Sangameshwar College, Solapur [Autonomous]

(Affiliated to Punyashlok Ahilyadevi Holkar Solapur University, Solapur)
Kannada Linguistic Minority Institute
NAAC Accredited with 'A' Grade (III Cycle CGPA 3.39)

Academic Council 3(3.3)
10th August, 2021

UG Science Programme: B.Sc.-II   To be implemented from A.Y. 2021-2022

System: Choice Based Credit System (CBCS) with SGPA and CGPA

B.O.S. in*: **Mathematics**

Syllabus for: Discipline Specific Core Courses (DSC-C and DSC-D)

Structure and Examination for: Discipline Specific Core Courses (DSC-1C and DSC-1D)

Table-3

Semester	Course			Teaching Scheme/week			
				Course Code	Hours	Lectures	Credits
III							
	DSC-1C		Theory Paper-V: Differential Calculus	2131305	4.8	6	4
			Theory Paper-VI: Laplace and Fourier Transform	2131306			
			Practical-II: Laplace and Fourier Transform & Differential Calculus	2131423	6.4	8	4
	SEC-1		Theory Paper-I: Gr.A: Programming skill using C–I	2131319	4.8	6	2
IV	AECC-C		ENVIRONMENTAL STUDIES	2131315	3.2	4	4
	DSC-1D		Theory Paper-VII: Differential Equations	2131405	4.8	6	4
			Theory Paper-VIII: Group Theory	2131406			
			Practical-III: Differential Calculus and Group Theory	2131423	6.4	8	4
	SEC-2		Theory Paper-II: Gr. A: Programming skill using C–II	2131428	4.8	6	2

Table-4

Semester	Course		EXAMINATION			Credits
			Marks			
			CA	SEE	Total	
III	DSC-1C	Theory Paper-V: Differential Calculus	15	35	50	2
		Theory Paper-VI: Laplace and Fourier Transform	15	35	50	2
	SEC-1	Theory Paper-I: Gr.A: Programming skill using C–I	15	35	50	2
IV	AECC-C	ENVIRONMENTAL STUDIES	15	35	50	4
	DSC-1D	Theory Paper-VII: Differential Equations	15	35	50	2
		Theory Paper-VIII: Group Theory	15	35	50	2
	SEC-2	Theory Paper-II: Gr. A: Programming skill using C–II	15	35	50	2
	DSC-1C & DSC-1D	Practical-II and III: Laplace and Fourier Transform, Differential Calculus, Group Theory	60	140	200	8

CA: Continuous Assessment   SEE: Semester End Examination

Note:-

The above structure (Table-3 and Table-4) is for Sem-III and Sem-IV of the undergraduate B.Sc.-II programmes* under science faculty.

*B.Sc.-II Select any three DSC form the four core courses opted at B.Sc.- I.

DSC: Discipline Specific Core Course AECC: Ability Enhancement Compulsory Course

SEC: Skill Enhancement Course

Passing in each course is compulsory including Environment Studies course.

SGPA/CGPA and Total Marks will be calculated excluding AECC course.

Passing in each course is compulsory. SGPA/CGPA and Total Marks will be calculated excluding AECC course.

Details Of Approved Syllabus of B. Sc. Part-II (MATHEMATICS)

B.Sc. II (Mathematics) (Honours) semester-wise Choice Based Credit System [CBCS] pattern to be implemented from September 2021. This syllabus of Mathematics carries 300 marks. In semester –III continuous assessment (CA) of 15 marks and semester end examination (SEE) of 35 marks [Total 35+15 =50] for Theory papers –DSC-C (Theory-I&II) each, and also in semester – IV for Theory papers – DSC-D (Theory-I&II) each and at the end of fourth semester practical examination in Mathematics entitled **Numerical Techniques In Laboratory-II (A&B)** [NTL-II (A and B)] [DSC-C&DSC-D] will be conducted.
 The distribution of marks is as follows.
Semester –III (DSC-C)
(1) DSC-C Theory-I   : Differential Calculus   **(Marks 35+15=50)**
(2) DSC-C Theory-II : Laplace and Fourier Transform   **(Marks 35+15=50)**

(3) DSC-D   Theory-I   : Differential Equations   **(Marks 35+15 = 50)**
(4) DSC-D   Theory-II : Group Theory   **(Marks 35+15 = 50)**
(5) Numerical Technique Laboratory-II (A&B) [NTL – II (A and B)]
   [DSC- C + DSC-D]   **(Marks 70+30 =100)**

Theory Examination: Continuous assessment (CA) of 15 marks and semester end examination (SEE) of 35 marks of all the above four theory papers will be conducted.

Practical Examination: Continuous assessment (CA) of 30 marks at the end of semester two and annual practical examination of 70 marks will be conducted.
(Marks Distribution: Journal (10) + Annual exam (60))

Duration of Annual Examination:
(i) For Paper –DSC- C Theory-I/II (Two hours) in semester –III.
(ii) For Paper – DSC-D Theory-I/II (Two hours) in semester –IV.
(iii) For NTL –II (A&B) [DSC- C+ DSC-D] (Three hours for a batch of 20 students for each practical's NTL-II A&B) Practical Examination will be conducted annually i.e. at the end of fourth semester.

Note:-

(1) Total teaching periods for each DSC-C Theory-I&II and DSC-D Theory-I&II are three (3) per week for each semester.
(2) Total teaching periods for NTL-II (A&B) [DSC- C+DSC-D] are four (4) per week per practical for whole class as one batch.

B.Sc II Mathematics (CBCS Pattern)
Discipline Specific Core Course (DSC-C)
Semester –III

Academic Council 3(3.3)
10th August, 2021

DSC-C Theory-I   MATHEMATICS-V (2131305)
Title: Differential Calculus

Credit: 2   **Marks: 50**
     Lectures: 36 Hours

Learning Objectives:
    To learn about:
- To find the equation of tangent line and normal line and length of tangent, normal, sub-tangent, subnormal at any point of a curve.
- To understand the concept of curvature of a curve.
- To understand the concept of Jacobian, Jacobian of function of function, Jacobian of implicit functions and condition of dependent functions.
- To be able to understand concept of Maxima and Minima for two and three variables.

Course Outcomes:
Upon successful completion of this course, the student will be able to:

- Evaluate the Tangents, Normals, Subtangent, Subnoral in Cartesian and Polar form.
- Derive Cartesian, Polar, Parametric and Pedal equation, radius of curvature and evaluate.
- Explain Jacobians and evaluate.
- Derive necessary and sufficient conditions for Extreme value.
- Find the Fourier transform of a function.

Unit-1 Tangents and Normals:
Equations of tangents and Normals, Angle of intersection of two curves, Length of tangent, normal, subtangent, subnormal at any point of a curve, Pedal equations or p, r equations (Cartesian form), Angle between radius vector and tangent, Length of the perpendicular from pole to the tangent, Length of polar subtangent and polar sub-normal, Pedal equations (polar form).

[10]

Unit-2 Curvature:
Definition of Curvature, Length of arc as a function, Radius of curvature, Cartesian Equation, Parametric Equations, Polar Equations, Pedal Equations.

[10]

Unit-3 Jacobians:
Definition of a Jacobian, Jacobian of a function of function, Jacobian of implicit function, Condition of dependent functions (statement only).
[6]

Unit- 4 Maxima and Minima:
Definiton of Maximum value and minimum value of a function of one, two variables, Necessary condition for extreme values (Statements only), sufficient condition for extreme values (Statements only), Use of second order derivatives. Maxima and Minima of a function of two variables, Lagrange's Method of undetermined multipliers of two variables and three variables. [10]

Recommended Book(Scope of Syllabus):
Differential Calculus by *Shanti Narayan and P.K.Mittal S.Chand Publication Revised Edition 2005.*
Unit 1 :7.2,7.3,7.4,7.5,7.6,7.7,7.8,7.9,7.10,7.11
Unit 2 :14.1,14.2,14.3.
Unit 3 :12.1,12.2,12.3,12.4
Unit 4 : 9.1,9.2,9.3,9.4, 9.6

Reference Books
1. Dr. Alandkar S. J., Prof. Dhanshetti N. I., Prof. Dhone A. S. and Prof. Mahimkar R. D. , B. Sc. – II (Mathematics) Semester-III, Paper –V Differential Calculus , Nirali Prakashan Pune.
2. Dr. Jadhav .B.P, Prof. Mahajan A. M., Prof. Gade S. P. and Prof. Kokare. B. D. ,B. Sc. – II (Mathematics) Semester-III, Paper –V Differential Calculus , Phadke Prakashan Kolapur .
3. Gorakh Prasad, Differential Calculus, Pothishala Pvt. Ltd., Allahabad
4. N. Piskunov, Differential and Integral Calculus, Peace Publishers, Moscow

5. P. N. Wartikar and J. N. Wartikar, A Text Book of Applied Mathematics, Vol. I, Poona Vidyarthi Griha Prakashan, Poona 30.
6. Tom M. Apostol, Calculus Vol. I and II, Wiley Publication

B.Sc II Mathematics (CBCS Pattern)
Discipline Specific Core Course (DSC-C)
Semester –III

Academic Council 3(3.3)
10th August, 2021
DSC-C Theory-II   MATHEMATICS-VI (2131306)
Title: Laplace and Fourier Transform

Credit: 2   **Marks: 50**
                                                                        Lectures: 36 Hours

Learning Objectives:

- The students will have to memorize and explain definitions, formulas, equations and theorems and learn certain techniques.
- To learn about the Laplace transforms, properties of Laplace transform and inverse Laplace Transform.
- To learn about the method of Laplace transform to solve some differential equations.
- To learn about the finite Fourier Transform, properties of Sine and Cosine transform and their applications.

Course Outcomes:
Upon successful completion of this course, the student will be able to:
- Evaluate the Laplace transform of a function.
- Evaluate time function by using inverse LT.
- Derive necessary and sufficient conditions of existence of a Laplace Transform.
- Solve ordinary and partial differential equations using Laplace transform technique.
- Find the Fourier transform of a function.

Unit-1 Laplace Transform

Integral Transform (Definition), Laplace Transform (Definition), Linearity property of Laplace Transform, Piecewise continuous functions, Existence of Laplace Transform, Functions of exponential order functions of Class A, First Translation or Shifting Theorem, Second Translation or Shifting Theorem, Change of Scale Property, Laplace Transform of the derivatives of F(t), Laplace Transform of the **nth** order derivatives of F(t), Initial value theorem, Final value theorem, Laplace Transform of Integrals, Multiplication by t, Multiplication by t^n, Division by t, Evolution of Integrals, periodic functions.   [10]

Untit-2 Inverse Laplace Transform

Inverse Laplace Transform, Null Function, Linearity Property, Table of Inverse Laplace Transform, First Translation or Shifting Theorem, Second Translation or Shifting Theorem, Change of Scale Property, Use of Partial function, Inverse Laplace Transform of the derivatives, Inverse Laplace Transform of Integrals, Multiplication by powers of p, Division by powers of p, Convolution (definition), Convolution theorem, Heaviside's expansion formula, Beta function.   [10]

Unit-3 Applications of Laplace Transforms

Ordinary Differential equations with constant coefficients, Ordinary Differential equations with variable coefficients and Partial differential equations.   [6]

(Examples 1 to 10, 26 to 29, 34 to 39 only)

Unit-4 Fourier Transform

Dirichlet's condition, Fourier series, Fourier integral formula, Fourier transform or complex Fourier Transform, Fourier sine transform, Inversion formula for Fourier sine formula(statements only), Fourier cosine formula and its inversion formula(statement only). Linearity property, change of scale property, Modulation theorem and its applications.
(Examples 1 to 10 only)   [10]

Recommended Books for Paper – VI (Integral Transform):

Integral Transform by *Vasistha* A.R., Gupta R.K., Krishna Prakashan *Media Pvt. Ltd. 11. Shivaji Road, Meerut India.*
Unit 1: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 1.10, 1.11, 1.12, 1.13, 1.14, 1.15, 1.16, 1.17, 1.18, 1.19, 1.20, 1.21.
Unit 2: 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10, 2.11, 2.12, 2.13, 2.14, 2.15, 2.16, 2.17
Unit 3: 3.1, 3.2, 3.4, (Examples 1 to 10, 26 to 29, 34 to 39 only)
Unit 4: 6.1 to 6.15(Examples 1 to 10 only)

Reference Books:

1. The Laplace Transform by Rainville E.D.
2. Integral Transform by Dr. J.R. Goyal and K.P. Gupta, Pragati Prakashan Meerut.
3. Differential equation by Sharma and Gupta, Krishna Prakashan Media Co.Meerut
4. Integral Transform and their Applications by Lokenath Debnath, CRC Press.
5. An introduction to Lapace Tranforms and Fourier series by Phill Dyke , Springer publication.

Academic Council 3(3.3)
10ᵗʰ August, 2021
DSC-D Theory-I   MATHEMATICS-VII (2131405)
Title: Differential Equations

Credit: 2   **Marks: 50**
                                                                        Lectures: 36 Hours

Learning Objectives:

- To understand the preliminary theory on differential equations of the first order and of degree higher than the first, to identify the types of equation, and to apply the suitable method of solution.
- To learn about the homogeneous second order ODE and to apply the method of solution.
- To learn about the types of linear equations of second order and their method of solutions.
- To learn about the Simultaneous and Total differential equations and the methods of solution.

Course Outcomes:
Upon successful completion of this course, the student will be able to:

- Solve first order and degree higher than first using various methods and Clairauts equations.
- Solve homogeneous and second order ODE by using various types and substitutions.
- Explain the methods of solving homogeneous (2-types) and second order equation (3-types) and its applications.
- Evaluate CF and PI in each case.
- Explain the condition of integrability.

Unit 1:- Differential Equations of the first order and of degree higher than the first:
Equations that can be resolved into factors of the first degree, Equations solvable for x, Equations solvable for y, Clairaut's equation, Equations reducible to Clairaut's form.
                                                                                        [8]

Unit 2: Linear Equations of the second order:
General form of the second order linear equation, complete solution when one integral belonging to complementary function is known, Rules of getting an integral belonging to complementary function, Removal of the First order Derivative. Transformation of the linear equation of second order by change of the independent variable.   [12]

Unit 3: Homogeneous linear equations:
Homogeneous linear equations, working rule for finding the solution, Equations reducible to Homogeneous form.   [8]

Unit4: Simultaneous and Total Differential equations:

Nature of the solution of simultaneous equations, Rules of solving the Equation, Total Differential Equation, Necessary and sufficient condition for the integrability of total differential equation (proof of Necessity only), Condition for exactness, criterion for exactness, method of solving the equation.   [8]

Recommended Book:

Differential Equation:

Ordinary and Partial Differential Equations:
 by *M.D. Raisinghania, S.Chand Co. Ltd. Ramanagar, New Delhi-110055(Edition2002)*

Unit 1 (Part I):6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.9, 6.10, 6.11, 6.12.
Unit 2 (Part I):5.1, 5.2, 5.3, 5.6, and 5.7.
Unit 3 (Part II):4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 4.10, 4.11.
Unit 4 (Part II) :5.1,5.2, 5.4,5.5,5.6,5.7.
Unit 5 (Part II):6.1, 6.2, 6.3, 6.4, 6.5, 6.6, and 6.7.

Reference Books:

1.Dr. Alandkar S. J., Prof. Dhanshetti N. I., Prof. Dhone A. S. and Prof. Mahimkar R. D. , B. Sc. – II (Mathematics) Semester-IV, Paper –VII Differential Equation , Nirali Prakashan Pune.
2. Dr. Jadhav .B.P, Prof. Mahajan A. M., Prof. Gade S. P. and Prof. Kokare. B. D. , B. Sc. – II (Mathematics) Semester-III, Paper –V Differential Equation, Phadke Prakashan Kolapur .
3. Differential Equation by Murrey.
4. Differential Equation by Diwan and Agashe
5. Differential Equation by Sharma-Gupta, Krishna Prakashan Media (Pvt.) Ltd, Meerut.

<div align="center">

B.Sc II Mathematics (CBCS Pattern)
Discipline Specific Core Course (DSC-D)
Semester –IV
</div>

Academic Council 3(3.3)
10th August, 2021
<div align="center">

DSC-D Theory-II   MATHEMATICS-VIII (2131406)
Title: Group Theory
</div>

Credit: 2   **Marks: 50**
                                                                                Lectures: 36 Hours

Learning Objectives:

    To learn about to:
- Define the meaning of Group and subgroup, to describe the formation and theories of group.

- Solve all type of problems on equivalence, congruence and divisibility.
- Understand the idea of isomorphism, properties of isomorphism and theorems.
- Understand Homomorphism, kernel, quotient group and fundamental theorem of homomorphism.

Course Outcomes:

Upon successful completion of this course, the student will be able to:
- Identify algebraic structures as groups.
- Explain Equivalence, Congruence and Divisibility.
- Explain cyclic, normal groups and theorems.
- Explain group homomorphism.

Unit-1: Groups and subgroups

Permutations, Subgroups, Groups and symmetry, Elementary Properties of Groups, Generators, Direct products, Cosets, Lagrange's Theorem, Cayley's Theorem.

[10]

Unit -2: Equivalence, Congruence, Divisibility

Equivalence relation and partitions, Congruence and Division Algorithm, Integer Modulo n, Greatest Common Divisors, The Euclidean Algorithm, Factorization, Euler's Phi Function.

[8]

Unit-3: Isomorphism of Group

Isomorphism, automorphism, homomorphism, epimorphism, monomorphism, properties of isomorphic groups, Cayley's theorem, solved problems and exercises.

[10]

Unit-4: Group Homomorphism

Homomorphism of Groups, Kernels, Quotient Groups, the Fundamental theorem of Homomorphism.   [8]

Recommended books (Scope of Syllabus):

Modern Algebra-An Introduction, by John R. Durbin, John Wiley & Sons, Inc. Fifth Edition
Unit – 1 : Chapter-II: Art. 5,6,7,8
Unit – 2 : Chapter-III: Art. 9,10,11,12
Unit – 4 : Chapter-IV : Art. 14,15,16,17,18,19,20 Ch- V : 21,22,23

Conteporary Abstract Algebra by Joseph A Galian. Narosa Publishing house. Fourth edition.

Unit3: Chapter-6

Reference Books:

1. Dr. Alandkar S. J., Prof. Dhanshetti N. I., Prof. Dhone A. S. and Prof. Mahimkar R. D. , B. Sc. – II (Mathematics) Semester-IV, Paper –VIII: Abstract Algebra -I, Nirali Prakashan Pune.

2. Dr. Jadhav B.P, Prof. Mahajan A. M., Prof. Gade S. P. and Prof. Kokare. B. D. B. Sc. – II (Mathematics) Semester-III, Paper VIII: Abstract Algebra -I, –, Phadke Prakashan Kolapur

3. A First Course In Abstract Algebra J. B. Fraleigh Pearson Education 7th edition.

4. University Algebra N.S. Gopalkrishnan.

5. Abstract Algebra David S. Dummit & Richard M. Foote Wiley & Sons, Inc.

6. Fundamentals of Abstract Algebra D. S. Malik & N. Mordeson & M. K.

Sen Mc. Graw Hill International Edition.

7. A Course in Abstract Algebra by Vijay K. Khanna and S.K. Bhambri, Vikas Publishing House Pvt. Ltd.

B.Sc-II Mathematics (CBCS Pattern)

Academic Council 3(3.3)
10th August, 2021

Practical Course

Numerical Technique In Laboratory [NTL – II (A&B)]

NTL – II (A)

[DSC-C&DSC-D] Four periods per week

(Differential Calculus and Group Theory)

Mathematics Practical-II (2131421)

Credit: 2   **Marks: 100**

Lectures: 4 periods per week

List of Problem solving sessions for DSC-C & DSC-D

Assignment No.1: Tangents and Normals

Assignment No.2: Curvature

 Assignment No.3: Jacobians

Assignment No. 4: Maxima and Minima

Assignment No.5: Groups and subgroups

Assignment No.6: Equivalence, Congruence, Divisibility.

Assignment No.7: Group Homomorphism

Assignment No.8: Isomorphism of Group

NTL – II (B)

[DSC-C&DSC-D] Four periods per week

(Laplace and Fourier Transforms and Differential Equations)

Mathematics Practical-III (2131421)

Credit: 2   **Marks: 100**

Lectures: 4 periods per week

List of Problem solving sessions for DSC-C & DSC-D

Assignment No. 9: Laplace Transform

Assignment No. 10: Inverse Laplace Transform

Assignment No. 11: Application of Laplace Transform

Assignment No. 12: Fourier Transform

Assignment No. 13: Differential Equations of the first order and of degree

higher than the first.

Assignment No. 14: Linear Equations of the second order (Part –I)

Assignment No. 15: Linear Equations of the second order & Homogeneous

linear equations (Part –II)

Assignment No.16: Simultaneous Equations & Total Differential Equations

Dhone A S
Chairman