॥ सा विद्या या विमुक्तये ॥

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

"ज्ञानतीर्थ" परिसर, विष्णुपुरी, नांदेड - ४३१६०६ (महाराष्ट्र)
SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY NANDED
"Dnyanteerth", Vishnupuri, Nanded - 431606 Maharashtra State (INDIA)
Established on 17th September 1994 - Recognized by the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'A' Grade

ACADEMIC (1-BOARD OF STUDIES) SECTION

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संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदवी स्तरावरील तृतीय वर्षाचे **CBCS Pattern** नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०२१–२२ पासून लागू करण्याबाबत.

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, मा. विद्याशाखेने दिनांक ३१ मे २०२१ रोजीच्या बैठकीतील केलेल्या शिफारशीप्रमाणे व दिनांक १२ जून २०२१ रोजी संपन्न झालेल्या ५१ व्या मा. विद्या परिषद बैठकीतील विषय क्र. २६/५१–२०२१च्या ठरावानुसार प्रस्तुत विद्यापीठाच्या संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदवी स्तरावरील तृतीय वर्षाचे खालील विषयांचे **C.B.C.S. (Choice Based Credit System) Pattern** नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०२१–२२ पासून लागू करण्यात येत आहेत.

1. B.Sc.-III Year-Biophysics	2. B.Sc.-III Year-Bioinformatics
3. B.Sc.-III Year-Biotechnology	4. B.Sc.-III Year-Biotechnology (Vocational)
5. B.Sc.-III Year-Botany	6. B.Sc.-III Year-Horticulture
7. B.Sc.-III Year-Agro Chemical Fertilizers	8. B.Sc.-III Year-Analytical Chemistry
9. B.Sc.-III Year-Biochemistry	10. B.Sc.-III Year-Chemistry
11. B.Sc.-III Year-Dyes & Drugs Chemistry	12. B.Sc.-III Year-Industrial Chemistry
13. B.C.A. (Bachelor of Computer Application)-III Year	14. B.I.T. (Bachelor of Information Technology)-III Year
15. B.Sc.-III Year-Computer Science	16. B.Sc.-III Year-Network Technology
17. B.Sc.-III Year-Computer Application (Optional)	18. B.Sc.-III Year-Computer Science (Optional)
19. B.Sc.-III Year-Information Technology (Optional)	20. B.Sc.-III Year-Software Engineering
21. B.Sc.-III Year-Dairy Science	22. B.Sc.-III Year-Electronics
23. B.Sc.-III Year-Environmental Science	24. B.Sc.-III Year-Fishery Science
25. B.Sc.-III Year-Geology	26. B. A./B.Sc.-III Year-Mathematics
27. B.Sc.-III Year-Microbiology	28. B.Sc.-III year Agricultural Microbiology
29. B.Sc.-III Year-Physics	30. B. A./B.Sc.-III Year Statistics
31. B.Sc.-III Year-Zoology	

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या **www.srtmun.ac.in** या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी, ही विनंती.

'ज्ञानतीर्थ' परिसर,
विष्णुपुरी, नांदेड – ४३१ ६०६.
दि.क्र.: शैक्षणिक–१/परिपत्रक/पदवी–सीबीसीएस अभ्यासक्रम/२०२१–२२/७५
दिनांक : १२.०७.२०२१.

स्वाक्षरित
सहा.कुलसचिव
शैक्षणिक (१–अभ्यासमंडळ) विभाग

प्रत माहिती व पुढील कार्यवाहीस्तव :
१) मा. कुलसचिव यांचे कार्यालय, प्रस्तुत विद्यापीठ.
२) मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
३) प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
४) साहाय्यक कुलसचिव, पदव्युत्तर विभाग, प्रस्तुत विद्यापीठ.
५) उपकुलसचिव, पात्रता विभाग, प्रस्तुत विद्यापीठ.
६) सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ.
७) अधीक्षक, परीक्षा विभाग विज्ञान व तंत्रज्ञान विद्याशाखा प्रस्तुत विद्यापीठ.

Gaikwad
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CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER PATTERN
B.A./B.Sc. (Third Year) (Mathematics)

CURRICULUM

Note:

1. Assessment shall consist of Continuous assessment (CA) and End of Semester Examination (ESE).
2. Weightage for Theory Papers: 80% for ESE and 20% for CA and Weightage for SEC: 50% for ESE and 50% for CA..
3. Workload includes Unit tests.

B.A./B.Sc. (Mathematics) Semester V and VI

Curriculum will be progressively effective from June-2021 Onwards.

Semester	Paper Code and Section	Period per week	Paper No. and Title of the papers	Marks of ESE	Marks of C.A.	Total Marks	Credits
V	DSEM-5 (Section A)	5	Paper-XII Metric Spaces	40	10	50	2
	DSEM-5 (Section B)	5	Paper-XIII Linear Algebra	40	10	50	2
	DSEM-5 (Section C) (Choose Any One of the Following and This Papers are only for B.Sc.)	5	Paper-XIV(A) Operation Research	40	10	50	2
			Paper-XIV(B) Mechanics-I	40	10	50	2
			Paper-XIV(C) Numerical Analysis	40	10	50	2
	SECM-III (Choose any one of the following)	3 (Theory-1 & Practical-2)	SEC-III(A)-Financial Mathematics	25	25	50	2
			SEC- III(B)-Working with PDE's using Mathematical software	25	25	50	2
			SEC-III(C)-LaTeX for Beginners-I	25	25	50	2
VI	DSEM-6 (Section A)	5	Paper-XV Complex Analysis	40	10	50	2
	DSEM-6 (Section B)	5	Paper-XVI Integral Transform	40	10	50	2
	DSEM-6 (Section C) (Choose Any One of the Following and This Papers are only for B.Sc.)	5	Paper-XVII(A) Topology	40	10	50	2
			Paper-XVII(B) Mechanics-II	40	10	50	2
			Paper-XVII(C) Elementary Number Theory	40	10	50	2
	SECM-IV (Choose any one of the following)	3 (Theory-1 & Practical-2)	SEC-IV(A)-Insurance Mathematics	25	25	50	2
			SEC- IV(B)-Solving Problems in Numerical Analysis using Mathematical Software	25	25	50	2
			SEC-IV(C)-LaTeX for Beginners-II	25	25	50	2
Total Marks/Credit				290	110	400	16

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B.A./ B.Sc. Third Year Semester-V
(CBCS PATTERN)
DSEM-5, Section-A
Paper XII:Metric Spaces

Course Description: This course gives general introduction to Metric Spaces and gives details Knowledge of open Sets and Closed Sets along with Subspaces, Convergence and Completeness, Compactness with Properties and Connectedness.

Objectives: A Primary Objective of this Course is to learn elementary Knowledge about Metric Spaces, Subspaces, and Elementary properties with Examples, Concepts of convergence and Completeness, Continuity and Uniform continuity, Banach Fixed point Theorem, Compactness and Connectedness.

Outcomes: After successful completion of the course student will be able to

1. Demonstrate an understanding of metric spaces and subspaces by proving unseen results.
2. Produce examples and counterexamples illustrating the mathematical concepts.
3. Understand the concepts of open and closed sets.
4. Understand the concepts and develop skill to check the positions of a point in the space.
5. Understand the concepts of convergences and completeness.
6. Understand the concepts of fixed point and Banach principle.
7. Understand the concepts of continuity and uniform continuity.
8. Understand the concepts of compact and non-compact sets with various properties.
9. Understand the concepts of Lebesgue Number for Covers and connectedness of sets.
10. After completion of this course student can aware with basic concepts of functional analysis.

Unit I:Metric Space:

Definition of Metric Space, Examples of Metric Space, Diameter of a nonempty Set, Open and Closed Sets: Open and Closed Spheres, Neighbourhood of a Point, Open Sets, Equivalent Metrics, Limit Points, Closed Sets, Subspaces, Closure of a Set, Definition of Interior, Exterior, Frontier and Boundary Point, Dense set, Perfect set, Separable set.

Unit II:Convergence and Completeness:

Cauchy Sequence, Complete Metric Space, Cantor's Intersection Theorem, Baire's Category Theorem.
Continuity and Uniform Continuity: Definitions, Examples, Theorems on Continuity and Uniform Continuity, Banach Fixed Point Theorem.

Unit III:Compactness:

Definitions and Theorems on Compactness, Heine-Borel Theorem, Compactness and Finite Intersection Property, Relative Compactness, ϵ-Nets and Totally Bounded Sets.

Unit IV:Connectedness:

Definition and Theorems on Lebesgue Number for Covers, Separated Sets, Definition and Theorems on Connectedness.

Text Book :
S.C.Malik and Savita Arora, Mathematical Analysis, New Age International (P) Ltd, Second Edition 1992 (Reprint 2014).

Scope:

Unit I:
Chapter 19: Art. 1, 2, 2.1, 2.2, 2.3 (lemma and Theorem 2 Statement only), 2.4, 2.5, 2.6, 2.7, 2.8 (only definitions and examples),2.9(Only Definitions).

Unit-II:
Chapter 19: Art. 3(Theorem 11 and 12 Statement Only), 4 (Theorem 16 statement only), 4.1.

Unit-III:
Chapter 19: Art. 5 (Theorem 21 Statement only), 5.1, 5.2(Theorems 26 to 28 Statements only) .

Unit-IV:
Chapter 19:Art. 5.2(Theorem 29 to 33), 6 (up to Theorem 39 and Example 45).

REFERENCES :

1. R. Goldberg, Methods of Real Analysis, Oxford & IBH Pub. Co.PVT Ltd.
2. Somasundaram & Chaudhary,A First Course in Mathematical Analysis, Narosa Pub. House New Delhi.
3. Shantinarayan & M.D. Raisinghania, Elements of Real Analysis, S. Chand. Co. Ltd.
4. E. T. Copson, Metric Spaces, Cambridge University Press. Universal Book Co. New Delhi.
5. T. M. Apostol, Mathematical Analysis, Narosa Pub. House New Delhi.
6. T. M. Karade, Lecturers on Analysis, Sonu Nilu Pub. Nagpur.
7. U.S.Rana, Mathematics for Degree Students, S.Chand &Company Ltd. New Delhi.

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B.A./B.Sc. Third Year Semester-V
(CBCS PATTERN)
DSEM-5, Section-B
Paper XIII: Linear Algebra

Course Description: Linear Algebra has wide range of applications in Physics, Economics, Chemistry And engineering. This course aims to make students become aware of finite Dimensional abstract vector spaces and linear transformations.

Objectives:

1. To make the student to familiar with important concept of vector space such as Independence, basis, dimensions, subspaces, inner products.
2. To enhance the student's ability to reason mathematically.
3. To understand the axiomatic structure of modern mathematical subject.
4. To learn construction of simple proofs.

Outcomes: After successful completion of the course student will be able to

1. Understand and prove algebraic statements about vector spaces, subspaces, basis, Inner product spaces.
2. Determine a basis and the dimension of finite dimensional space.
3. Understand and prove statements about linear transformations.
4. Find the kernel, range, rank and nullity of linear transformation.
5. Determine eigen values and eigen vectors.
6. Interpret a matrix as a representation of linear transformation.

Unit I:Vector spaces:

Vector spaces, Subspaces, Span of a set, More about subspaces, Linear Dependence, Independence.

Unit II:Dimension and Basis:

Dimension and Basis, Definition and Examples of Linear transformations, Range and Kernel of a linear map, Rank and Nullity.

Unit III: Linear transformations:

Inverse of a linear transformation, Consequences of Rank-Nullity theorem, The space $L(U, V)$, composition of linear maps, operator equations.

Unit IV: Matrices:

Matrix associated with a linear map, Linear map associated with a matrix, Linear operators in $M_{m,n}$, Determinants: Eigenvalues, Eigenvectors, More matrix theory: Inner product spaces.

Text Book:
V. Krishnamurthy, V.P. Mainra, J.l Arora, "An introduction to Linear Algebra", Affiliated East-west press PVT. LTD. New Delhi.

Scope:

Unit I:
Chapter 3: art 3.1 to 3.5
Unit-II:
Chapter 3: art 3.6
Chapter 4: art 4.1 to 4.3
Unit-III:
Chapter 4: art 4.4 to 4.8
Unit-IV:
Chapter 5: art 5.1 to 5.3
Chapter 6: art 6.8
Chapter 7: art 7.2

REFERENCES :

1. I. N. Herstein, Topics in Algebra" John Wiley and sons
2. P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul, "First course in Linear Algebra" New age International 1983.
3. Smith, Linear Algebra", Springer-Verlag, New York
4. V.K. Khanna, S.K. Bhambri, "A course in Abstract Algebra", S. Chand publications.
5. K. B. Datta," Matrix and Linear Algebra" Prentice Hall of India PVT. LTD. New Delhi.
6. A. R. Vasishtha, "Linear Algebra" Krishna Prakashan media (p) LTD.

B.Sc. Third Year Semester-V
(CBCS PATTERN)
DSEM-5, Section-C
Paper XIV (A): Operation Research

Course Description: This is an introductory course in operation research. It covers standard topics such as Linear Programming problem: Mathematical Formulation, Graphical solution, Introductory simplex method. Introduction to transportation problem and assignment problem.

Objectives: To impart knowledge in concepts and tools of Operations Research. To understand some mathematical models used in Operations Research like Linear programming, Transportation Problems, Assignment Problem.

Outcomes: After successful completion of the course student will be able to

1. Formulate a given simplified description of a suitable real-world problem as a linear programming.
2. Sketch a graphical representation of a two-dimensional linear programming problem.
3. Solve a two-dimensional linear programming problem graphically
4. Use the simplex method to solve simple linear programming models by hand.
5. Understanding transportation problem and solve simple assignment problems.

Unit I:Linear Programming:

Mathematical Formulation: Introduction, Linear Programming Problem, Mathematical Formulation of the Problem, Illustration on Mathematical Formulation of LPPs.

Unit II:Graphical Solution and Extension:

Introduction, Graphical Solution Method, Some Exceptional Cases, General Linear Programming Problem, Canonical and Standard Forms of L.P.P.

Unit III:Simplex Method:

Introduction, Fundamental Properties of Solution,Computational Procedure, Use of Artificial Variables, Degeneracy in Linear Programming, Solution of Simultaneous Linear Equations,Inverting a Matrix using Simplex Method, Applications of Simplex Method.

Unit IV:Transportation and Assignment Problem:

Transportation Problem: Introduction, LP Formulation of Transportation Problem, Existence of Solution in Transportation Problem.
Assignment Problem: Introduction, Mathematical Formulation of the Problem,Solution Methods of Assignment Method, Specialcases in Assignment Problem, A typical Assignment Problem.

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Text Book :
Kanti Swarup, P.K. Gupta and Man Mohan, "Operations Research", Fourteenth Thoroughly Revised Edition, Sultan Chand & Sons. Educational Publishers, New Delhi.

Scope:
Unit I:
Chapter-2: Articles 2.1 to 2.4 (complete),
Unit-II:
Chapter- 3: Art. 3.1 to 3.5.
Unit-III:
Chapter-4: Articles 4.1 to 4.8.(Complete).
Unit-IV:
Chapter-10: Articles 10.1, 10.2, 10.3,
Chapter-11: Articles 11.1 to 11.5.

REFERENCES :

1. Hiller and Lieberman "Introduction to Operation Research", Tata Mc Graw Hill.
2. Hamdy A. Taha "Operation Research an Introduction", Eight Edition Pearson Prentice Hall, Pearson Education Inc.
3. Er. Prem Kumar Gupta, Dr. D. S. Hira "Problems in Operations Research (Principles and solutions)", S. Chand & Company, Ram Nagar, New Delhi.
4. R. K. Gupta, "Operation Research", Krishna Prakashan Media Ltd.
5. J. K. Sharma, "Operation Research: Theory and Applications", Second Edn. 2006, Macmillan India Ltd.

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B.Sc. Third Year Semester-V
(CBCS PATTERN)
DSEM-5, Section-C
Paper XIV (B): Mechanics-I (Statics)

Course Description: Mechanics is an important part in Sciences which deals with the motion of a particle. Mechanics(Statics) is a typically first mechanics course taught for Undergraduate Students. Mechanics can be studied under main two topics which are Kinematics concerning the motion of the particle and dynamics concerning the causes of motion. This course deals the primary concepts and derivations of forces acting on a particle , forces acting on a rigid body , work done ,couples , equilibrium conditions of forces and coplanar forces.

Objectives: To learn basic, primary knowledge of motion, force and their relations which is important in Applied Mathematics. Understand the force systems. Understand the concept of motion of particles and rigid bodies.

Outcomes: After successful completion of the course student will be able to

1. Understand concepts of motion, force and its importance in Physical Sciences.
2. After learned this course , Student will be interested in Applied Mathematics.
3. Develop research oriented skills in Applied Mathematics
4. Know the principles of equilibrium of two forces.
5. To realize the forces acting on a particle , forces acting on a rigid body and its derivations.
6. Analyze the equilibrium state of a particle and rigid body.
7. Obtain the equivalent force - couple system of a given system.

Unit I:Forces Acting on a Particle:

Definitions, Law of Parallelogram of Forces, Magnitude and Direction of the Resultant, Deductions, Resultant of Forces, Components and Resolved parts, Algebraic Sum of the Resolved Parts, Magnitude and Direction of the Resultant of any number of Forces.

Unit II:Equilibrium of Forces Acting on a Particle:

Resultant of Parallel Forces, Triangle law of Forces, Converse of the Triangle Law of Forces, Polygon of Forces, Lami's Theorem.

Unit III:Forces Acting on a Rigid Body:

Conditions of Equilibrium of Forces acting on a Particle,Introduction, Moment of a Force, Sum of the Vector Moment of a System of Forces, Sum of the Vector Moments of to like Parallel Forces.

Unit IV:Forces Acting on a Rigid Body:

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Couples, Two Couples acting in one Plane upon a Rigid Body, Equivalent Couples, Vector Moment of the Resultant Couple of two Couples acting upon o Rigid Body, System of Forces acting upon a Rigid Body, Conditions of Equilibrium of Forces, Conditions of Equilibrium of Coplanar Forces.

Text Book :
V. Tulsani, T. W.Warhekar, N.N. Saste , "Mechanics and Differential Geometry", S. Chand & Co.(Pvt.) Ltd. New Delhi,Second Edition.
Scope:
Unit I:
Chapter 1: Art. 1.1 to 1.12.
Unit-II:
Chapter 1: Art.1.13 to 1.17 ,
Chapter 2:Art. 2.1 to 2.4.
Unit-III:
Chapter 2:Art. 2.5,
Chapter 3: Art. 3.1 to 3.4.
Unit-IV:
Chapter 3: Art. 3.5 to 3.12.

REFERENCES :

1. B.R. Thakur and G.P. Shrivastav, "Mechanics", Ram Prasad and Sons, Agra-3, New Edition, New Delhi.
2. Shanti Narayan, "Mechanics" S. Chand and Co.
3. S. L. Loney, "An elementary Treatise on Dynamics Particle and Rigid Bodies", A.I.T.B.S. Publishers and Distributers 2003, New Delhi.
4. S. L. Loney, "An elementary Treatise on Statics", A.I.T.B.S. Publishers and Distributers 2004, New Delhi.

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B.Sc. Third Year Semester-V
(CBCS PATTERN)
DSEM-5, Section-C
Paper XIV(C):Numerical Analysis

Course Description: This course provides an elementary knowledge of calculus of finite differences, interpolation with equal intervals, interpolation with unequal intervals, central difference interpolation formulae, numerical differentiation, numerical quadrature and numerical solution of ordinary differential equations

Objectives: A primary objective of the course is to learn Interpolation under certain assumptions, Numerical Differentiation, Numerical Integration, Numerical Solution of Ordinary Differential Equations

Outcomes: After successful completion of the course student will be able to

1. Estimate the value of a function under certain assumptions.
2. Find the missing terms in the given data using numerical techniques.
3. Apply numerical derivation and numerical integration methods.
4. Investigate numerical solutions of differential equations.
5. Find the integration of a functions using numerical methods.
6. Find the solutions of ordinary differential equations.

Unit I:Finite Differences and Interpolation:

Finite Differences: Introduction, Differences, Theorem, Factorial Notation, Factorial Function, Representation of a given Polynomial, The operator E and Δ, The operators D and ∇ and their relation, Interpolation: Interpolation with equal intervals, Newton-Gregory formula for forward interpolation, Newton-Gregory formula for backward interpolation,

Unit II:Interpolation with unequal intervals:

Equidistant terms with one or more missing terms, Interpolation with unequal intervals: Introduction, Divided differences with unequal arguments, Divided differences when two or more arguments are same or coincident, Properties of divided differences (Theorem 4 statement only), Newton's formula for unequal intervals, Lagrange's interpolation formula for unequal intervals, Lagrange's interpolation formula for equal intervals

Unit III:Central Differences and Numerical Differentiation:

Central Difference Interpolation Formulae: Introduction, Operators Δ, ∇,δ, σ and μ, Gauss's central difference formula, Stirling's formula, Bessel's formula, Numerical Differentiation: Introduction, Use of central difference interpolation formulae in obtaining the derivative(s) of an interpolating polynomial, Approximate expressions for the derivative of a function

Unit IV:Applications

Numerical Quadrature or Numerical Integration: Introduction, A general quadrature formula for equidistant ordinates, Some important approximate quadrature formulae, The Trapezoidal rule, Simpson's one third rule, Simpson's three eighth rule, Weddle's rule, Numerical Solution of Ordinary Differential Equations: Introduction, Equations of the first order, Euler's method, Euler's modified method, Picard's method of successive approximations, Taylor's series method

Text Book :
H.C. Saxena, Finite Differences and Numerical Analysis, S. Chand & Co.reprint 2001.

Scope:
Unit I:
Chapter 1 : 1.1, 1.2, 1.3, 1.5.1, 1.5.3, 1.5.4, 1.6, 1.6.1, 1.6.2, 1.7.1, 1.8, 1.8.1, 1.8.2 .
Unit-II:
Chapter 1 : 1.8.3
Chapter 2 : 2.1, 2.2, 2.2.1, 2.2.2 (Theorem 4 statement only), 2.3, 2.4.1, 2.4.2
Unit-III:
Chapter 3 : 3.1, 3.2, 3.3, 3.4, 3.5
Chapter 5 : 5.1, 5.2, 5.3
Unit-IV:
Chapter 6 : 6.1, 6.2, 6.3, 6.3.1, 6.3.3, 6.3.4, 6.3.5
Chapter 16 : 16.1, 16.2, 16.2.1, 16.2.2, 16.2.3, 16.2.4(a).

REFERENCES :

1. S.S. Sastry, "Introductory Methods of Numerical Analysis" Prentice-Hall of India Private Ltd. (Second Edition) 1997.
2. E.V. Krishnamurthi & Sen, "Numerical Algorithm", Affiliate East, West press Private Limited 1986.
3. M.K. Jain, SRK Iyengar, R.K. Jain, "Numerical Methods for Scientific and Engineering Computations", New Age International Limited

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Third Year (Semester-V)
(CBCS PATTERN)
ANNUAL PATTERN EVALUATION SKILLS
(SECM-3 for 2 Credits)

Note: Amongst the following skills students can choose one for fifth semester

SKILL-III(A)

- **Financial Mathematics** (The measurement of interest): Introduction, The accumulation and amount functions, The effective rate of interest, Simple interest, Compound interest, Present value, The effective rate of discount, Nominal rates of interest and discount, Forces of interest and discount, Varying interest, Summary of results.

SKILL-III(B)

- Working with Partial Differential Equations using Mathematical Software like Matlab, Mapple, Scilab and other software.

SKILL-III(C)

- **LaTeX for Beginners-I**

Latex Installation:

- Introduction to LaTeX and Installation
- Structure and preparation of basic document

Document class:

- Changing the class (article, report) and document options
- Sectioning and sub sectioning

Text Formatting:

- Lists, Font size and display
- Special characters, Foot note.

Math mode and graphics:

- Mathematical Formulas
- Exponents and Subscripts
- Fractions, Sums
- Integrals, and Limits
- Roots
- Text in Math Displays
- Operators

- Relations
- Negated Symbols
- Mathematical equation and their labeling and referring
- Greek letters
- Working with image
- Giving caption and label

REFERENCES BOOKS :

1. Kellison Stephen G., The Theory of Interest, 3rd Edition. McGraw-Hill International Edition (2009).
2. UK Institute of Actuaries core leading for the subject CT1-Financial Mathematics.
3. Elliott R.J. and Kopp P.E. Mathematics of Financial Markets. Springer (1999).
4. Rudra Pratap, Getting Started with MATLAB 7, Oxford Unversity Press, (Indian Edition) www.oup.com.
5. Michael Baudin, Introduction to Scilab, Consortium Scilab (2010).
6. Atlas- automatically turned linear algebra software. http://math-atlas.source.forge.net.
7. Cecill and free software.http://www.cecill.info.
8. The Scilab Consortium, Scilab. http://www.scilab.org.
9. Intel. Intel math Kernel library. http://software.intel.com/en-us/intel-mkl/.
10. Sylvestre Ledru. Different execution modes of Scilab. http://wiki.scilab.org/Different_execution_modes_of_Scilab.
11. Flexdock project.Flexdock project home. http://flexdock.dev.java.net/.
12. Leslie Lamport, LaTeX a Document Preparation System User's Guide and Reference Manual, Addison-Wesley Publishing Company. .
13. Online LaTeX Editor https://www.overleaf.com/

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Umri. Dist Nanded. [M.S.]

B.A./B.Sc. Third Year Semester-VI
(CBCS PATTERN)
DSEM-6, Section-A
Paper-XV: Complex Analysis

Course Description: This course is intended to introduce some fundamental ideas of complex analysis. The concept of algebraic and geometric structure of complex numbers, analyticity, harmonic functions, Cauchy integral and Liouville's theorem, Taylor and Laurent's series are introduced.

Objectives: To develop clear understanding of basic concept of functions of complex variable, understand and learn to use argument principle, study the analytic and elementary functions of complex variables and develop manipulation skill in the use of complex numbers.

Outcomes: After successful completion of the course student will be able to

1. Operate basic mathematical operations with complex numbers in Cartesian and polar forms.
2. Demonstrate the ability of limit, continuity, analyticity of a function.
3. Find the derivative and integral of a complex variable function.
4. Work with exponential and logarithmic functions.
5. Use Cauchy integral theorem and Liouville's theorem.
6. Use Taylor and Laurent's series.

Unit I:Complex Numbers and Analytic functions:

Complex Numbers: Exponential form, Roots of complex numbers, Regions in the complex plane, Analytic functions: Functions of complex variables, Mappings, Mappings by the exponential Function, Limits, Theorems on limits, Limit involving, The point at infinity, Continuity, Derivatives, Differentiation formulae.

Unit II:Elementary functions:

Analytic functions: Cauchy- Riemann equations, Sufficient conditions for derivability, polar co-ordinates, Analytic functions,Harmonic functions, Elementary functions:The exponential functions, The logarithmic functions, Branches and Derivatives of logarithms, Some identities involving logarithms, Complex exponents.

Unit III:Integrals:

Integrals: Derivatives of functions w(t), Definite integrals of functions $w(t)$, Contours, Contour Integrals, Upper bounds for moduli of contour integrals, Antiderivatives, Simply and Multiply connected domains,

Unit IV:Integrals and Series:

Integrals: Cauchy integral formula, Derivatives of analytic functions, Liouville's theorem and the Fundamental theorem of algebra, Series: Convergence of sequences, Convergence

of series, Taylor series, Laurent series.

Text Book :
J W. Brown and R.V. Churchill, "Complex variables and Applications", International Students' edition 2009, 7th edition.

Scope:

Unit I:
Chapter 1: art 6, 8 to 10
Chapter 2: art 11 to 19

Unit-II:
Chapter 2: art 20 to 25
Chapter 3: art 28 to 32

Unit-III:
Chapter 4: art 36 to 42.

Unit-IV:
Chapter 4: art 46 to 49
Chapter 5: 51 to 56

REFERENCES :

1. S. Punnusamy," Complex Analysis". Narosa Publishing house, 2nd edition.
2. Lang, "Complex Analysis", Springer Verlag.
3. A.R.Shastri," An introduction to Complex Analysis", Macmillan.
4. H.S. Kasana," Complex Variables" PHI Learning PVT. limited New Delhi.
5. M.R.Spiege, S. Lipschut, J.J. Schiller, D. Spellman,"Complex Variables", Schaum's Outlines, Tata McGraw Hill education Private Limited New Delhi.

B.A./B.Sc. Third Year Semester-VI
(CBCS PATTERN)
DSEM-6, Section-B
Paper XVI: Integral Transforms

Course Description: This course gives general introduction to Integral Transforms and gives detail knowledge of Laplace Transforms along with their inverse Transforms, Fourier Complex Transforms, Fourier Sine Transforms and Fourier Cosine Transforms.
Objectives: A primary objective of this course is to get introduced to Integral Transforms, study some of them in details along with their properties and applications.
Outcomes: After successful completion of the course student will be able to

1. Understand the concept of Integral Transforms
2. Identify integral transforms by their integration limits and kernels
3. Obtain integral transforms of functions
4. Know the formulae for integral transforms of standard functions
5. Understand various properties of integral transforms
6. Apply the integral transforms for evaluating integrals
7. Apply the integral transforms along with their inversion formulae for solving differential equations with initial conditions
8. Apply the integral transforms along with their inversion formulae for solving systems of simultaneous differential equations with initial conditions

Unit I: Laplace Transformations:

Introduction, Laplace Transform, Important Formulae, Properties of Laplace Transforms, Laplace Transform of the Derivative of $f(t)$, Laplace Transform of the Derivative of Order n, Laplace Transform of Integral of $f(t)$, Laplace Transform of $t.f(t)$ (Multiplication by t), Laplace Transform of $\frac{1}{t}f(t)$ (Division by t), Unit Step Function, Second Shifting Theorem, Impulse Function, Periodic Functions, Convolution Theorem, Evaluation of Integrals, Formulae of Laplace Transform, Properties of Laplace Transform.

Unit II: Inverse Laplace Transforms:

Inverse Laplace Transforms, Important Formulae, Multiplication by s, Division by s (Multiplication by 1/s), First Shifting Property, Second Shifting Property, Inverse Laplace Transforms of Derivatives, Inverse Laplace Transform of Integrals, Partial Fractions Method, Inverse Laplace Transform by Convolution.

Unit III: Solutions of Differential Equations and Integral Transforms

Solution of Differential Equations by Laplace Transforms, Solution of Simultaneous Differential Equations by Laplace Transforms, Introduction to Integral Transforms

Unit IV: Fourier Transforms

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Fourier Integral Theorem, Fourier Sine and Cosine Integrals, Fourier's Complex Integral, Fourier Transforms, Fourier Sine and Cosine Transforms, Properties of Fourier Transforms.

Text Book 1:
H.K.Dass, "Advanced Engineering Mathematics", S. Chand & Company Ltd.
Scope:
Unit I:
Chapter 13 : Articles 13.1 to 13.19
Unit-II:
Chapter 13 : Articles 13.20 to 13.29
Unit-III:
Chapter 13 : Articles 13.30 to 13.31,
Chapter 14 : Articles 14.1 to 14.2
Unit-IV:
Chapter 14 : Articles 14.3 to 14.8

REFERENCES :

1. Grove A. C., "An Introduction to Laplace Transforms and Z- Transforms", Prentice Hall 1991.
2. Doetsch G., "Introduction to Theory and Application of Laplace Transforms", Springer Verlag, 1990.
3. Murray Spigel, "Schaum Outline of Laplace Transforms", Schaum Outline Series, Mc-Graw Hill 2012.
4. Joel L. Schiff, "The Laplace Transforms: Theory and Applications", Springer, 2008.
5. 5. R.J. Becrends, H.G. Morsche J.C. Vande Berg and E.M. Vande Vrie, "Fourier and Laplace Transform", Cambridge Press, 2003.

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B.Sc. Third Year Semester-VI
(CBCS PATTERN)
DSEM-6, Section-C
Paper XVII(A): Topology

Course Description: The concepts of topological space grew out the study of real line and Euclidean spaces also, the study of continuous functions on these spaces. This course gives introduction to topological spaces, and the number of ways to construct the topological spaces. Also this course deals with the concepts of open and closed sets, limit points, and continuous function, basic aspects of connected and compact spaces.

Objectives: Primary objective is to provide an elementary Knowledge about Elementary properties of Set theory. Basic concept of Topology, Basis of a topology, Order topology, Product topology, Subspace topology, Closed sets, Limit points, Continuity of a function, Hausdroff Space, Connected sets and compact sets.

Outcomes: After successful completion of the course student will be able to

1. Understand Concept of Topological spaces.
2. Understand Topological Properties of Sets.
3. Understand the concept of order Topology and product topology.
4. Understand concept of Subspace topology.
5. Understand Concept of Closed and Open sets, limit points.
6. Understand of continuity, Concept of Homeomorphisms, Imbedding's.
7. Understand the separation properties like Hausdroff Spaces and T1 Axioms.
8. Understand basic Concept of Connected Spaces and compact Spaces.
9. Understand Utility of Connected and compactness.

Unit I:Set Theory and Logic:

Set Theory and Logic: Fundamental Concepts, Functions, Relations, The Integers and the Real Numbers, Cartesian Product, Finite Sets, Well-ordering Theorem, Topological Spaces and Continuous Functions: Topological Spaces, Basis for Topology. .

Unit II:Topological Spaces and Continuous Functions:

Topological Spaces and Continuous Functions: The Order Topology, The Product Topology, The Subspace Topology.

Unit III:Hausdroff Spaces:

Topological Spaces and Continuous Functions: Closed Sets and Limit Points, Closure and Interior of a Set, Limit Points,Hausdroff Spaces.

Unit IV:Connectedness and Compactness:

Connectedness and Compactness : Connectedness(Definition , Examples and Basic Results) and Compactness (Definition , Examples and Basic Results)

Text Book 1:
R. Munkres, "Topology: A First Course", Prentice Hall of India.
Scope:
Unit I:
Chapter 1: Art. 1.1 to 1.6, Art. 1.7 (Statements of Theorems), Art. 1.10
Chapter 2: Art. 2.1, 2.2.
Unit-II:
Chapter 2: Art. 2.3, 2.4, 2.5.
Unit-III:
Chapter 2: Art. 2.6, 2.7, 2.8 (Definitions Only)
Unit-IV:
Chapter 3: Art. 3.1,3.5 (Definitions and Examples, Lemma 1,2, Theorems1,2,3,4 ,5,6) (All other theorems and Results are Statements only)

REFERENCES :

1. John Horvath, "Topological Vector Spaces & Distribution", Addison-Wesely, Publishing Company 1966.
2. F. Treves, "Topological Vector spaces, Distribution, Kernel", Academic Press, Inc., New York, 1967.
3. G. Kothe, "Topological Vector spaces", Vol.1, Springer, New York, 1969.
4. R. Larsen, "Functional Analysis", Marcel Dekker, Inc., New York, 1973.
5. Walter Rudin, "Functional Analysis", TMH edition, 1974.

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B.Sc. Third Year Semester-VI
(CBCS PATTERN)
DSEM-6, Section-C
Paper XVII (B): Mechanics-II (Dynamics)

Course Description: Mechanics can be studied under main two topics which are Kinematics concerning the motion of the particle and dynamics concerning the causes of motion. This course deals the Kinematics and Dynamics of a Particle in Two Dimensions , Kinetics of a Particle, Motion of a Projectile and Motion in Resisting Medium.

Objectives: To learn basic knowledge of displacement ,velocity and acceleration and their relations. Understand the motion of a projectile and in Resisting Medium. To deals the Newton's Laws of Motion and its important deductions. The concepts of Matter, Mass, Weight, Linear Momentum, Moment of Momentum, Work, Power and Energy and their derivations.

Outcomes: After successful completion of the course student will be able to

1. Understand Newton's Laws of Motion and its importance in Physical Sciences.
2. Develop research oriented skills in Applied Mathematics.
3. Understand the expressions for Velocity and Acceleration, Components of Velocity and Acceleration and principles of equilibrium of two forces.
4. To realize the forces acting on a particle , forces acting on a rigid body and its derivations.
5. Analyze the Impulsive Force and its Impulse, Conservation of Linear Momentum and , Impact of two bodies.
6. Find the Motion of Projectile and Derivation of Equation of its trajectory, Cartesian Equation of the path of Projectile, equivalent force - couple system of a given system.

Unit I: Kinematics and Dynamics of a Particle in Two Dimensions

Introduction, Definitions, Expressions for Velocity and Acceleration, Components of Velocity and Acceleration, Tangent and Unit Vector along the Tangent, Curvature and Principal normal, Tangential and Normal Components of Velocity and Acceleration, Angular Speed and Angular Velocity, Angular Acceleration, Radial and Transverse directions, Radial and Transverse Components of Velocity and Acceleration.

Unit II:Kinetics of a Particle:

Introduction, Newton's Laws of Motion, Deductions from Newton's Laws of Motion, Matter, Mass, Weight, Linear Momentum, Moment of Momentum or Angular Momentum, Impulsive Force and its Impulse, Conservation of Linear Momentum, Impact of two bodies, Work, Power, Energy.

Unit III:Motion of a Projectile and Motion in Resisting Medium:

Scalar Point Function and Scalar Field, Vector Point Function and Vector Field, Field of Force, Conservative Field of Force, Potential Function. Rectilinear Motion, Motion under

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Unit IV:Motion of a Projectile and Motion in Resisting Medium
LMotion of Projectile and Derivation of Equation of its trajectory, Cartesian Equation of the path of Projectile, Vertex and Latus rectum of the Parabola, Velocity of a Particle in terms of its height, Range on an inclined Plane, Projectile to pass through a given Point, Relation $t_1 t_2 = 2R/g$.

Text Book :
V. Tulsani, T. W.Warhekar, N.N. Saste ,"Mechanics and Differential Geometry", S. Chand & Co.(Pvt.) Ltd. New Delhi,Second Edition.

Scope:
Unit I:
Chap. 1: Art. 1.01 to 1.13
Unit-II:
Chap. 2: Art. 2.01 to 2.17.
Unit-III:
Chap. 2: Art. 2.18 to 2.25,
Chap. 3: Art. 3.01 to 3.02.
Unit-IV:
Chapter 3: Art. 3.03 to 3.10, 3.13,3.14.

REFERENCES :

1. A. Baker, "A concise Introduction to the Theory of Numbers", Cambridge University press, 1984.

2. J. P. Serre, "A course in Arithmetic-GTM Vol 7", Springer Verlag, 1973.

3. Tom M Apostol," Introduction to Analytic Number Theory", Norosa Publishing House, 1980.

4. I Niven and Zuckerman," An Introduction to the Theory of Numbers", Wiley, New York, 4^{th} edition 1980.

5. Rosen K. H," Elementary Number theory and its application", Pearson Addition Wesely, 5^{th} edition.

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B.Sc. Third Year Semester-VI
(CBCS PATTERN)
DSEM-6, Section-C
Paper XVII(C):Elementary Number Theory

Course Description: This is an introductory course in Number Theory. It covers standard topics such as Mathematical induction, divisibility, prime numbers, Diophantine equations, congruences.

Objectives: To present some basic ideas of Number Theory using definitions, examples, conjectures, Theorems and their proofs.

Outcomes: After successful completion of the course student will be able to

1. Apply different methods of proofs including induction, contradiction, counter examples to verify mathematical assertions.
2. Explain basic concepts like divisibility, greatest common divisor, congruences, linear congruences.
3. Solve systems of Diophantine equations using the Euclidean algorithm and Chinese remainder theorem
4. Demonstrate knowledge and understanding of prime numbers.
5. Use Fermat's theorem and Wilson's theorem.

Unit I:Divisibility Theory in the Integers:

Mathematical induction, The division algorithm, The greatest common divisor, The Euclidean algorithm.

Unit II:Prime Numbers and properties:

The Diophantine equation, The fundamental theorem of arithmetic, The sieve of Eratosthenes.

Unit III:The Theory of Congruences:

The Goldbach conjecture, Basic properties of congruence, Binary and decimal representation of integers.

Unit IV:Fermats Theorem:

Linear congruences and the Chinese remainder theorem, Fermat's little theorem and Pseudoprimes, Wilson's theorem.

Text Book :
David M. Burton, "Elementary Number Theory", McGraw Hill Education (India). Private limited, 7^{th} edition.

Scope:
Unit I:

Chapter 1: art 1.1
Chapter 2: art 2.2,2.3,2.4
Unit-II:
Chapter 2: art 2.5
Chapter 3: art 3.1,3.2
Unit-III:
Chapter 3: art 3.3
Chapter 4: art 4.2,4.3
Unit-IV:
Chapter 4: art 4.4
Chapter 5: art 5.2,5.3

REFERENCES :

1. A. Baker, "A concise Introduction to the Theory of Numbers", Cambridge University press, 1984.

2. J. P. Serre, "A course in Arithmetic-GTM Vol 7", Springer Verlag, 1973.

3. Tom M Apostol," Introduction to Analytic Number Theory", Norosa Publishing House, 1980.

4. I Niven and Zuckerman," An Introduction to the Theory of Numbers", Wiley, New York, 4^{th} edition 1980.

5. Rosen K. H," Elementary Number theory and its application", Pearson Addition Wesely, 5^{th} edition.

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Third Year (Semester-VI)
(CBCS PATTERN)
ANNUAL PATTERN EVALUATION SKILLS
(SECM-4 for 2 Credits)

Note: Amongst the following skills students can choose one for the sixth semester

SKILL-IV(A)

- **Insurance Mathematics** (Basic annuities): Introduction, Annuity-immediate, Annuity-due, Annuity values on any date, Perpetuities, Unknown time, Unknown rate of interest, Varying interest, Annuities not involving compound interest.

SKILL-IV(B)

- Solving problems in Numerical Analysis using Mathematical Software like Matlab, Mapple, Scilab and other software

SKILL-IV(C)

- **LaTeX for Beginners-II**

Tables, Arrays, and Lists

- Constructing Arrays
- Constructing Tables
- Constructing Lists

Theorems

- Basic theorems and proofs
- Theorem counters
- Theorem styles

Referencing

- Bibliography and citation

Journal Articles/Reports

- Preparing research papers and project reports

Presentations in Latex

- Brief introduction to beamer
- Presentation using beamer class

REFERENCES BOOKS :

1. Kellison Stephen G., The Theory of Interest, 3rd Edition. McGraw-Hill International Edition (2009).
2. UK Institute of Actuaries core leading for the subject CT1-Financial Mathematics.

3. Elliott R.J. and Kopp P.E. Mathematics of Financial Markets. Springer (1999).
4. Rudra Pratap, Getting Started with MATLAB 7, Oxford Unversity Press, (Indian Edition) www.oup.com.
5. Michael Baudin, Introduction to Scilab, Consortium Scilab, 2010.
6. Atlas- automatically turned linear algebra software. http://math-atlas.sourceforge.net.
7. Cecill and free software.http://www.cecill.info.
8. The Scilab Consortium, Scilab. http://www.scilab.org.
9. Intel. Intel math Kernel library. http://software.intel.com/en-us/intel-mkl/.
10. Sylvestre Ledru. Different execution modes of Scilab. http://wiki.scilab.org/Different_execution_modes_of_Scilab.
11. Flexdock project.Flexdock project home. http://flexdock.dev.java.net/.
12. Leslie Lamport, LaTeX a Document Preparation System User's Guide and Reference Manual, Addison-Wesley Publishing Company.
13. Online LaTeX Editor https://www.overleaf.com/

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