NATIONAL EDUCATION POLICY 2020

PROPOSED CURRICULUM FOR

V and VI Semester B.Sc. Mathematics

TUMKUR UNIVERSITY

VISHVAVIDYANILAYA KARYALAYA,

B. H. ROAD, TUMAKURU – 572103

2023

Composition of Board of Studies in Under Graduate Mathematics, Tumkur University

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   DoSR Mathematics, Kuvempu University, Shivamogga
10. **Dr. U. S. Mahabaleshwar, Member,**
    DoSR Mathematics, Davanagere University, Davanagere

Name of the Degree Program : **B. Sc. Discipline**

Course : **Mathematics**

Starting Year of Implementation : **2023-24**

Programme Outcomes (PO): By the end of the program the students will be able to:

PO1	**Disciplinary Knowledge:** Bachelor degree in Mathematics is the culmination of in-depth knowledge of Algebra, Calculus, Geometry, differential equations and several other branches of pure and applied mathematics. This also leads to study the related areas such as computer science and other allied subjects
PO2	**Communication Skills:** Ability to communicate various mathematical concepts effectively using examples and their geometrical visualization. The skills and knowledge gained in this program will lead to the proficiency in analytical reasoning which can be used for modelling and solving of real life problems.
PO3	**Critical thinking and analytical reasoning:** The students undergoing this programme acquire ability of critical thinking and logical reasoning and capability of recognizing and distinguishing the various aspects of real life problems.
PO4	**Problem Solving:** The Mathematical knowledge gained by the students through this programme develop an ability to analyze the problems, identify and define appropriate computing requirements for its solutions. This programme enhances students overall development and also equip them with mathematical modelling ability, problem solving skills.
PO5	**Research related skills:** Completing this programme develops the capability of inquiring about appropriate questions relating to the Mathematical concepts in different areas of Mathematics.
PO6	**Information/ digital literacy:** The completion of this programme will enable the learner to use appropriate software to solve system of algebraic equation and differential equations.
PO7	**Self – directed learning:** The student completing this program will develop the ability to work independently and to make an in-depth study of various notions of Mathematics.
PO8	**Moral and ethical awareness/reasoning:** The student completing this program will develop an ability to identify unethical behaviour such as fabrication, falsification or misinterpretation of data and adopting objectives, unbiased and truthful actions in all aspects of life in general and Mathematical studies in particular.
PO9	**Lifelong learning:** This programme provides self directed learning and lifelong learning skills. This programme helps the learner to think independently and develop algorithms and computational skills for solving real word problems.
PO10	Ability to pursue advanced studies and research in pure and applied Mathematical sciences.

Content of Courses for V and VI Semester B.Sc. Mathematics

Semester	Course No.	Theory/ Practical	Credits	Paper Title	Marks	
					S. A.	I. A.
V	MATDSCT5.1	Theory	4	Advanced Algebra and Numerical Methods – I	60	40
	MATDSCP5.1	Practical	2	Theory based Practical's on Advanced Algebra and Numerical Methods – I	25	25
	MATDSCT5.2	Theory	4	Vector Calculus and Complex Analysis	60	40
	MATDSCP5.2	Practical	2	Theory based Practical's on Vector Calculus and Complex Analysis	25	25
VI	MATDSCT6.1	Theory	4	Linear Algebra and Numerical Methods - II	60	40
	MATDSCP6.1	Practical	2	Theory based Practical's on Linear Algebra and Numerical Methods - II	25	25
	MATDSCT6.2	Theory	4	Number Theory and Linear Programming	60	40
	MATDSCP6.2	Practical	2	Theory based Practical's on Number Theory and Linear Programming	25	25

Assessment

Weightage for the Assessment (in percentage)

Type of Course	Formative Assessment/ I.A.	Summative Assessment (S.A.)
Theory	40%	60%
Practical	50%	50%
Projects	50%	50%
Experiential Learning (Internship, etc.)	--	--

CURRICULUM STRUCTURE FOR FIFTH AND SIXTH SEMESTER B. SC. MATHEMATICS

Name of the Degree Program : B. Sc.
Discipline/Subject :Mathematics
Starting Year of Implementation: 2023-24

PROGRAM ARTICULATION MATRIX

Semester	Course No.	Programme Outcomes that the Course Addresses	Pre-Requisite Course(s)	Pedagogy*	Assessment**
V	MATDSCT5.1	PO1,PO2, PO3,PO4, PO5, PO7, PO9, PO10	MATDSCT1.1, MATDSCT2.1	MOOC PROBLEM SOLVING SEMINAR PROJECT BASED LEARNING ASSIGNMENTS GROUP DISCUSSION	CLASS TESTS SEMINAR QUIZ ASSIGNMENT TERM END EXAM VIVA-VOCE
V	MATDSCT5.2	PO3,PO4, PO5, PO7, PO9, PO10	MATDSCT1.1, MATDSCT3.1		
VI	MATDSCT6.1	PO3, PO4, PO5, PO7, PO10	MATDSCT1.1, MATDSCT5.1,		
VI	MATDSCT6.2	PO3,PO4, PO5, PO7, PO9, PO10	MATDSCT1.1		

** Pedagogy for student engagement is predominantly Lecture. However, other pedagogies enhancing better student engagement to be recommended for each course. This list includes active learning/course projects /Problem based or Project based Learning / Case Studies /Self Study like Seminar, Term Paper or MOOC.

*** Every Course needs to include assessment for higher order thinking skills (Applying/Evaluating/ Creating). However, this column may contain alternate assessment methods that help formative assessment (i.e.,, assessment for Learning).

Syllabus for V and VI Semester B.Sc. Mathematics

SEMESTER – V

MATDSCT 5.1: Advanced Algebra and Numerical Methods – I	
Teaching Hours : 4 Hours/Week	Credits: 4
Total Teaching Hours: 60 Hours	Max. Marks: 100 (S.A.-60 + I.A. – 40)

Course Learning Outcomes: This course will enable the students to:

- Know the significance of normal subgroups and quotient groups.
- Understand the structure preserving mapping between two algebraic structures of the same type.
- Know the algebraic structures having the same structure with different elements.
- Identify and analyze the algebraic structures such as rings, fields and integral domains.
- Articulate the rationale behind various techniques of numerical analysis.
- Compare various methods to solve algebraic and transcendental equations and systems of linear equations.
- Examine the convergence properties of iterative methods and identify conditions for convergence.

Unit-I: Groups-II:

Normal Subgroups – properties, examples and problems, Quotient group, Homomorphism and Isomorphism of groups – properties, examples and problems, Kernel and image of a homomorphism, Normality of the kernel, Fundamental theorem of homomorphism, Properties related to isomorphism, Permutation group – Cayley's theorem. 14 Hours

Unit-II: Rings, Integral Domains, Fields:

Rings – definition and properties of rings, Types of rings, Integral Domain, Fields, Rings of integers modulo n, Subrings, Ideals - Principal, Prime and Maximal ideals in a commutative ring - examples and standard properties following the definition, Quotient rings, Homomorphism – Properties, Fundamental Theorem of Homomorphism of Rings. 14 Hours

Unit–III: Numerical Solution to Algebraic and Transcendental Equations:

Errors - Significant digits, absolute, relative, percentage errors, rounding off and truncation errors (meanings and related problems), Taylor series approximations (problems only), Solutions to algebraic and transcendental equations - Bisection method, Regula-Falsi method, iterative method Newton-Raphson method and secant method (Plain discussion of the rationale behind techniques and problems on their applications). 14 Hours

Unit – IV: Numerical Solution to System of Linear Algebraic Equations:

Direct Methods – Gauss elimination method, Gauss-Jordan elimination method and Triangularization method; Iterative methods – Gauss-Jacobi method, Gauss-Seidel method, Successive-Over Relaxation method (SOR) method. 14 Hours

Reference Books and web resources:

1. A Course in Abstract Algebra – V. K. Khanna and S. K. Bhambri, 5th Edition, S. Chand and Company Ltd, 2022.
2. Topics in Algebra - I. N. Herstein, 4th ed. New Delhi, India: Vikas Publishing House Pvt. Ltd, 1991.
3. University Algebra - N.S. Gopala Krishnan, New Age International (P) Limited, 2021.
4. First Course in Abstract Algebra – J. B. Fraleigh, N. Brand, Pearson, 2022.
5. Abstract Algebra, M. Artin, 2nd Ed., Pearson, 2011.
6. Contemporary Abstract Algebra - Joseph A. Gallian, 10th Ed., CRC Press, 2020.
7. Theory of Matrices - B S Vatsa, New Age International Publishers.
8. Introductory methods of Numerical Analysis - S. S. Sastry, 5th Edition, PHI Learning Private Limited.
9. Numerical Methods: For Scientific and Engineering Computation - M. K. Jain, S. R. K. Iyengar and R. K. Jain, , 8th Edition, New Age International, 2022.
10. Numerical Methods for Scientists and Engineers - B. S. Grewal, Khanna Publishers.
11. https://www.nptelvideos.com/mathematics/
12. https://www.my-mooc.com/en/categorie/mathematics
13. https://ocw.mit.edu/courses/mathematics
14. https://tutorial.math.lamar.edu/
15. http://www.infocobuild.com/education/audio-video-courses/mathematics/mathematics.html

MATDSCP 5.1: Theory based Practical's on Advanced Algebra and Numerical Methods – I	
Teaching Hours : 4 Hours/Week	Credits: 2
Total Teaching Hours: 60 Hours	Max. Marks: 50 (S.A.-25 + I.A.-25)

Course Learning Outcomes: This course will enable the students to

- Learn Free and Open Source Software (FOSS) tools for computer programming.
- Solve problems on advanced algebra and numerical methods studied in MATDSCT 5.1 using wxMaxima software.
- Acquire knowledge of applications of algebra and calculus through wxMaxima.

Practical/Lab Work to be performed in Computer Lab

1. Program on fundamental concepts of advanced algebra and numerical methods.
2. Program to verify normality of a subgroup of a group.
3. Program to verify homomorphism of a finite group.
4. Program to verify a ring to be (i) commutative (ii) with/without unity.
5. Program to verify a ring to be an integral domain/field.
6. Program to solve an algebraic/transcendental equation by bisection method.
7. Program to solve an algebraic/transcendental equation by regula-falsi method.
8. Program to solve an algebraic/transcendental equation by Newton-Raphson method.
9. Program to solve a system of linear equations by the method of Gaussian elimination.
10. Program to solve a system of linear equations by Gauss-Jacobi iterative method.
11. Program to solve a system of linear equations by Gauss-Siedel iterative method.
12. Program to solve a system of linear equations by SOR method.

MATDSCT 5.2: Vector Calculus and Complex Analysis	
Teaching Hours : 4 Hours/Week	Credits: 4
Total Teaching Hours: 60 Hours	Max. Marks: 100 (S.A.-60 + I.A. – 40)

Course Learning Outcomes: This course will enable the students to:

- Comprehend the significance of the derivative and its role in describing space curves.
- Develop skills to solve problems involving tangent, normal, and binormal vectors to a space curve.
- Investigate how curvature and torsion relate to the shape and behaviour of space curves.
- Explain the significance of complex variables and their applications in mathematics and engineering.
- Comprehend the fundamental concepts of analytic functions, including the Cauchy-Riemann equations and orthogonal systems.
- Understand the construction of analytic functions given the real or imaginary part.
- Apply complex integration techniques and properties to solve mathematical problems involving complex functions.
- Analyze the various applications of Cauchy's integral formula.

Unit-I: Vector Analysis:

Vector function of a scalar variable – interpretation as a space curve, derivative, tangent, normal and binormal vectors to a space curve; Curvature and Torsion of a space curve- definitions, derivation and problems, Serret-Frenet formulae.

Scalar field - Gradient of a scalar field, geometrical meaning, directional derivative, unit normal using surfaces - tangent plane and normal to the surface; Vector field - divergence and curl of a vector field, geometrical meaning, solenoidal and irrotational fields; Laplacian of a scalar field; Vector identities.

14 Hours

Unit – II: Vector Integration:

Vector Integration – Definition and basic properties, vector line integral, surface integral and volume integral; Green's theorem in the plane – Proof and related problems, Direct consequences of the theorem; Gauss' Divergence theorem – Proof and related problems, Direct consequences of the theorem; Stokes' theorem – Proof and related problems, Direct consequences of the theorem.

14 Hours

Unit – III: Function of a complex variable and differentiability:

Functions of a complex variable-limit, continuity and differentiability of a complex function. Analytic function, Cauchy-Riemann equations in Cartesian and Polar forms-Sufficiency conditions for analyticity(Cartesian form only), Harmonic functions-standard properties of analytic functions-construction of analytic function when real or imaginary part is given-Milne Thomson method.

14 Hours

Unit –IV: Complex integration:

Complex integration– definition, Complex Line integral - properties and problems, Cauchy's Integral theorem-proof using Green's theorem-direct consequences. Cauchy's Integral formula,Cauchy's generalized formula for the derivatives and applications for evaluation of simple line integrals, Cauchy's inequality, Fundamental Theorem of Algebra, Liouville's theorem.

14 Hours

Reference Books and web resources:

1. Vector Analysis - M. Spiegel, 2nd Edition, Schaum's Outline Series, Mc Graw Hill, Education,2017.
2. Calculus - H. Anton, I. Bivens, S. Davis, Wiley, 2015.
3. Complex Variables and Applications - J. W. Brown and R. V. Churchill, Mc Graw Hill Education, 2021.
4. Complex Analysis - L. V. Ahlfors,3rd Edition, Mc Graw Hill, 2021.
5. Foundation of Complex Analysis – S. Ponnuswamy, Alpha Edition, Narosa Publishing House, 2015.
6. Complex Analysis – Serge Lang, Springer, 2010.
7. Theory of Functions of a Complex Variable - Shanthinarayan, S. Chand Publishers, 2005.
8. Functions of a Complex Variable – B. S. Tyagi, Kedarnath Ramnath Publishers, 2020.
9. https://www.nptelvideos.com/mathematics/
10. https://www.my-mooc.com/en/categorie/mathematics
11. https://ocw.mit.edu/courses/mathematics
12. https://tutorial.math.lamar.edu/
13. http://www.infocobuild.com/education/audio-video-courses/mathematics/mathematics.html

MATDSCP 5.2: Theory based Practical's on Vector Calculus and Complex Analysis	
Teaching Hours : 4 Hours/Week	Credits: 2
Total Teaching Hours: 60 Hours	Max. Marks: 50 (S.A.-25 + I.A.-25)

Course Learning Outcomes: This course will enable the students to

- Learn Free and Open Source Software (FOSS) tools for computer programming.
- Solve problems on vector calculus and complex analysis studied in MATDSCT 5.2 using wxMaxima software.
- Acquire knowledge of applications of algebra and calculus through wxMaxima.

Practical/Lab Work to be performed in Computer Lab

1. Program on fundamental concepts of vector calculus and complex analysis.
2. Program to compute the dot, cross, scalar triple and vector triple product of vectors.
3. Program to compute the tangent, normal and binormal vectors to a space curve.
4. Program to compute the curvature and torsion of a space curve.
5. Program to compute the gradient of a scalar field, divergence and curl of a vector field.
6. Program to demonstrate the physical interpretation of gradient, divergence and curl.
7. Program to compute the vector line integral.
8. Program to verify Green's theorem in the plane.
9. Program to verify Cauchy-Riemann equations in Cartesian form and polar form.
10. Program to implement Milne-Thomson method of constructing analytic functions(simple examples).
11. Program to illustrate orthogonality of the surfaces obtained from the real and imaginary parts of an analytic function.
12. Program to verify harmonicity of the real and imaginary parts of an analytic function.
13. Program to compute the complex line integral – basic problems.
14. Program to verify Cauchy's integral theorem.

MATDSCT 6.1: Linear Algebra and Numerical Methods – II	
Teaching Hours : 4 Hours/Week	Credits: 4
Total Teaching Hours: 60 Hours	Max. Marks: 100 (S.A.-60 + I.A. – 40)

Course Learning Outcomes: This course will enable the students to:

- Demonstrate competence with the basic concepts of linear algebra.
- Identify and investigate the various properties of vector spaces and subspaces.
- Describe the fundamental aspects of linear span, independence and dependence of vectors.
- Analyze the properties of linear transformation.
- Utilize forward and backward difference tables to approximate derivatives and solve interpolation problems.
- Design and construct polynomial interpolation solutions using different interpolation formulas.
- Compare different methods to evaluate an ordinary definite integral using numerical techniques.

Unit-I: Vector spaces:

Vector spaces - Definition, examples and properties; Subspaces - Examples, criterion for a subset to be a subspace and some properties; Linear Combination - Linear span, Linear dependence and Linear independence, basic properties of linear dependence and independence, techniques of determining linear dependence and independence in various vector spaces and related problems; Basis and dimension - Co-ordinates, ordered basis, some basic properties of basis and dimension and subspace spanned by given set of vectors. 14 Hours

Unit-II: Linear Transformations:

Linear transformation - Definition, examples, equivalent criteria, some basic properties and matrix representation and change of basis and effect on associated matrix, similar matrices; Null space, Range space, Rank-nullity theorem and related problems. 14 Hours

Unit-III: Polynomial Interpolation:

Finite differences. Forward, backward and central differences and shift operators: definitions, properties and problems; Polynomial interpolation - Newton-Gregory forward and backward interpolation formulae, Gauss's Forward and backward interpolation formulae, Lagrange interpolation polynomial, Newton's divided differences and Newton's general interpolation formula (Discussion on setting up the polynomials, differences between them and problems on their applications). 14 Hours

Unit-IV: Numerical Differentiation and Integration:

Formula for derivatives (till second order) based on Newton-Gregory forward and backward interpolations (Derivations and problems based on them). Numerical Integration - General quadrature formula, Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule and Weddle's rule (derivations for only general quadrature formula, trapezoidal rule and Simpson's 1/3 rule and problems on the applications of all formulae). 14 Hours

Reference Books and web resources:

1. Topics in Algebra - I. N. Herstein, 4th ed. New Delhi, India: Vikas Publishing House Pvt. Ltd, 1991.
2. Linear Algebra and its Applications - David C. Lay, 5rd Ed., Pearson Education, 2023.
3. Introduction to Linear Algebra - S. Lang, 2nd Ed., Springer, 2004.
4. Introduction to Linear Algebra - Gilbert Strang, Wellesley – Cambridge Press, 2023.
5. Schaum's Outline of Linear Algebra – S. Lipschutz, M. Lipson, 3rd Edition, McGraw Hill Education, 2017.
6. Introductory methods of Numerical Analysis - S. S. Sastry, 5th Edition, PHI Learning Private Limited.
7. Numerical Methods: For Scientific and Engineering Computation - M. K. Jain, S. R. K. Iyengar and R. K. Jain, , 8th Edition, New Age International, 2022.
8. Numerical Methods for Scientists and Engineers - B. S. Grewal, Khanna Publishers.
9. https://www.nptelvideos.com/mathematics/
10. https://www.my-mooc.com/en/categorie/mathematics
11. https://ocw.mit.edu/courses/mathematics
12. https://tutorial.math.lamar.edu/
13. http://www.infocobuild.com/education/audio-video-courses/mathematics/mathematics.html

MATDSCP 6.1: Theory based Practical's on Linear Algebra and Numerical Methods - II	
Teaching Hours : 4 Hours/Week	Credits: 2
Total Teaching Hours: 60 Hours	Max. Marks: 50 (S.A.-25 + I.A.-25)

Course Learning Outcomes: This course will enable the students to

- Learn Free and Open Source Software (FOSS) tools for computer programming.
- Solve problems on linear algebra and numerical methods studied in MATDSCT 6.1 using wxMaxima software.
- Acquire knowledge of applications of algebra and calculus through wxMaxima.

Practical/Lab Work to be performed in Computer Lab

1. Program on fundamental concepts of linear algebra and numerical methods.
2. Program to express a vector as a linear combination of the given set of vectors.
3. Program to verify linear dependence and independence of a set of vectors.
4. Program to find the basis and dimension of a vector space– illustrative examples.
5. Program to verify whether the given transformation is linear.
6. Program to verify rank-nullity theorem.
7. Program to find the nth differences of polynomial.
8. Program to perform Newton-Gregory forward and backward interpolation.
9. Program to find the interpolating polynomial using Lagrange's interpolation method.
10. Program to evaluate definite integrals using trapezoidal rule.
11. Program to evaluate definite integrals using Simpson's 1/3 rule.
12. Program to evaluate definite integrals using Simpson's 3/8 rule.
13. Program to evaluate definite integrals using Weddle's rule.

MATDSCT 6.2: Number Theory and Linear Programming	
Teaching Hours : 4 Hours/Week	Credits: 4
Total Teaching Hours: 60 Hours	Max. Marks: 100 (S.A.-60 + I.A. – 40)

Course Learning Outcomes: This course will enable the students to:

- Recall the fundamental aspects of different types of numbers.
- Describe division algorithm to find the quotient and remainder during the division of an integer by another integer.
- Use Euclidean algorithm to find the GCD of two numbers and apply it to solve linear Diophantine equations and linear congruences.
- Describe the various properties of prime numbers.
- Examine the properties of different number theoretic functions.
- Define the basics of linear programming.
- Interpret the optimal solution to an LPP using graphical method.
- Apply simplex method to solve LPPs in two and three variables.

Unit-I: Properties of divisibility and primes:

The Division Algorithm, Properties of Divisibility, Greatest Common Divisor, The Euclidean Algorithm, Least Common Multiple, Linear Diophantine Equation,Prime numbers and their properties, The Fundamental Theorem of Arithmetic. 14 Hours

Unit-II: Congruences and Chinese Remainder Theorem:

Basic Properties of Congruences and applications, Binary and Decimal Representations of Integers, Linear Congruences and their solutions, Chinese Remainder Theorem and applications, Fermat's Little Theorem and Pseudo primes, Wilson's Theorem, Fermat's numbers.

14 Hours

Unit-III: Number Theoritic Functions:

Multiplicative Functions, The Sum and Number of Divisors, The Möbius Inversion Formula, The Greatest Integer Function, Euler's Phi-Function, Euler's Generalization of Fermat's Theorem, Properties of Phi-Function. 14 Hours

Unit-IV: Linear Programming Problem (LPP):

Formulation, canonical and standard forms of LPP, Graphical method for LPP involving two variables; Convex and Polyhedral sets, Hyperplanes, Extreme points; Basic solutions, Basic feasible solutions, Reduction of feasible solution to basic feasible solution, correspondence between basic feasible solution and extreme points. Related Problems, Simplex method for LPP involving two/three variables. 14 Hours

Reference Books and web resources:

1. Elementary Number Theory - David M. Burton, 7th Ed., McGraw-Hill Edition, Indian reprint, 2023.
2. An Introduction to The Theory of Numbers - I. Niven, H.S. Zuckerman and H.L. Montgomery, Fifth Edition, New Delhi: John Wiley & Sons, Inc., 2012.
3. A Classical Introduction to Modern Number Theory - K. Ireland and M. Rosen, Second Edition, New York: Springer-Verlag, 2010.

4. Elementary Number Theory - G. A. Jones And J. Mary Jones, Springer, 1998.
5. A Friendly Introduction To Number Theory - J. H. Silverman, 4th Edition, Pearson Prentice Hall, 2019.
6. Introduction to Operations Research – F. S. Hillier, G. J. Leiberman, 11th Edition, Mc Graw Hill, 2021.
7. Linear Programming and Game Theory - J. G. Chakraborty and P. R. Ghosh, Moulik Library.
8. Operations Research: An Introduction – H. A. Taha, 10th Edition, Pearson Education, 2019.
9. Operations Research – R. Panneerselvam, 3rd Edition, PHI Learning Pvt. Ltd., 2023.
10. https://www.nptelvideos.com/mathematics/
11. https://www.my-mooc.com/en/categorie/mathematics
12. https://ocw.mit.edu/courses/mathematics
13. https://tutorial.math.lamar.edu/
14. http://www.infocobuild.com/education/audio-video-courses/mathematics/mathematics.html

MATDSCP 6.2: Theory based Practical's on Number Theory and Linear Programming	
Teaching Hours : 4 Hours/Week	Credits: 2
Total Teaching Hours: 60 Hours	Max. Marks: 50 (S.A.-25 + I.A.-25)

Course Learning Outcomes: This course will enable the students to

- Learn Free and Open Source Software (FOSS) tools for computer programming.
- Solve problems on number theory and linear programming studied in MATDSCT 6.2 using wxMaxima software.
- Acquire knowledge of applications of algebra and calculus through wxMaxima.

Practical/Lab Work to be performed in Computer Lab

1. Program on fundamental concepts of number theory and linear programming.
2. Program to perform the division algorithm.
3. Program to find the gcd of two integers and expressing it as their linear combination.
4. Program to find the lcm of two integers.
5. Program to find the solution/s to a linear Diophantine equation in two variables.
6. Program to obtain the prime power factorization using the fundamental theorem of arithmetic.
7. Program to generate prime numbers up to a positive integer.
8. Program to find the solution/s to a linear congruence.
9. Program to find the ordered partitions of a positive integer.
10. Program to find the number and sum of positive divisors of a positive integer.
11. Program to find the Euler's phi function of a positive integer.
12. Program to find the optimal solution to a system of linear inequalities using graphical method.
13. Program to find the optimal solution to a system of linear inequalities using simplex method.

Question Paper Pattern for DSCT (I Semester to VI Semester)
4 Credits (S.A. - 60 + I.A. - 40)

Duration: 02 hours Max. Marks: 60

PART- A	
Answer any 4 questions	4 X 2 = 8
Question Numbers – 1 to 6	
PART- B	
Answer any 4 questions	4 X 3 = 12
Question Numbers –7 to 12	
PART- C	
Answer any 4 questions	4 X 5 = 20
Question Numbers – 13 to 18 (From Unit 1 and Unit 2)	
PART–D	
Answer any 4 questions	4 X 5 = 20
Question Numbers – 19 to 24 (From Unit 3 and Unit 4)	

Note: The question paper shall strictly adhere to the following blueprint:

Blueprint

Unit	Number of two marks questions	Number of three marks questions	Number of five marks questions	Total number of questions
Unit 1	01	02	03	06
Unit 2	02	01	03	06
Unit 3	01	02	03	06
Unit 4	02	01	03	06

Practical Examination Pattern for DSCT (I Semester to VI Semester)
2 Credits (S.A. - 25 + I.A. - 25)

Duration: 03 hours Max. Marks: 25

Marks Allotment	
Program writing*	05
Problem solving*	05
Program execution*	05
Viva-voce**	05
Record	05
Total	25 marks

Note:
*(i)A total of 3 programs should be given to each student. He/she has to write any two out of the three programs, solve the corresponding problems and then execute the program based on which the evaluation would be carried out.
**(ii) Viva-voce examination should be conducted based on the syllabus for the corresponding semester.

Question Paper Pattern for Open Elective Theory (MATOET)(I Semester to VI Semester)
(For open elective papers with practical's)
2 Credits (S.A. - 40 + I.A. - 20)

Duration: 02 hours Max. Marks: 40

PART- A	
Answer any 3 questions	3 X 2 = 06
Question Number	Unit
1 & 2	Unit- 01
3 & 4	Unit- 02
PART- B	
Answer any 3 questions	3 X 3 = 09
5 & 6	Unit- 01
7 & 8	Unit- 02
PART- C	
Answer any 5 questions	5 X 5 = 25
9, 10 & 11	Unit- 01
12, 13 & 14	Unit- 02

Note: The Open Elective Question papers should be set in both English and Kannada Language.

Practical Examination Pattern for Open Elective Practical's(MATOEP)
(I Semester to VI Semester)
(For open elective papers with practical's)
1 Credit (S.A. - 20+ I.A. - 20)

Duration: 02 hours Max. Marks: 20

Marks Allotment	
Program writing*	04
Problem solving*	04
Program execution*	04
Viva-voce**	04
Record	04
Total	20 marks

NOTE:

*(i)A total of 2 programs out of the given two programs should be given to each student. He/she has to write one program out of the given two programs, solve the corresponding problem and then execute the program based on which the evaluation would be carried out.

**(ii) Viva-voce examination should be conducted based on the syllabus for the corresponding semester.

Question Paper Pattern for Open Elective Theory (MATOET) (I Semester to VI Semester)
(For open elective papers without practical's)
3 Credits (S.A. - 60 + I.A. - 40)

Duration: 02 hours Max. Marks: 60

PART- A	
Answer any 6 questions	6 X 2 = 12
Question Number	Unit
1, 2 & 3	Unit- 01
4, 5 & 6	Unit- 02
7, 8 & 9	Unit- 03
PART- B	
Answer any 6 questions	6 X 3 = 18
10, 11 & 12	Unit- 01
13, 14 & 15	Unit- 02

16, 17 & 18	Unit -03
PART- C	
Answer any 6 questions	6 X 5 = 30
19, 20&21	Unit- 01
22, 23 & 24	Unit- 02
25, 26 & 27	Unit -03

Note: The Open Elective Question papers should be set in both English and Kannada Language.

Question Paper Pattern for Skill Enhancement Theory (MATSECT)
(I Semester to VI Semester) (For Skill Enhancement Theory papers with practical's)
2 Credits (S.A. - 30 + I.A. - 20)

Duration: 01 hour Max. Marks: 30

PART- A	
Answer any 3 questions	3 X 2 = 6
Question Number	Unit
1& 2	Theory
3 & 4	Practical's
PART- B	
Answer any 3 questions	3 X 3 = 9
5 & 6	Theory
7 & 8	Practical's
PART- C	
Answer any 3 questions	3 X 5 = 15
9 & 10	Theory
11 & 12	Practical's

Note*: Questions related to the practical component should be asked in the theory examination question paper. No separate practical examination shall be conducted.

Question Paper Pattern for Skill Enhancement Theory (MATSECT)
(I Semester to VI Semester) (For Skill Enhancement Theory papers without practical's)
2 Credits (S.A. - 30 + I.A. - 20)

Duration: 01 hour	Max. Marks: 30
PART- A	
Answer any 3 questions	3 X 2 = 6
Question Number	Unit
1& 2	Unit I
3 & 4	Unit II
PART- B	
Answer any 3 questions	3 X 3 = 9
5 & 6	Unit I
7 & 8	Unit II
PART- C	
Answer any 3 questions	3 X 5 = 15
9 & 10	Unit I
11 & 12	Unit II