet – Formatting – Functions – Charts – Graphs – Worksheets and Data Strings.
(Text Book 1)

UNIT II

Overview of C – Constants - Variables and Data types - Operators and Expressions - Managing Input and Output operations.
(Chapters 1, 2, 3 and 4 of Text Book 2)

UNIT III

Decision making and Branching - Decision Making and Looping – Arrays - Handling Character Strings - User Defined Functions.
(Chapters 5, 6, 7, 8 and 9 of Text Book 2)

UNIT IV

Structures and Unions – Pointers - File Management in C.
(Chapters 10, 11 and 12 of Text Book 2)

Text Book:

1.Working in MS-Office – By Ron Mansfeild, Tata McGrawHill.

2. Programming in ANSI C by E.Balagurusamy, Third Edition, Tata McGraw-Hill

Reference Book:

MS-OFFICE For everyone by Sanjay Saxena, Vikas Publication.

Outcome:
This course is designed to provide knowledge on office Automation with MS- Word, MS-Excel and C language. The student will be able to develop logic, which will help them to create programs and applications through C.

Computer Lab Work

1. Prepare Curriculum Vitea of a student.
2. Mail Merge.
3. Create graphs(Line, Pie and Bar) in Excel
4. Simple macros in Excel.
5. Program to print Biggest of 3 given numbers.
6. Program to print sum of N given numbers.
7. Program to check whether the given number is palindrome or not.
8. Implement functions to find whether a given number is prime or not.
9. Program to find the n^{th} Fibonacci number using recursion.
10. Program to multiply two matrices
11. Program to check whether the given string is palindrome or not.
12. Program to sort a given string.
13. Create a file of student records .
14. Program to swap two numbers using pointers.
15. Program to read student records (name, roll, m1,m2,m3) as structure and sort according to name.
16. Program to copy contents of one file to another file.

KAKATIYA UNIVERSITY
M.Sc.(APPLIED MATHEMATICS) Syllabus (w.e.f.2019-20)
Semester –III
Paper – V (Elective)
Paper Code : A M3OP5(3)

NUMERICAL ANALYSIS Using C

UNIT I

Transcendental and polynomial equations: Introduction - Bisection Method - Secant Method - Regula-Falsi Method - Newton-Raphson Method - Mullar Method - Chebyshev Method - Multipoint Iterative Methods - Rate of convergence
(Chapter 2: Sec 2.1, 2.2, 2.3, 2.4 and 2.5 of the Text Book)

UNIT II

System of linear algebraic equations and eigen value problems: Introduction
Direct Methods: Gauss-Elimination Method - Gauss-Jordan Method - Triangularisation Method - Cholesky Method - Partition Method - Error analysis for direct methods
Iteration Methods: Jacobi Iteration Method - Gauss-Seidel Iteration Method - Eigen Values and Eigen Vectors - Power Method - Inverse Power Method.
(Chapter 3: Sec 3.1, 3.2, 3.3, 3.4, 3.5, 3.11 and 3.12 of the Text Book)

UNIT III

Interpolation and approximation: Introduction - Lagrange Interpolation - Newton Divided Differences - Quadratic Interpolation - Higher Order Interpolation - Iterated Interpolation - Finite Differences Operators
Interpolating Polynomials using finite differences: Gregory-Newton forward difference interpolation - Backward difference interpolation - Stirling and Bessel interpolation - Hermite interpolation - Spline interpolation
Approximation: Least square approximation.
(Chapter 4: Sec 4.1, 4.2, 4.3, 4.4, 4.5, 4.6 and 4.9 of the Text Book)

UNIT IV

Numerical differentiation and integration: Introduction
Numerical Differentiation: Linear interpolation - Quadratic interpolation - Methods based on finite differences - Methods Based on Undetermined Coefficients - Numerical Integration Methods Based on Interpolation: Newton-Cotes Methods - Open type integration Rules Composite Integration Methods: Romberg Integration - Double Integration.
(Chapter 5: Sec 5.1, 5.2, 5.6, 5.7, 5.9, 5.10 and 5.11 of the Text Book)

Text Book:

Numerical Methods for Scientific and Engineering Computation by M. K. Jain, S. R. K. Iyengar, R. K. Jain, 5th Edition, New Age International (p) Limited Publishers

Reference Book:

An Introduction to Numerical Analysis by Kendall E. Atkinson

Outcome:

After completion of the course, the students will be able to solve the problems using Numerical Techniques and with the learning the logics using C language, we will be writing.

Numerical Analysis Laboratory

The following programs are to be executed in C/Fortran language.

1. Solution of system of n x n linear equations AX=B using Gauss Elimination method.
2. Finding solution of n x n linear equations AX=B using LU decomposition method.
3. Finding solution of n x n linear equations AX=B using Gauss-Seidel iteration method.
4. Finding the largest Eigen value in magnitude and the corresponding Eigen vector of an n x n matrix A by Power method.
5. Lagrange interpolation.
6. Newton-Gregory forward interpolation.
7. Newton-Gregory backward interpolation.
8. Evaluation of the integral of f(x) between the limits 'a' and 'b' using Trapezoidal rule with 'n' subintervals.
9. Evaluation of the integral of f(x) between the limits 'a' and 'b' using Simpson's $1/3^{rd}$ rule with '2n' subintervals.
10. Evaluation of the integral of f(x) between the limits 'a' and 'b' using Simpson's $3/8^{th}$ rule with '3n' subintervals.
11. Solution of equation by Bisection method.
12. Solution of equation by Regula-Falsi method.
13. Solution of equation by Newton-Raphson method.
14. Solution of equation by Mullar method.

Text/Reference Books:

1. Numerical methods for scientific and Engineering Computation by M. K. Jain, S. R. K. Iyengar and R. K. Jain.
2. Numerical methods by E. Balagurusamy.
3. Computer oriented Numerical methods by V. Raja Raman.

KAKATIYA UNIVERSITY
M.Sc. (APPLIEDMATHEMATICS) Syllabus (w.e.f.2019-20)
Semester –IV
Paper – I
Paper Code: AM4CP1
FUNCTIONAL ANALYSIS

UNIT I

Normed spaces-Banach spaces: Definition and examples of Normed spaces and Banach spaces - Continuous linear transformations - The Hahn-Banach Theorem - The natural imbedding of N in N^{**}.
(Chapter 9: Sec 46-49 of Text Book 1)

UNIT II

The Open mapping Theorem - The Conjugate of an Operator.
Hilbert Spaces: Definition and examples of inner product spaces and Hilbert Spaces - Simple Properties of Hilbert Spaces - Orthogonal Complements.
(Chapter10 : Sec 50-53 of Text Book 1)

UNIT III
Orthogonal sets - Bessel's inequality - Fourier series in Hilbert Spaces - Gram-Schmidt orthogonalization process - The Conjugate Space H^*.
Operators on Hilbert Spaces: The Adjoint of an Operator - Self –Adjoint Operators
(Chapter 10: Sections 54-57 of Text Book 1)

UNIT IV

The Normal Operator and the Unitary Operator.
Further Applications: Banach fixed point theorem and its applications to linear equations - Approximation in Normed spaces - Uniform approximations.
(Chapter 10: Sec 58 of Text Book 1, Chapter 5: Sec 5.1-5.4; Chapter 6: Sec 6.1-6.3 of Text Book 2)

Text Book:
1. Introduction to Topology and Modern Analysis by G.F. Simmons, McGraw-Hill.
2. Introductory Functional Analysis with Applications by E.Kreyszig, McGraw-Hill.

Reference Books:
1.Function analysis with applications by B.Chaudary and Sudarshan Nanda, New Age International (pvt) Ltd.
2.Functional Analysis by B.V.Limaye, Wiley Eastern Ltd
Outcome:
After studying this course the student will be exposed to the knowledge of linear spaces, metric spaces, and inner product spaces. The applications of fixed point theorem to linear expansions will be well understan

KAKATIYA UNIVERSITY
M.Sc. (APPLIED MATHEMATICS) Syllabus (w.e.f.2019-20)
Semester –IV
Paper – II
Paper Code: AM4CP2
FLUID DYNAMICS

UNIT I

Kinematics of Fluids in Motion: Real Fluids and Ideal Fluids - Velocity of a Fluid at a Point - Stream Lines and Path Lines - Steady and Unsteady Flows - The Velocity Potential - The Vorticity Vector - Local and Particle Rates of Change - The Equation of Continuity - Acceleration of a Fluid - Conditions at a Rigid Body

Equations of Motion of Fluid: Euler's equation of Motion - Bernoulli's equation.

(Chapter 2: Sec 2.1 to 2.10 and Chapter 3: Sec 3.4 to 3.6 of the Text Book)

UNIT II

Some Three- dimensional flows: Introduction - Sources, Sinks and Doublets.

Some Two- dimensional flows: Meaning of Two-Dimensional flow - The Stream Function - The Complex Potential for two-dimensional irrotational and incompressible flow - Complex Velocity Potentials for standard two-dimensional flows - Uniform stream - Line Sources, Line Sinks and Line Doublets - Line Vortices.

(Chapter 4: Sec 4.1 to 4.2 and Chapter 5: Sec 5.1to 5.6 of the Text Book)

UNIT-III

The Milne-Thompson Circle Theorem - Some Applications of the Circle theorem - Extension of the Circle theorem - The theorem of Blasius.

Viscous Flows: Stress analysis in Fluid motion - Relation between stress and rate of strain - The Coefficient of Viscosity and Laminar Flow.

(Chapter 8: Sec 8.6 to 8.10 of the Text Book)

UNIT-IV

The Navier-Stoke's equation of motion of Viscous Fluids - Some solvable Problems - Steady motion between parallel planes through tube of uniform cross section and flow between concentric rotating cylinders.

Steady Viscous Flow in a tube of uniform cross section: A Uniqueness Theorem - Tube having uniform elliptic cross section and equilateral cross section - Diffusion of Vorticity - Energy dissipation due viscosity.

(Chapter 8: Sec 8.11, 8.14 and 8.15 of the Text Book)

Text Book:

Fluid Dynamics by Frank Charlton- CBS Publications.

Reference Books:

1. Theoretical Hydrodynamics by L.M.Milne-Thompson, Macmillan.
2. Modern Fluid Dynamics by N.Curle and H.J.Davies, VanNostrand.

Outcome:

After doing this course, student would know various types fluids, applications of fluids, and how constitutive relation and the solutions of equations of motion of fluids are useful in real time problems.

KAKATIYA UNIVERSITY
M.Sc. (APPLIED MATHEMATICS) Syllabus (w.e.f.2019-20)
Semester –IV
Paper – III
Paper Code: AM4CP3

INTEGRAL EQUATIONS AND TRANSFORMS

UNIT I

Integral Equation – Differentiation of a Function under an Integral Sign – Relation Between Differential and integral Equations – Solution of Non-homogeneous Volterra's Integral Equations by the method of Successive Substitution and Successive Approximation of some Resolvent Kernels – Volterra Integral Equation of First Kind.
(Sec 1.1 to 2.4 of Text Book 1)

UNIT I I

Solution of the Fredholm Integral Equation by the Method of Successive Substitution and successive approximation – Reciprocal Functions - Volterra's Solution of Fredholm's Equation – Statement of Fredholm first Theorem- Statement of Unique Solution of the Non-homogeneous Fredohlm Integral Equation – Integral equations with degenerate kernels - Symmetric Kernel – Eigen value of a Symmetric kernel- Real Characteristic Constants.
(Sec 2.5 to 2.9, 3.1, 3.2, 3.14 and 4.1, 4.4, 4.5. of Text Book 1)

UNIT III

Laplace Transforms – Existence of Laplace Transform – Properties of Laplace Transform- The inverse Laplace transform and properties – Convolution Theorem- Solution of ordinary differential Equations by Laplace Transforms- Solution of Ordinary Differential Equations with variable coefficients by Laplace Transforms.-
(Chapter 1, Chapter 2: Sec 2.1 to 2.15, Chapter 3: Sec 3.1, 3.2, of Text Book 2)

UNIT IV

Fourier Transforms – Fourier Integral Formula – Inversion Theorem for Complex Fourier Transform -Fourier Sine and Cosine Transform - Inversion of Formulae – Convolution Theorem- Parseval's identity -Finite Fourier Sine and Cosine Transforms -Inversion Formulae -Operational Properties – Convolution.
(Chapter 6:Sec 6.1 to 6.15, 6.17, 6.18, 6.19,Chapter7: Sec 7.1 to 7.4, 7.6, 7.7, 7.9, of Text Book 2)

Text Book:

1. Integral Equations by Shanty Swarup
2. Integral Transforms by A. R Vasistha and R.K. Gupta

Reference Book:

Advance Calculus for Applications by Francis B. Hilder Brand Prentic Hall of India

Outcome:

This course is designed the learnt transformations and solving of integral equations.

KAKATIYA UNIVERSITY
M.Sc. (APPLIED MATHEMATICS) Syllabus (w.e.f.2019-20)
Semester –IV
Paper – IV (Elective)
Paper Code: AM4OP4(1)

BIO MECHANICS

UNIT I

A brief on cell biology - The extra cellular matrix and mechanotransduction in cells
Bio Solid Mechanics: Concept of stress and stress transformation - Principal stresses and maximum shear stress - Concept of strain and the constitutive behavior of materials - Mechanical properties of bone - General equilibrium equations - Navier space equations and axially loaded rods.
(Chapter 1: Sec1.4 to 1.6, Chapter 2, Chapter 3: Sec 3.1 to 3.3)

UNIT II

Pressurization and Extension of a thin walled tube - Pressurization of a thin spherical structure and thick walled cylindrical tube.
Extension and Torsion: Deformation due to extension - Shear stress due to torsion - Principal stresses and principal strains in torsion - Angle of twist due to torque and experimental design - Bone properties and papillary muscles - Inflation, extension and twist.
(Chapter 3: Sec 3.4 to 3.6, Chapter 4)

UNIT III

Beam bending and Column buckling: Shear forces and bending moments - Stresses in beams - Deformation in beams and transducer design - The AFM and the principle of superposion - Column buckling.
Bio Fluid Mechanics: Stress and Pressure – Kinematics - Study of Motion - Constitutive Behavior - Blood characteristics - Cone and Plate viscometry.
(Chapter 5, Chapter 7: Sec 7.1 to 7.6)

UNIT IV

Fundamental Balance Relations: Balance of mass and linear momentum - Navier- Stokes equations - The Euler equation and the Bernoulli equation - Measurement of Pressure and Flow.
Some Exact Solutions: Flow between parallel plates - Steady flow in circular tubes - Circumferential flow between concentric cylinders.
(Chapter 8: Sec 8.1 to 8.6 and Chapter 9: Sec 9.1 to 9.3)

Text Book:

An Introduction to Biomechanics, Solids and Fluids and Design by J.D. Humphrey and Sherry L. Delange, Springer (2005).

Reference Books:

1. Bio-Mechanics, Flow, Stress and Growth by Y.C. Fung Springer.
2. Fundamentals of biomechanics, equilibrium and deformation by Ozakaya N. M. Nordin, Springer (1999).

Outcome:

By the end of the course, students would know how to model the molecules, cells, osseous tissues, and bones in the framework of Mechanics. Moreover, they would know how these models are the tools of Non Destructives Evaluation (NDE) in the destructive areas and health care applications.

KAKATIYA UNIVERSITY
M.A. /M.Sc. MATHEMATICS Syllabus (w.e.f.2019-20)
Semester –IV
Paper – IV (Elective)
Paper Code: AM4OP4(2)

GRAPH THEORY

U N I T – I

Relations and Digraphs

Relations and Digraphs – Special Properties of Binary Relations – Equivalence Relations – Ordering Relations – Lattices and Enumerations – Paths and Closures – Directed Graphs and Adjacency Matrices

U N I T –I I

Graphs

Basic Concepts – Isomorphism and Subgraphs – Trees and their properties – Spanning Trees – Directed Trees – Binary Trees – Planar Graphs.

U N I T – III

Multigraphs

Euler's Formula – Konigsberg Seven Bridges problems – Multigraphs – Euler Circuits – Hamiltonian Graphs – Chromatic Numbers – The Four–Colour Problem.

U N I T – IV

Net works flows

Graphs as Models of Flow of Commodities – Flows – Maximal Flows and Minimal cuts- The Maxflow Min- Cut Theorem – Applications – Matching and Hall's Marriage Theorem.

TEXT BOOK :

Discrete Mathematics for Computer Scientists and Mathematicians By J.L. Mott. A. Kandle, P.Bakes.

REFERENCE BOOKS :

1. A First Book at Graph Theory – By John Clark and Derek Allan Hotton.
2. Discrete Mathematical Structures & Graph Theory – By Rao
3. A Text Book of Graph Theory and its applications – By B. Suryanarayana and G.K. Ranganath.

Outcome:

At the end of this course the student will understand the applications of Graph Theory to various other branches of science in particular to Statistics, Computer Science, Operations Research etc.

KAKATIYA UNIVERSITY
M.Sc. (APPLIED MATHEMATICS) Syllabus (w.e.f.2019-20)
Semester –IV
Paper – IV(Elective)
Paper Code: AM4OP4(3)

OPERATIONS RESEARCH

UNIT I:
Sequencing and Scheduling: Sequencing Problem – The Problem of n Jobs and Two Machines – Problem with n Jobs and m Machines – General Problem of n Jobs and m Machines - Scheduling – Critical Path Determination by CPM – Critical Path Determination by PERT – Optimum Scheduling by CPM.
(Chapter 7 of Text Book1)

UNIT II
Queueing Theory – Introduction – Queueing system – Elements of a Queueing system – Operating characteristics of a Queueing system – Deterministic Queueing system – Probability distributions in Queueing systems – Classification of Queueing Models – Definition of Transient and Steady States – Poisson Queueing systems.
(Chapter 21: Sec 21.1 to 21.9 of Text Book 2)

UNIT III
Dynamic Programming – Introduction – The recursive equation approach – Characteristics of Dynamic Programming – Dynamic Programming Algorithm – Solution of L.P.P. by Dynamic Programming.
(Chapter13: Sec 13.1 to 13.4, 13.7 of Text Book 2)

UNIT- IV
Non-Linear Programming – General Non – Linear Programming Problem – Constrained Optimization with Equality Constraints - Constrained Optimization with Inequality Constraints – Non – Linear Programming Methods – Graphical Solution – Quadratic Programming – Wolfe's Modified Simplex Method – Beale's Method.
(Chapter 27: Sec 27.3 to 27.5, Chapter 28:Sec 28.1, 28.2, 28.4 to 28.6 of Text Book 2)

Text Book:

1. Introduction to Optimization Operations Research by J.C.Pant(6^{th} Edition)
2. Operations Research by Kanthi Swarup, P.K.Gupta, Man Mohan, Sultan Chand & Sons

Outcome:
After studying this course, students will be motivated to do, research in queueing theory and nonlinear programming and they will get the knowledge of the construction of a network diagram, solving the problems by using network diagrams and dynamic programming.

KAKATIYA UNIVERSITY
M.Sc. (APPLIED MATHEMATICS) Syllabus (w.e.f.2019-20)
Semester –IV
Paper –IV (Elective)
Paper Code: AM4OP4(4)

Computational Methods for Partial Differential Equations

UNIT I

Partial Differential Equations – Introduction – Difference Method – Routh Hurwitz Criterion – Domain of Dependence of Hyperbolic Equations.
(Chapter 1: Sec 1.1 to 1.4 of Text Book)

UNIT II

Difference Methods for Parabolic Differential Equations – Introduction – One Space Dimension – Two Space Dimensions – Spherical and Cylindrical Coordinate System.
(Chapter 2: Sec 2.1 to 2.3, 2.5 of Text Book)

UNIT III

Difference Methods for Hyperbolic Partial Differential Equations – One Space Dimensions – Two Space Dimensions – First Order Equations.
(Chapter 3: Sec 3.1 to 3.4 of Text Book)

UNIT- IV

Numerical Methods for Elliptic Partial Differential Equations – Introduction – Difference Methods for Linear Boundary Value Problems – General Second Order Linear Equation – Equation in Polar Coordinates.
(Chapter 4: Sec 4.1 to 4.4 of Text Book)

Text Book :

Computational Methods for Partial Differential Equations by M.K.Jain, S.R.K.Iyengar, R.K.Jain, Wiley Eastern Limited, New Age International Limited, New Delhi.

Outcome:
At the end of this course the student will gain the knowledge of Numerical techniques in solving partial differential equations and applications of these in solving Boundary value problems.

KAKATIYA UNIVERSITY
M.Sc. (APPLIED MATHEMATICS) Syllabus (w.e.f.2019-20)
Semester –IV
Paper –IV (Elective)
Paper Code: AM4OP4(5)

AUTOMATA AND MACHINES

U N I T I

Context - Free Languages : Context – Free languages – Derivation Tress- Ambiguity in Context – Free Grammers – Simplification of Context – Free Grammers – Comosky Normal Form of Context - Free Grammars – Pumping Lemma for context – Free Languages- Decision Algorithms for Context – Free Languages.

U N I T I I

Pushdown Automata : Basic Definitions – Acceptance by Pda – Pushdown Automata and Context Free Languages- Parsing and Push Down Automata.

U N I T III

Turning Machines And Linear Bounded Automata: Turning Machine Model – Representation of Turning Machines – Language Acceptability by Turing Machines – Design of Turing Machines – Universal Turing Machines and their Modifications. The Model of Linear Bounded Automation – Turing Machines and Type O Grammers.

U N I T IV

Linear Bounded Automata and languages – Halting Problem of Turning Machines – NP – Completeness – LR (K) Grammers – Properties of LR(K) Grammars – Closure Properties of Languages.

Text Book:

Theory of Computer Science (Automata, languages and Computation) by KLP Mishra and N.Chandrasekhar, Printice Hall of India.

Outcome:
After completion of the course, the student will be able to understand and has the knowledge on how the machines will compute functions and solve the problems.

KAKATIYA UNIVERSITY
M.Sc. (APPLIED MATHEMATICS)Syllabus (w.e.f.2019-20)
Semester –IV
Paper –IV (Elective)
Paper Code: AM4OP4(6)

THEORY OF RELIABILITY

UNIT I

Reliability – Definition of Reliability - Failure Data Analysis – Failure data – Mean failure rate – Mean time to failure – Mean time between failures – Graphical plots – MTTF in terms of failure density – Generalization - Reliability in terms of Hazard rate and failure density – Mean time to failure in integral form - Hazard Models: Constant Hazard, Linearly increasing Hazard – The Weibull model – Distribution functions and reliability analysis – Some important distributions - Expected value — Standard deviation and variation.
(Chapter 2, Chapter 3: Sec 3.1 to 3.11, Chapter 4: Sec 4.1 to 4.4, 4.6, 4.7, 4.9, 4.10 of Text Book1)

UNIT II

Interference Theory and Reliability Computations – General expression for reliability – Reliability computation for normally distributed stress and strength – Reliability computation for Log normally distributed stress and strength – Reliability computation for exponentially distributed stress and strength - Reliability computation for normally(exponentially) distributed strength and exponentially(normally) distributed stress - Reliability computation for gamma distributed stress and strength- Reliability computation for weibull distributed stress and strength.
(Chapter 6: Sec 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.8 of Text Book 2)

UNIT III

System Reliability – Series configuration – Parallel configuration – Mixed configuration – Application to specific hazard models – An r-out of –n structure – Methods of solving complex systems – Systems not reducible to mixed configuration - Mean time to failure of systems - Logic diagrams – Markov models – Markov graphs.
(Chapter 6: Sec 6.1 to 6.12 of Text Book 1)

UNIT IV

Reliability improvement – Improvement of components – Redundancy - Element Redundancy - Unit Redundancy - Standby Redundancy.
Maintainability and availability - Maintainability – Availability.
Repairable systems – Instantaneous repair rate – Mean time to repair – Reliability and availability functions.
(Chapter 7: Sec 7.1 to7.6, Chapter 9: Sec 9.1 to 9.3, chapter 10 of Text Book 1)

Text Books:

1. Reliability Engineering by L.S. Srinath, Fourth edition, East-West Press Private Limited.
2. Reliability in Engineering Design by K.C.Kapur, L.R.Lamberson, John Wiley & Sons, Inc.

Reference Books:

Reliability Engineering by E.Balagurusamy, Tata McGraw-Hill Publishing Company Limited.

Outcome: This course is designed to learn fundamentals and more applications on Reliability.

KAKATIYA UNIVERSITY
M.Sc. (APPLIED MATHEMATICS)Syllabus (w.e.f.2019-20)
Semester –IV
Paper – V (Elective)
Paper Code: AM4OP5(1)
PROGRAMMING METHODOLOGY

U N I T I

Algorithms – Data-Data types and primitive operations – Variables and Expressions - From Algorithms to Programs Decisions Structures – Looping – Use of Compound conditions – Case Statement Applications

U N I T II

Sub Algorithms – Argument – Parameter Correspondence – Recursive Sub algorithms – Applications composite Date Structures One- Dimensional Arrays – Sorting and Searching with Vectors – Application of Vectors.

U N I T III

Higher – Dimensional Arrays – Application of Arrays – Files – Linear Data Structures – Linear Lists- Storage Structure Concepts – Sequential Storage Structure for Arrays – Application of Stacks – Queues.

U N I T IV

Non-Linear Data Structures – Trees – General Trees – Application of Trees- Graphs.

Text Book :

Introduction to Computer Science by Trembay and Bunt.

Lab Work :

Simple programs in C on the above Structures

Pattern of Lab Training.

The total number of students are made into batches. The number of students in each batch should not more than students and each batch should be handled by two teachers

Outcome:
This course is designed to provide the knowledge to analyze a problem and to design algorithms, implement and evaluate a computing solution.

KAKATIYA UNIVERSITY
M.Sc. (APPLIED MATHEMATICS)Syllabus (w.e.f.2019-20)
Semester –IV
Paper – V (Elective)
Paper Code: AM4OP5(2)
PROGRAMMING IN C++

U N I T I

Input and Output in C++-C++ Declarative control Structures .
(Chapters 2, 3 and 4 of Text Book)

U N I T I I

Functions in C++ - Classes and Objects.
(Chapters 5 and 6 of Text Book)

U N I T III

Constructors and Destructors – Operator Overloading and Type conversion – Inheritance
(Chapters 7, 8 and 9 of Text Book)

U N I T IV

Pointers and Array – C++ and Memory – Binding , Polymorphism and Virtual Functions
(Chapters 10, 11 and 12 of Text Book)

Text Book:

Object-Oriented Programming with ANSI & Turbo C++ by Ahok. N. Kamthane.

Lab Work:

Simple programs in C ++ on the above topics.

Pattern of Lab Training :

The total number of students are made into batches. The number of students in each batch should not be more than 10 students and each batch should be handled by two teachers.

Outcome:
The student will be able to understand how C++ improves C with object oriented features. It is also helps to learn how to use functions for efficiency and performance.

KAKATIYA UNIVERSITY
M.Sc. (APPLIED MATHEMATICS)Syllabus (w.e.f.2019-20)
Semester –IV
Paper – V (Elective)
Paper Code: AM4OP5(3)
APPLIED STOCHASTIC PROCESS WITH MAT LAB

UNIT I

Stochastic Process: Some Notations – Introduction - Specifications of Stochastic Process - Stationary process.
(Sec 2.1, 2.2 & 2.3 of Text Book 1)
Markov chains: Definition and Examples - Transition Matrix - Order of Markov chains - Markov chain as graphs - Higher transition probabilities - Classification of States and chains – Irreducible chain - periodic chain - transient and recurrence states - first passage time distributions - stability of Markov system - Stationary distribution - Ergodicity.
(Sec 3.1, 3.2, 3.4, 3.6 of Text Book 1)

UNIT II

Markov Process with Discrete State Space - Poison process - Poisson process and related distributions - Continuous Time Markov Chain (CTMC).
(Sec 4.1, 4.2 & 4.5 of Text Book 1)

UNIT III

Finite Markov Chains and its Applications: Finite Markov chains with recurrent & transient States - Irreducible finite Markov Chains with Ergodic states , statistical inference.
(Sec 5.1, 5.2 & 5.3 of Text Book 2)

UNIT IV

Stationary Process and Time Series : Introduction - Models of time series - Time and frequency domain - Power spectrum Statistical Analysis of Time Series - Some definitions
(Sec 8.1, 8.2, 8.3 & 8.4 of Text Book 1)

Text Book:

1. Stochastic Process by J.Medhi, Second Edition, Wiley Eastern Limited
2. Elements of Applied Stochastic Process by U.N.Bhatt, JohnWiley & Sons

Reference Books:

1. Stochastic Process by N.U. Prabhu, Macmillan, NewYork

Outcome:
After doing this course, student would understand how to model some real time problem which are Stochastic in nature. Moreover, exposing to many techniques and capabilities in MATLAB, the student will enhance the ability to use computer tools and languages to solve problems for academic and professional career.

PRACTICALS (20 Marks)

i) Lab Work (MATLAB)

(10 Marks)

1. Basic Matrix operations
2. Computation of Eigen values & Eigen vectors.
3. Computation of steady state probability distribution using
    a. Power method
    b. Jacobi method
    c. Gauss-Seidel method

Reference Books:

1. Getting Started with MATLAB by Rudra Pratap, Oxford University Press.
2. Introduction to Numerical Solutions of Markov Chains by William J. Stewart, Princeton University Press.

ii.Case Studies (10 Marks)

Applications of finite Markov Chains in Finance and Banking, Health Care, Retail Business, Internet Traffic Modeling and other research and development areas.

Note: For the case studies, students will be divided into batches. Each batch consists of two or three students.