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

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 -∞ - 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

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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.;

AM2CP4

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

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