।। 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 द्वितीय वर्षाचे CBCS Pattern नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०२०–२१ पासून लागू करण्याबाबत.

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, **दिनांक २० जून २०२० रोजी** संपन्न झालेल्या **४७व्या मा. विद्या परिषद बैठकीतील विषय क्र.११/४७–२०२०**च्या ठरावानुसार प्रस्तुत विद्यापीठाच्या **संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील** पदवी **स्तरावरील द्वितीय वर्षाचे** खालील विषयांचे **C.B.C.S. (Choice Based Credit System) Pattern** नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०२०–२१ पासून लागू करण्यात येत आहेत.

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

'ज्ञानतीर्थ' परिसर,
विष्णुपुरी, नांदेड – ४३१ ६०६.
जा.क्र.: शैक्षणिक–१/परिपत्रक/पदवी–सीबीसीएस अभ्यासक्रम/२०२०–२१/३३३

दिनांक : १५.०७.२०२०.

स्वाक्षरित/–
उपकुलसचिव
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.

Principal
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SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER PATTERN B.A./B.Sc. (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 & 20% for CA. and weightage for SEC : 50% for ESE & 50% for CA.
3. Workload includes Unit tests.

B.A./B.Sc. (Mathematics) Semester III and IV
Curriculum will be progressively effective from June-2020 Onwards.

Semester	Section and Paper Code	Period per week	Paper No. and Title of the papers	Marks of ESE	Marks of C.A.	Total Marks	Credits
III	CCM-3 Section A	5	Paper -VI Real Analysis-I	40	10	50	2
	CCM-3 Section B	5	Paper-VII Group Theory	40	10	50	2
	CCM-3 Section C	5	Paper-VIII Ordinary Differential Equations (This paper is only for B.Sc.)	40	10	50	2
	CCM-3 SEC-I	3(Theory-1 & Practical-2)	Two skills out of which one skill can be chosen	25	25	50	2
IV	CCM-4 Section A	5	Paper-IX Real Analysis-II	40	10	50	2
	CCM-4 Section B	5	Paper -X Ring Theory	40	10	50	2
	CCM-4 Section C	5	Paper-XI Partial Differential Equations (This paper is only for B.Sc.)	40	10	50	2
	CCM-4 SEC-II	3(Theory-1 & Practical-2)	Two skills out of which one skill can be chosen	25	25	50	2
Total Credits							16

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B.A./B.Sc.S.Y. (Semester-III)
(CBCS PATTERN)
CCM-3, Section-A
Paper VI: Real Analysis-I

Course Description: This course provides an elementary knowledge of Sets, Properties of sets, Open set, Closed set, Real sequences, Subsequences, Principle of convergence for sequences, Infinite series, General principle of convergence for series, Comparison Test for Series.
Objectives: A primary objective of the course is to learn elementary knowledge of Sets, Properties of sets, Real sequences, Infinite series, and Comparison test for series.
Outcomes: After successful completion of the course student will be able to

1. Understanding the basic concept of sets and their properties.
2. Understanding the concept of a neighborhood of a point, interior points of a set, open set.
3. Understanding concept of limit points of a set, closed set, closure of a set, dense set.
4. Understanding the basic concept of sequences, subsequences, bounds of sequences, limit point of sequences, general principle of convergence, different types of sequences.
5. Understanding the concept of infinite series, different types of series, the general principle of convergence
6. Use the results to solve some problems.
7. Understanding the difference between different types of sequences, series, and comparison tests.

Unit-I: Sets and Properties

Field structure and order structure, Intervals, Bounded and unbounded sets, Supremum, Infimum, Completeness in the set of real numbers, Order completeness in R, Archimedean property of real numbers, Dedekind's Property, Complete-ordered field, Representation of real numbers as points of a straight line, Neighbourhood of a point, Interior point of a set, Open set, Limit point of a set, Bolzano-Weierstrass theorem, Closed sets, Closure of a set, Dense sets, Some important theorems, Countable and uncountable sets.

Unit-II: Real Sequences

Sequence, Range set, Bounds of a sequence, Convergence of sequences, Some theorem, Limit point of a sequence, Existence of limit points, Convergent sequences, Cauchy's general principle of convergence, Cauchy's sequence, Algebra of sequences, Some important theorem, Monotonic sequences, Subsequences.

Unit-III: Infinite Series

Introduction, Definitions, Necessary condition for convergence, Cauchy's general principle of convergence for series, Some preliminary theorems, Positive term series, Necessary condition for convergence of positive term series, Geometric series, Comparison series, Series with arbitrary terms, Alternating series, Absolute convergence, Rearrangement of terms,

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Fourier series.

Unit-IV: Comparison Test for Series

Comparison test (first and second type), Cauchy's root test, D 'Alembert's root test, Raabe's test, logarithmic test, Test for series of arbitrary term.

Text Book 1:
S.C.Malik and Savita Arora, Mathematical Analysis, New Age International (P) Ltd, Fourth Edition 2012 (Reprint 2014).
Scope:

Unit I:
Chapter 1: Art 2,2.1,2.2,2.3,2.4,2.6,3,4,4.1,4.2(Corollary's 1,2,3,4,5 only statement),4.3,4.5,4.6,
Chapter 2: Art 1.1, 1.2, 1.3(Corollary's only statement), 2, 2.1(Theorem only statement), 2.2,3,3.1,3.2,3.3,3.4,3.5(Theorems 10,11,12 and Corollary only statement),4
Unit-II:
Chapter 3: Art 1,1.1,1.2,1.3,1.4,2,2.1,2.2,2.3,4,4.1,4.2(Only definitions and statement of theorem 13),6,6.1,7 (Only Theorem 16 and its Lemma),8 (Theorem 20,21,22,23 and 24 and Examples 8,9,10 only),9,9.1(Definition, Examples 14,15,16 only).
Unit-III:
Chapter 4: 1,1.1,1.2,1.3,1.4,2,2.1,2.2,2.3,10,10.1,10.2,11
Chapter 14:1,1.1
Unit-IV:
Chapter 4: 3,3.1, 3.2, 3.3, 4, 5, 6, 7, 10.3

REFERENCES :

1. Richard R. Goldberg, Methods of Real Analysis, Oxford & IBH Publishing Co. Pvt.Ltd.,New Delhi
2. Shanti Narayan and Dr. M.D. Raisinghania, Elements of Real Analysis, S. Chand & Company Ltd., New Delhi.
3. R.G.Bartle and D.R.Sherbert, Introduction to Real Analysis, John Wiley & Sons (Asia) P.Ltd, 2002.
4. William F.Trench, Introduction to Real Analysis, Pearson Education Pub.
5. T.M.Apostol, Calculus (Vol.1), John Wiley & Sons (Asia) P.Ltd., 2002.
6. K.A.Ross, Elementary Analysis-The Theory of Calculus Series-Undergraduate Text in Mathematics, Springer Verlag, 2003.

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B.A/B.Sc.S.Y. (Semester-III)
(CBCS PATTERN)
CCM-3,Section B
Paper VII: Group Theory

Course Description: This course provides an elementary knowledge of Relation, Equivalence relation, Group, Properties of groups, Subgroups, Order of a group, Cyclic groups, Normal subgroups, Automorphism of a group.
Objectives: A primary objective of the course is to learn elementary knowledge of Group Theory.
Outcomes: After successful completion of the course student will be able to

1. Understand the concepts on an equivalence relation.
2. Find the examples of equivalence relation.
3. Check whether the given set, is a group for the given operation or not.
4. Understand the general properties of groups.
5. Solve problems on groups.
6. Understand the concepts of the cyclic group.
7. Use Lagrange's theorem to solve the problems in number theory.
8. Form a quotient group.
9. Find the kernel of a group homomorphism.

Unit-I:

Cartesian product of two sets, Functions or mappings, Types of functions, Inverse image of an element, Inverse function, Intervals defined as sets of real numbers, Product or Composite of functions, Some properties of composite of mappings, Binary operation, Relations, Equivalence relations, Equivalence classes, Properties of equivalence classes. Groups: Binary operation on a set, Algebraic structure, definition of group, abelian group, finite and infinite groups, order of an infinite group, General properties of a group.
Unit-II:

Composition table for finite sets, Addition modulo n, Multiplication modulo p, Residue classes of the set of integers, Permutations, Group of permutations, cyclic permutations, Integral powers of an element of a group, Order of an element of a group, Complexes and subgroups of a group. Criterion for a complex to be a subgroup.

Unit-III:

Cosets, Relation of congruence modulo, Lagrange's theorem, Euler's theorem, Fermat's theorem, Calcys's theorem, Cyclic groups, Some properties of cyclic group, Subgroup generated by a subset of a group.

Unit-IV:

Normal subgroups, Quotient groups, Homomorphisms of a groups, Kernal of homomorphism, Fundamental theorem on homomorphism of groups, Automorphisms of a group,

Inner automorphisms.

Text Book 1:

A.R. Vasishtha,Modern Algebra, (Krishna Prakashan Mandir) (19^{th}-edition).

Scope:

Unit I: Chapter 1:§18 to 37, Chapter 2: §1 to 5
Unit-II: Chapter 2: §7 to 10, §12, 13,14,16, 17,22,24.
Unit-III: Chapter 2: §27, 28, 29, 31, 32, 33, 34.
Unit-IV: Chapter 3: §1, 4, 5, 6, 7, 8.

REFERENCE BOOKS :

1. I.N. Herstein, Topic in Algebra John Wiley and Sons (New York).
2. J.B. Fraleigh, A first course in abstract algebra, Narosa Publications.
3. Joseph Gallion, Contemporary Abstract Algebra, Narosa Publications.
4. R.P. Rohtatgi, Modern Algebra, Dominant Publishers and Distributors, New Delhi.
5. Goyal and Gupta, Modern Algebra, Pragati Prakashan Meerut.
6. P.B. Bhattacharya, S.K. Jain and S.K. Nagpaul, Basic Abstract Algebra, Cambridge University Press Indian Edition.
7. N.S. Gopalkrishnan, University Algebra, New Age, Delhi.
8. Shanti Narayan, A Text Book of Modern Algebra, S.Chand and C0., New Delhi.
9. M.Artin, ALgebra, Pub, PHI New Delhi 1994.

B.Sc.S.Y. (Semester-III)
(CBCS PATTERN)
CCM-3, Section-C
Paper VIII: Ordinary Differential Equations

Course Description: This course provides an elementary knowledge of the Equations the First Order, and of the first degree, Equations of the first order but not of the first degree, Linear equations with constant coefficients and Linear equations with variable coefficients.

Objectives: A primary objective of the course is to learn elementary knowledge of Ordinary Differential Equations.

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

1. Understanding concept of solution of differential equations, order and degree.
2. Transform the equations into variable separable form.
3. Transform first-order non-homogeneous equation in x and y to homogeneous equation in x and y and solve it.
4. Find the equations that can be resolved into components equation and solve it.
5. Solve Clairaut's equation.
6. Find the solutions when the auxiliary equations are equal, different, repeated, and imaginary roots.
7. Find the solution of the exact differential equation, rules of finding the integrating factor.
8. Transform non-linear equation to linear equation and solve it.
9. Find integral corresponding to a term of the form e^{ax}, x^m, $\sin ax$ or $\cos ax$, $e^{ax}V$, xV, x^2V in the second member.
10. Find the solution of linear equation with variable coefficients.
11. Transform the equations to the homogeneous linear form.
12. Transform the homogeneous linear equation with constant coefficient by changing the independent variable x to z by putting $x = e^z$ or $Z = \log x$

Unit-I:

Formation of a Differential Equation: Ordinary and partial differential equations, Order and degree, Solution and constant of integration, Equation of the first order and the first degree: Equations of the form $f_1(x)dx + f_2(y)dy = 0$, Equations homogeneous in x and y, Non-homogeneous equations of the first degree in x and y, Exact differential equations, Condition that an equation of the first order be exact, Rules for finding the solution of an exact differential equation, Integrating factors, The number of integrating factors is infinite, Integrating factors found by inspections.

Unit-II:

Rules for finding integrating factors, Rules $I\&II$, Rules $III\&IV$, Rule V, Linear equations, Equation reducible to the linear form. Equations of the first order but not of first degree: Equations that can be resolved into component equations of the first degree, Equations that can't be resolved into component equations, Equations solvable for y, Equation solvable for x, Equations that do not contain x, that do not contain y, Equations homogeneous in x and y, Equations of first degree in $x\&y$: Clairaut"s equation.

Unit-III:

Linear equations with constant coefficients: Linear equations defined, The Complementary Function, The particular integral, The complete solution, The linear equation with constant coefficients and second member zero, Case of the auxiliary equation having equal roots, Case of the auxiliary equation having imaginary roots, The symbol D(Theorem concerning D), Another way of finding the solution when the auxiliary equation has repeated roots, The linear equation with constant coefficients and a second member a function of x, The symbolic function $1/f(D)$, Methods of finding the particular integral.

Unit-IV:

Short method of finding the particular integrals in certain cases: Integral corresponding to a term of the form $e^{ax}, x^m, \sin ax$ or $\cos ax$ in the second member, Integral corresponding to a term of the form $e^{ax}V, xV$ the second member
Linear Equations with Variable Coefficients: The homogeneous linear equation first method of solution, Second method of solution: (A) To find the complementary function, (B) To find the particular integral, The symbolic function $f(\theta)$ and $1/f(\theta)$, Method of finding the particular integral, Integral corresponding to a term of the form x^m in the second member, Equation reducible to the homogeneous linear form.
Text Book 1:
Daniel A. Murray, Introductory Course in Differential equations, Published by Orient Longman Limited.
Scope:
Unit I: Chapter I : Art. 1 to 2
Chapter II: Art. 8 to 16
Unit-II: Chapter II: Art 17 to 21, Chapter III: Art 22 to 28(Complete)
Unit-III: Chapter VI: Art 49 to 58
Unit-IV: Chapter VI: Art 59 to 64, Chapter VII: Art 65 to 71

REFERENCES :

1. M.D. Raisinghania, Ordinary and Partial Differential Equations, S. Chand and Company Limited.

2. G. Birkhoff and G. C. Rota, Ordinary Differential Equations, John Wiley and sons.

3. Frank Ayres, Theory and Problems on Differential Equations, McGraw Hill.

4. George F. Simmons, Differential Equations with Applications and Historical Notes, Tata McGraw Hill Publishing House Limited.

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SEC-I(Open Elective) (Semester-III) (CBCS PATTERN)

ANNUAL PATTERN EVALUATION SKILLS

(SECM-I for 2 Credits)

Note:

1. This open elective will opt any students of second year for any descipline.
2. Amongst the following skills students can choose one for third semester.

SKILL-I

- Plotting of Graphs using Mathematical software like Scilab, MATLAB, Mathematica, Maple etc.

SKILL-II

- Solving of Ordinary Differential Equations, using Mathematical software like Scilab, MATLAB, Mathematica, Maple etc.

REFERENCES BOOKS :

1. Rudra Pratap, Getting Started with MATLAB 7, Oxford Unversity Press, (Indian Edition) www.oup.com.
2. Michael Baudin, Introduction to Scilab, Consortium Scilab, 2010.
3. Atlas- automatically turned linear algebra software. http://math-atlas.source.forge.net.
4. Cecill and free software.http://www.cecill.info.
5. The Scilab Consortium, Scilab. http://www.scilab.org.
6. Intel. Intel math Kernel library. http://software.intel.com/en-us/intel-mkl/.
7. Sylvestre Ledru. Different execution modes of Scilab. http://wiki.scilab.org/Different_execution_modes_of_Scilab.
8. Flexdock project.Flexdock project home. http://flexdock.dev.java.net/.

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B.A./B.Sc.S.Y. (Semester-IV)
(CBCS PATTERN)
CCM-4 Section-A
Paper IX: Real Analysis-II

Course Description: This course provides an elementary knowledge of Riemann integrable function and Riemann integral, conditions of integrability, some integrable and fundamental theorems, improper integral-range of integrations is finite and infinite, comparison tests and general tests.

Objectives: A primary objective of the course is to learn elementary knowledge of Riemann integral and improper integral, other objectives of the course is how to use comparison and general tests.

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

1. Understand the meaning of interval, subinterval, partitions, and their refinement.
2. Understanding the basic concept of upper integral and lower integral and Riemann integral.
3. Understanding difference between upper sum, lower sum and Riemann sum
4. Acquire the idea about Riemann Integrability and Riemann Integration
5. Understand various theorems associated with Riemann Integration
6. Develop a knowledge about Riemann Integration and applies to problems
7. Understand the meaning of improper integral.
8. Determine convergence of improper integrals with discontinuities in their domain or infinite limits of integration.
9. Develop skill in checking the convergence of improper integral using various tests of convergence
10. Understanding distinguishes between convergence and absolute convergence of improper integral.
11. Use comparison test with a corresponding improper integral with other improper integral to decide whether improper integral converge or diverge
12. Use the results to solve some problems.

Unit-I:Riemann Integral

Introduction, Definition, and existence of the integral, Definitions, Inequalities for integrals, Refinement of partitions, Darboux's theorem, Conditions of integrability, Deductions, integrability of the sum and difference of integrable functions, Integrability of the product, Quotient and the modulus of Integrable functions.

Unit-II: Riemann Sum and Some Fundamental Theorems

The integral as a limit of sums (only definitions of Riemann sums), Some applications, Some integrable functions, Integration and differentiation, Fundamental theorem of integral calculus, Mean value theorems of integral calculus.

Unit III: Improper Integral-Range of Integration is Finite

Introduction, Integration of unbounded functions with finite limits of integrations, Comparison tests for convergence, Useful comparison integral, Examples, General test for convergence, Absolute convergence.

Unit-IV:Improper Integral-Range of Integration is Infinite

Infinite range of integration, comparison tests for convergence at ∞, Comparison test first and second, Useful comparison integral, General test for convergence at ∞, Absolute convergence, Integrand as a product of functions (convergence at ∞).

Text Book :
S.C.Malik and Savita Arora, Mathematical Analysis, New Age International (P) Ltd, Second Edition 1992 (Reprint 2014).
Scope:
Unit I: Chapter 9: §1, 1.1, 1.2, 2, 3, 4(Theorem 4 only statement), 4.1,5,5.1
Unit-II: Chapter 9: §6, 6.1, 6.2, 7(only theorems 12 to13 with corollary and examples), 8, 9, 9.1, 10, 10.1, 10.2
Unit-III: Chapter 11: §1, 2, 3, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6
Unit-IV: Chapter 11: §4, 4.1, 4.2, 4.3, 4.4, 4.6, 4.7(theorem4 only statement), 5, 5.1, 5.2

REFERENCES :

1. Richard R. Goldberg, Methods of Real Analysis, Oxford IBH Publishing Co. Pvt.Ltd.,New Delhi
2. Shanti Narayan and Dr. M.D. Raisinghania, Elements of Real Analysis, S. Chand & Company Ltd., New Delhi.
3. R.G.Bartle and D.R.Sherbet, Introduction to Real Analysis, John Wiley & Sons (Asia) P.Ltd, 2002.
4. William F.Trench, Introduction to Real Analysis, Pearson Education Pub.
5. J.A.Anderson, Logos Press Limited, London.
6. T.M.Apostol, Calculus (Vol.1), John Wiley & Sons (Asia) P.Ltd., 2002.
7. K.A.Ross, Elementary Analysis-The Theory of Calculus Series-Undergraduate Text in Mathematics, Springer Verlag, 2003.

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B.A./B.Sc.S.Y. (Semester-IV)
(CBCS PATTERN)
CCM-4, Section-B
Paper X: Ring Theory

Course Description: This course provides an elementary knowledge of Ring (Algebraic structure), Field, Ideals, Euclidean rings, Particular Euclidean rings.
Objectives: A primary objective of the course is to learn elementary knowledge of Ring Theory.
Outcomes: After successful completion of the course student will be able to

1. Understand given algebraic structure is a Ring or not.
2. Construct the examples of ring with known examples of ring.
3. Differentiate between zero-divisors and non-zero-divisors in a given ring.
4. Check whether given two rings are isomorphic or not.
5. Check whether the given ideal of a ring is a principal ideal or not.
6. Understand the concepts on principal ideal ring
7. Understand concepts on Euclidean rings.

Unit-I:

Ring: Definition, Elementary properties of a ring, Integral multiples of the elements of a ring, Examples of rings, Some special types of rings, Integral domains, Field, Division ring or Skew field.

Unit-II:

Isomorphism of rings, Properties of isomorphism of rings, Subrings(only definition), Characteristics of a ring, Imbedding of a ring into another ring, the field of quotients, Ideals, More about ideals, Ideal generated by a given subset of a ring, Principal ideal, Principal ideal ring.

Unit-III:

Divisibility in an integral domain, Units, Associates, Prime elements, greatest common divisor, polynomial rings, Degree of the sum and the product of two polynomials, Ring of polynomials, R as a subset of $R[x]$, polynomial over an integral domain, Polynomial over a field, Ring of polynomials in n variables over an integral domain, Divisibility of polynomials over a field, Division algorithm for polynomials over a field, Euclidean algorithm for polynomials over a field

Unit-IV:

Unique factorization domain, Unique factorization theorem for polynomials over a field, Quotient rings or residue class rings, Homomorphism of rings, Kernel of a ring homomorphism, Maximal ideal, Some more results on ideals, Prime ideals, Euclidean rings or Euclidean domains, Properties of Euclidean rings.

Text Book 1:
Modern Algebra, by A.R. Vasishtha (Krishna Prakashan Mandir) (19^{th}-edition).
Scope:
Unit I: Chapter 4:§1 to 6 .
Unit-II: Chapter 4: §7 to 9, §11, §13, 14, 15, 16, 17, 18.
Unit-III: Chapter 4: §19, 20, 21, 22, 23,24, 25, 26,27,28, 29
Unit-IV: Chapter 4: §30, 31 Chapter 5: §1, 2,3,4,5,6,7,8

REFERENCES BOOKS :

1. I.N. Herstein, Topic in Algebra John Wiley and Sons (New York).
2. J.B. Fraleigh, A first course in abstract algebra, Narosa Publications.
3. Joseph Gallion, Contemporary Abstract Algebra, Narosa Publications.
4. R.P. Rohtatgi, Modern Algebra, Dominant Publishers and Distributors, New Delhi.
5. Goyal and Gupta, Modern Algebra, Pragati Prakashan Meerut.
6. P.B. Bhattacharya, S.K. Jain and S.K. Nagpaul, Basic Abstract Algebra, Cambridge University Press Indian Edition.
7. N.S. Gopalkrishnan, University Algebra, New Age, Delhi.
8. Shanti Narayan, A Text Book of Modern Algebra, S.Chand and C0., New Delhi.
9. M.Artin, ALgebra, Pub, PHI New Delhi 1994.

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B.Sc.S.Y. (Semester-IV)
(CBCS PATTERN)
CCM-4, Section-C
Paper XI: Partial Differential Equations

Course Description: This course provides an elementary knowledge of partial differential equation (PDE), Linear and non-linear PDE, Solution of PDE, Method of finding particular integrals, Lagrange's Method, Charpit's Method, Monge's Method, Method of separation of Variables, Wave equation, Heat equation, and Transmission line equation.

Objectives: Partial Differential Equations allows deterministic Mathematical formulation of phenomena in Physics, Engineering, and Biological processes. The objectives of this course are as follows:

1. Introduce students to PDE
2. Introduce students to different methods of solutions of PDE.
3. Techniques of separation of variables to solve PDE.
4. Introduce students to real-world problems like wave equation, heat equation, etc.

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

1. Classification of PDE.
2. Solve linear as well as non-linear PDE of first and second order.
3. Apply PDE techniques to predict the behavior of certain phenomena.
4. Solve real problems by identifying them approximately from the perspective of PDE.
5. Mathematical formation of real problem precisely.
6. Solve problem using boundary conditions.

Unit-I:

Partial differential equation (PDE), Order and method of forming PDE, solution of equations by direct integration, Lagrange's linear equations, method of multipliers.

Unit-II:

Partial differential equations non-linear in p and q, Charpit's method, Linear homogeneous PDE of n^{th} order with constant coefficients, Rules for finding the complementary functions, Rules for finding the particular integral.

Unit-III:

Non-homogeneous linear equations, Monge's method, Method of separation of variables, Equations of vibrating strings, Solution of the wave equation by D'Almbert's method.

Unit-IV:

One-dimensional heat flow, Two-dimensional heat flow, Laplace equations in polar co-ordinates, Transmission line equations.

Text Book 1:
H. K. Dass, Advanced Engineering Mathematics S.Chand and Company Ltd.(2004).
Scope:
Unit I: Chapter 9:§9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 9.7.
Unit-II: Chapter 9:§9.8, 9.9, 9.10, 9.11, 9.12.
Unit-III: Chapter 9: §9.13, 9.14, 9.15, 9.16, 9.17, 9.18.
Unit-IV: Chapter 9: §9.19, 9.20, 9.21, and 9.22.

REFERENCES :

1. D.A.Murray, Introductory course in Differential equation, New York Longmans and Green Co. London and Bombay.
2. M.D. Raisinghania, Ordinary and Partial Differential equations, S.Chand and Co.
3. T.M.Karade, Lectures on Differential equation, Sonu-Nilu Pub.Nagpur.
4. I.N.Sneddon, Elements of Partial Differential Equation, Mc Graw Hill co.
5. Peter Olver, Introduction to Partial Differential equation Springer Cham Heidelberg New York Dordrecht London.
6. A. Singaravelu, Engineering Mathematics, Engineering Mathematics, Meenakshi Agency Chennai.
7. W.E. Williams, Partial Differential equations, Claredon Press Oxford.
8. M.E.Tayor, Partial Differential equations, Springer Cham Heidelberg New York Dordrecht London.

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SEC-II (Open Elective)(Semester-IV)
(CBCS PATTERN)
ANNUAL PATTERN EVALUATION SKILLS
(SECM-II for 2 Credits)

Note:

1. This open elective will opt any students of second year for any descipline.
2. Amongst the following skills students can choose one for third semester.

SKILL-III

- Solving problems in Calculus using Mathematical software like Scilab, MATLAB, Mathematica, Maple etc.

SKILL-IV

- Introduction to symbolic methods and solving problems, using Mathematical software like Scilab, MATLAB, Mathematica, Maple etc.

REFERENCES BOOKS :

1. Rudra Pratap, Getting Started with MATLAB 7, Oxford Unversity Press, (Indian Edition) www.oup.com.
2. Michael Baudin, Introduction to Scilab, Consortium Scilab, 2010.
3. Atlas- automatically turned linear algebra software. http://math-atlas.source.forge.net.
4. Cecill and free software.http://www.cecill.info.
5. The Scilab Consortium, Scilab. http://www.scilab.org.
6. Intel. Intel math Kernel library. http://software.intel.com/en-us/intel-mkl/.
7. Sylvestre Ledru. Different execution modes of Scilab. http://wiki.scilab.org/Different_execution_modes_of_Scilab.
8. Flexdock project.Flexdock project home. http://flexdock.dev.java.net/.

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