



KARNATAK UNIVERSITY, DHARWAD  
ACADEMIC (S&T) SECTION  
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ  
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ



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NAAC Accredited  
'A' Grade 2014

website: kud.ac.in

No.KU/Aca(S&T)/RPH-394A/2021-22/1155

Date: 29 OCT 2021

ಅಧಿಸೂಚನೆ

ವಿಷಯ: 2021-22ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಎಲ್ಲ ಸ್ನಾತಕ ಕೋರ್ಸುಗಳಿಗೆ 1 ಮತ್ತು 2ನೇ ಸೆಮಿಸ್ಟರ್  
NEP-2020 ಮಾದರಿಯ ಪಠ್ಯಕ್ರಮವನ್ನು ಅಳವಡಿಸಿರುವ ಕುರಿತು.

- ಉಲ್ಲೇಖ: 1. ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿಗಳು(ವಿಶ್ವವಿದ್ಯಾಲಯ 1) ಉನ್ನತ ಶಿಕ್ಷಣ ಇಲಾಖೆ ಇವರ ಆದೇಶ  
ಸಂಖ್ಯೆ: ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ-1), ದಿ:7.8.2021.  
2. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ದಿನಾಂಕ: 19.08.2021  
3. ಈ ಕಚೇರಿ ಸುತ್ತೋಲೆ ಸಂ.No. KU/Aca(S&T)/RPH-394A/2021-22/18 ದಿ:21.08.2021.  
4. ಸರ್ಕಾರಿ ಆದೇಶ ಸಂ ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ-1),ಬೆಂಗಳೂರು ದಿ. 15.9.2021.  
5. ಎಲ್ಲ ಅಭ್ಯಾಸಸೂಚಿ ಮಂಡಳಿ ಸಭೆಗಳ ನಡವಳಿಗಳು  
6. ಎಲ್ಲ ನಿಖಾಯಗಳ ಸಭೆಗಳು ಜರುಗಿದ ದಿನಾಂಕ: 24.25-09-2021.  
7. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 01 ದಿನಾಂಕ: 28.9.2021.  
8. ಈ ಕಚೇರಿ ಸುತ್ತೋಲೆ ಸಂ.No. KU/Aca(S&T)/RPH-394A/2021-22/954 ದಿ:30.09.2021.  
9. ಎಲ್ಲ ನಿಖಾಯದ ಡೀನರು / ಸಂಪನ್ಮೂಲ ತಜ್ಞರ ಸಭೆ ದಿನಾಂಕ 21.10.2021.  
10. ಎಲ್ಲ ಸ್ನಾತಕ ಅಭ್ಯಾಸಸೂಚಿ ಮಂಡಳಿ ಅಧ್ಯಕ್ಷರುಗಳ ಸಭೆ ದಿನಾಂಕ 22.10.2021.  
11. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 01 ದಿನಾಂಕ: 27.10.2021.  
12. ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶ ದಿನಾಂಕ: 29-10-2021

ಮೇಲ್ಕಾಣಿಸಿದ ವಿಷಯ ಹಾಗೂ ಉಲ್ಲೇಖಗಳನ್ವಯ ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶದ ಮೇರೆಗೆ, 2021-22ನೇ  
ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಅನ್ವಯವಾಗುವಂತೆ, ಎಲ್ಲ B.A./ BPA (Music)/BVA/ BTM/ BSW/ B.Sc./B.Sc. Pulp & Paper  
Science/ B.Sc. (H.M)/ BCA/ B.A.S.L.P./ B.Com/ B.Com (CS)/ & BBA ಸ್ನಾತಕ ಕೋರ್ಸುಗಳ 1 ಮತ್ತು 2ನೇ  
ಸೆಮಿಸ್ಟರ್‌ಗಳಿಗೆ NEP-2020 ರಂತೆ ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ಅನುಮೋದಿತ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಈಗಾಗಲೇ  
ಪ್ರಕಟಪಡಿಸಿದ್ದು, ಮುಂದೆ ದಿನಾಂಕ 04.10.2021 ವರೆಗೆ ಸರ್ಕಾರವು ಕಾಲಕಾಲಕ್ಕೆ ನೀಡಿದ ನಿರ್ದೇಶನಗಳನ್ನು ಅಳವಡಿಸಿಕೊಂಡು  
ದಿನಾಂಕ 27.10.2021 ರಂದು ಜರುಗಿದ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯಲ್ಲಿ ಅನುಮೋದನೆ ಪಡೆದು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ  
[www.kud.ac.in](http://www.kud.ac.in) ದಲ್ಲಿ ಭಿತ್ತರಿಸಲಾಗಿದೆ. ಸದರ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲದಿಂದ ಡೌನ್‌ಲೋಡ್ ಮಾಡಿಕೊಳ್ಳಲು  
ಸೂಚಿಸುತ್ತ ವಿದ್ಯಾರ್ಥಿಗಳ ಹಾಗೂ ಸಂಬಂಧಿಸಿದ ಎಲ್ಲ ಬೋಧಕರ ಗಮನಕ್ಕೆ ತಂದು ಅದರಂತೆ ಕಾರ್ಯಪ್ರವೃತ್ತರಾಗಲು ಕವಿವಿ  
ಅಧೀನದ/ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ ಸೂಚಿಸಲಾಗಿದೆ.

ಆಡಕ: ಮೇಲಿನಂತೆ  
ಗೆ,

ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವ್ಯಾಪ್ತಿಯಲ್ಲಿ ಬರುವ ಎಲ್ಲ ಅಧೀನ ಹಾಗೂ ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ  
ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ. (ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ ಹಾಗೂ ಮಿಂಚಂಚೆ ಮೂಲಕ ಬಿತ್ತರಿಸಲಾಗುವುದು)

ಪ್ರತಿ:

1. ಕುಲಪತಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
2. ಕುಲಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
3. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ) ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
4. ಅಧೀಕ್ಷಕರು, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ / ಗೌಪ್ಯ / ಜಿ.ಎ.ಡಿ. / ವಿದ್ಯಾಮಂಡಳ (ಪಿ.ಜಿ.ಪಿ.ಎಚ್.ಡಿ) ವಿಭಾಗ, ಸಂಬಂಧಿಸಿದ  
ಕೋರ್ಸುಗಳ ವಿಭಾಗಗಳು ಪರೀಕ್ಷಾ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
5. ನಿರ್ದೇಶಕರು, ಕಾಲೇಜು ಅಭಿವೃದ್ಧಿ / ವಿದ್ಯಾರ್ಥಿ ಕಲ್ಯಾಣ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.

*Haniff 29/10/21*  
ಕುಲಸಚಿವರು.



**KARNATAK UNIVERSITY, DHARWAD**

## **04 - Year B.Sc. (Hons.) Program**

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### **SYLLABUS**

**Subject: Mathematics**

**[Effective from 2021-22]**

**DISCIPLINE SPECIFIC CORE COURSE (DSCC) FOR SEM I & II,  
OPEN ELECTIVE COURSE (OEC) FOR SEM I & II and  
SKILL ENHANCEMENT COURSE (SEC) FOR SEM I**

**AS PER NEP - 2020**

**Karnatak University, Dharwad**  
**Four Years Under Graduate Program in Mathematics for B.Sc. (Hons.)**  
**Effective from 2021-22**

Sem	Type of Course	Theory/ Practical	Instruction hour per week	Total hours of Syllabus / Sem	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks	Credits
I	DSCC 1	Theory	04 hrs	56	02 hrs	40	60	100	04
		Practical	04 hrs	52	03 hrs	25	25	50	02
	OEC-1	Theory	03 hrs	42	02 hrs	40	60	100	03
	*SEC-1	Practical	03 hrs	30	02 hrs	25	25	50	02
II	DSCC2	Theory	04 hrs	56	02 hrs	40	60	100	04
		Practical	04 hrs	52	03 hrs	25	25	50	02
	OEC-2	Theory	03 hrs	42	02 hrs	40	60	100	03
<b>Details of the other Semesters will be given later</b>									

\* Student can opt digital fluency as SEC or the SEC of his/ her any one DSCC selected

**Name of Course (Subject): Mathematics**

**Programme Specific Outcome (PSO):**

On completion of the 03/ 04 years Degree in Mathematics students will be able to:

- PSO 1 : Culminate in-depth knowledge of Algebra, Calculus, Geometry, differential equations and several other branches of mathematics and also in other allied subjects.**
- PSO 2 : To communicate various mathematical concepts effectively using examples and their geometrical visualization which can be used for modeling and solving of real life problems.**
- PSO 3 : Acquire ability of critical thinking and logical reasoning and capability of recognizing and distinguishing the various aspects of real life problems.**
- PSO 4 : Develop an ability to analyze the problems, identify and define appropriate computing requirements for its solutions.**
- PSO 5 : Develop the capability of inquiring about appropriate questions relating to the Mathematical concepts in different areas of Mathematics.**
- PSO 6 : Use appropriate softwares to solve system of algebraic equation and differential equations.**
- PSO 7 : Develop an ability of working independently and to make an in-depth study of various notions of Mathematics.**
- PSO 8 : Develop an ability to identify unethical behavior 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.**
- PSO 9 : Think independently and develop algorithms and computational skills for solving real word problems.**
- PSO 10 : Peruse advanced studies and research in Mathematical sciences.**

# B.Sc. Semester – I

## Subject: Mathematics Discipline Specific Course (DSC)

The course Mathematics in I semester has two papers (Theory Paper –I for 04 credits & Practical Paper -II for 2 credits) for 06 credits: Both the papers are compulsory. Details of the courses are as under.

### Course No.-1 (Theory)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
<b>Course-01</b>	DSCC	Theory	04	04	56 hrs	2 hrs	40	60	100

Course No.1 (Theory): Title of the Course (Theory): **Algebra - I and Calculus - I**

### Course Outcome (CO):

After completion of course (Theory), students will be able to:

- CO 1:** Learn to solve the system of homogeneous and non homogeneous linear equations in m variables by using concept of rank of matrix, finding eigenvalues and eigenvectors.
- CO 2:** Sketch curves in Cartesian, polar and pedal equations.
- CO 3:** Learn geometrical representation and problem solving on MVT and Rolls theorems.
- CO 4:** Get familiar with the techniques of integration and differentiation of function with real variables.
- CO 5:** Identify and apply the intermediate value theorems and L'Hospital rule and Trace the curves.

<b>Syllabus- Course 1(Theory): Title- Algebra - I and Calculus - I</b>	<b>Total Hrs: 56</b>
<b>Unit-I</b>	<b>14 hrs</b>
<b>Matrices:</b> Elementary row and column transformations, Row reduction to Echelon form. Rank of a matrix; Reduction to normal form; Solution of system of linear equations by Gauss Elimination and Gauss-Jordan methods. Condition for existence of non-trivial solutions of homogeneous system of linear equations. Solution of non-homogeneous system of linear equations. Eigenvalues and Eigenvectors of square matrices, real symmetric matrices and their properties, reduction of such matrices to diagonal form, Cayley-Hamilton theorem (without proof), inverse of matrices by Cayley-Hamilton theorem.	
<b>Unit-II</b>	<b>14 hrs</b>
<b>Differentiation in polar Co-ordinates:</b> Polar coordinates, angle between the radius vector and tangent. Angle of intersection of curves (polar forms), Length of perpendicular from pole to the tangent, pedal equations. Derivative of an arc length in Cartesian, parametric and polar forms, curvature of plane curve-radius of curvature formula in Cartesian, parametric and polar and pedal forms. - center of curvature, Asymptotes, Evolutes and envelops of plane curves.	

<b>Unit-III</b>	<b>14 hrs</b>
<b>Differential Calculus:</b> Limits and Continuity, $\varepsilon$ - $\delta$ from definition only. Differentiability: Definition and Problems, Properties of continuous functions, Intermediate value theorem, Rolles Theorem, Lagranges Mean Value Theorem, Cauchy's Mean Value Theorem. Taylor's theorem (without proof), Taylor's series, Maclaurin's expansions, Indeterminate forms: Evaluation of Limits using L-Hospital rule.	
<b>Unit-IV</b>	<b>14 hrs</b>
<b>Successive Differentiation:</b> nth Derivatives of Standard functions $e^{ax+b}$ , $(ax + b)^n$ , $\log(ax + b)$ , $\sin(ax + b)$ , $\cos(ax + b)$ , $e^{ax}\sin(bx + c)$ , $e^{ax}\cos(bx + c)$ , Leibnitz theorem and its applications. Tracing of Curves (standard curves).	

Books recommended.

1. University Algebra - N.S. Gopala Krishnan, New Age International (P) Limited
2. Theory of Matrices - B S Vatsa, New Age International Publishers.
3. Matrices - A R Vasista, Krishna Prakashana Mandir.
4. Elements of Real Analysis - Shanti Narayan, S. Chand & Company, New Delhi.
5. Differential Calculus - Shanti Narayan, S. Chand & Company, New Delhi.
6. Calculus – Lipman Bers, Holt, Rinehart & Winston.
7. Calculus - S Narayanan & T. K. Manicavachogam Pillay, S. Viswanathan Pvt. Ltd., vol. I & II.
8. Schaum's Outline of Calculus - Frank Ayres and Elliott Mendelson, 5th ed. USA: Mc. Graw.

## B.Sc. Semester – I

**Subject: Mathematics**  
**Discipline Specific Course (DSC)**

### Course No.-1 (Practical)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-01	DSCC	Practical	02	04	52 hrs	3 hrs	25	25	50

Course No.1 (Practical): Title of the Course (Practical): **Practicals on Algebra - I and Calculus – I**

### Course Outcome (CO):

After completion of course (Practical), students will be able to:

**CO 1:** Learn Free and Open Source Software (FOSS) tools for computer programming

**CO 2:** Solve problem on algebra and calculus using FOSS softwares.

**CO 3:** Acquire knowledge of applications of algebra and calculus through FOSS.

### List of the Experiments for 52 hrs / Semesters

Introduction to the software and commands related to the topic.

1. Computation of addition and subtraction of matrices.
2. Computation of Multiplication of matrices.
3. Computation of Trace and Transpose of Matrix
4. Computation of Rank of matrix and Row reduced Echelon form.
5. Computation of Inverse of a Matrix using Cayley-Hamilton theorem.
6. Solving the system of homogeneous and non-homogeneous linear equations.
7. Finding the nth Derivative of  $e^{ax}$ , trigonometric and hyperbolic functions
8. Finding the nth Derivative of algebraic and logarithmic functions.
9. Finding the nth Derivative of  $e^{ax}\sin(bx + c)$ ,  $e^{ax}\cos(bx + c)$ .
10. Finding the Taylor's and Maclaurin's expansions of the given functions.
11. Finding the angle between the radius vector and tangent.
12. Finding the curvatures of the given curves.
13. Tracing of standard curves.

**General instructions: Suggested Softwares:** Maxima/Scilab/Maple/MatLab/Mathematica/Python/R.

**Scheme of Practical Examination (distribution of marks): 25 marks for Semester end examination**

- 1. Programme writing and problem solving: 10 Marks**
- 2. Programme Execution: 5 Marks**
- 3. Viva: 5 Marks**
- 4. Journal: 5 Marks**

**Total 25 marks**

**Note: Same Scheme may be used for IA (Formative Assessment) examination**

Books recommended.

1. Scilab by example: M. Affouf 2012, ISBN: 978-1479203444
2. Scilab (A free software to Matlab): H. Ramchandran, A.S.Nair.2011S.Chand and Company
3. Scilab for very beginners. - [www.scilab-enterprises.com](http://www.scilab-enterprises.com)
4. University Algebra - N.S. Gopala Krishnan, New Age International (P) Limited
5. Theory of Matrices - B S Vatsa, New Age International Publishers.
6. Matrices - A R Vasista, Krishna Prakashana Mandir.
7. Elements of Real Analysis - Shanti Narayan, S. Chand & Company, New Delhi.
8. Differential Calculus - Shanti Narayan, S. Chand & Company, New Delhi.
9. Calculus – Lipman Bers, Holt, Rinehart & Winston.
10. Calculus - S Narayanan & T. K. Manicavachogam Pillay, S. Viswanathan Pvt. Ltd., vol. I & II.
11. Schaum's Outline of Calculus - Frank Ayres and Elliott Mendelson, 5th ed. USA: Mc. Graw.

## B.Sc. Semester – I

**Subject: Mathematics**  
**Open Elective Course (OEC-1)**  
**(OEC for other students)**

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
OEC-1	OEC	Theory	03	03	42 hrs	2 hrs	40	60	100

OEC-1: Title of the Course: **Business Mathematics-I**

### Course Outcome (CO):

After completion of course, students will be able to:

- CO 1:** Apply sets, relations, functions in business.
- CO 2:** Use permutations and combinations.
- CO 3:** Use matrices in commercial field.
- CO 4:** Apply trigonometric function in real world.

<b>Syllabus- OEC: Title- Business Mathematics-I</b>	<b>Total Hrs: 42</b>
<b>Unit-I</b>	<b>14 hrs</b>
<b>Algebra:</b> Sets, relations, functions, indices, logarithms, permutations and combinations, Examples on commercial mathematics	
<b>Unit-II</b>	<b>14 hrs</b>
<b>Matrices:</b> Definition of a matrix; types of matrices; Algebra of matrices, Determinants, Properties of determinants; calculations of values of determinants up to third order. Adjoint of a matrix, elementary row and column operations; solution of a system of linear equations involving not more than three variables. Examples on commercial mathematics	
<b>Unit-III</b>	<b>14 hrs</b>
<b>Trigonometric Functions:</b> Recapitulation of basic Definitions of trigonometric functions. Signs of trigonometric functions and sketch of their graphs. Trigonometric functions of sum and difference of two angles. Trigonometric ratios of multiple angles (Simple problems).	

Books recommended.

1. Allel R.G.A: Basic Mathematics: Macmilan, New Delhi.
2. Dowling, E.T. Mathematics for Economics: Schaum Series, McGraw Hill, London.
3. Soni R.S.: Business Mathematics: Pitamber Publishing House, Delhi
4. N. Rudraiah and Others: College Mathematics for B.Sc Series I and II SBS Publication Co. Bangalore.



## B.Sc. Semester - I

Subject: Mathematics  
SKILL ENHANCEMENT COURSE (SEC)-I

### Title of Paper: Scilab

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Mode of Examination	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
SEC-I	Theory + Practical	02	03 hrs	30	Practical	2 hrs	25	25	50

#### Course Outcome (CO):

After completion of Skill Enhancement course, students will be able to:

- CO 1:** Understand the Scilab and apply commands in Scilab
- CO 2:** Use looping in Scilab
- CO 3:** Build Scilab functions
- CO 4:** Plot graphs
- CO 5:** Develop skills to write programme in Scilab

Syllabus- SEC: Title- Scilab	Total Hrs: 30
<b>Unit-I</b>	<b>15 hrs</b>
Introduction to Scilab, The general environment, The editor, Command Window, graphics window, window management and workspace customization, Variables assignments, display array in terms of matrices and vectors, Displaying output data, data file, Scilab functions.	
<b>Unit-II</b>	<b>15 hrs</b>
Relational and logical operators, Branching Statements and program design, Loops, the while loop, for loop, Tests, 2D and 3D plotting, developing the skills of writing a program Solving differential equations	

#### Scheme of Practical Examination (distribution of marks): 25 marks for Semester end examination

1. Programme writing and problem solving: 10 Marks
2. Programme Execution: 5 Marks
3. Viva: 5 Marks
4. Journal: 5 Marks

**Total 25 marks**

**Note: Same Scheme may be used for IA( Formative Assessment) examination**

Books recommended.

1. Scilab by example: M. Affouf 2012, ISBN: 978-1479203444
2. Scilab (A free software to Matlab): H. Ramchandran, A.S.Nair.2011S.Chand and Company
3. Scilab for very beginners. - [www.scilab-enterprises.com](http://www.scilab-enterprises.com)

**Details of Formative assessment (IA) for DSCC theory/OEC: 40% weightage for total marks**

Type of Assessment	Weightage	Duration	Commencement
Written test-1	10%	1 hr	8 <sup>th</sup> Week
Written test-2	10%	1 hr	12 <sup>th</sup> Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	-----	--
Total	40% of the maximum marks allotted for the paper		

**Faculty of Science  
04 - Year UG Honors programme:2021-22**

**GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC  
(60 marks for semester end Examination with 2 hrs duration)**

**Part-A**

1. Question number 1-06 carries 2 marks each. Answer any 05 questions : 10marks

**Part-B**

2. Question number 07- 11 carries 05Marks each. Answer any 04 questions : 20 marks

**Part-C**

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

**Total: 60 Marks**

**Note: Proportionate weightage shall be given to each unit based on number of hours prescribed.**



# B.Sc. Semester – II

**Subject: Mathematics**  
**Discipline Specific Course (DSC)**

The course Mathematics in II semester has two papers (Theory Paper –I for 04 credits & Practical paper-II for 2 credits) for 06 credits: Both the papers are compulsory. Details of the courses are as under.

## Course No.-2 (Theory)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
<b>Course-02</b>	DSCC	Theory	04	04	56 hrs	2 hrs	40	60	100

Course No.2 (Theory): Title of the Course (Theory): **Algebra - II and Calculus - II**

### Course Outcome (CO):

After completion of course (Theory), students will be able to:

- CO 1:** Recognize the countable set and groups.
- CO 2:** Link the fundamental concepts of groups and symmetries of geometrical objects.
- CO 3:** Explain the significance of the notions of Cosets, normal subgroups and factor groups.
- CO 4:** Finding the extreme values of functions.
- CO 5:** Evaluate multiple integration.

Syllabus- Course 2 (Theory): Title- Algebra - II and Calculus - II	Total Hrs: 56
<b>Unit-I</b>	<b>14 hrs</b>
<b>Real Number System:</b> Countable and uncountable sets-standard theorems. Real line, Bounded sets, supremum and infimum of a set, completeness properties of $\mathbb{R}$ , Archimedean property of $\mathbb{R}$ . Intervals, neighbourhood of a point, open sets, closed sets, limit points and Bolzano-Weierstrass theorem (without proof).	
<b>Unit-II</b>	<b>14 hrs</b>
<b>Groups:</b> Definition of a group with examples and properties, congruence, problems. Subgroups, center of groups, definition of order of an element of a group and its related theorems, cyclic groups, Coset decomposition, Factor groups, Lagrange's theorem and its consequences. Fermat's theorem and Euler's $\phi$ function.	
<b>Unit-III</b>	<b>14 hrs</b>
<b>Multivariate Calculus:</b> Functions of two or more variables, explicit and implicit functions, Partial derivatives of implicit and composite functions. Homogeneous functions- Euler's theorem and its extension. Total differentials, Jacobians and standard properties and illustrative examples. Taylor's and Maclaurin's series for functions of two variables, Maxima-Minima of functions of two variables. Lagrange's method of undetermined multipliers.	

<b>Unit-IV</b>	<b>14 hrs</b>
<b>Integral Calculus:</b> <i>Line integral:</i> Definition of line integral and basic properties, examples on evaluation of line integrals. <i>Double integral:</i> Definition of Double integrals and its conversion to iterated integrals. Evaluation of double integrals by changing the order of integration and change of variables. Computation of plane surface areas, volume underneath a surface of revolution using double integral. <i>Triple integral:</i> Definition of triple integrals and evaluation-change of variables, volume as triple integral. Differentiation under the integral sign by Leibnitz rule.	

Books recommended.

1. Topics in Algebra- I N Herstein, Wiley Eastern Ltd., New Delhi.
2. Higher algebra - Bernard & Child, Arihant, ISBN: 9350943199/ 9789350943199.
3. Modern Algebra - Sharma and Vasishta, Krishna Prakashan Mandir, Meerut, U.P.
4. Differential Calculus - Shanti Narayan, S. Chand & Company, New Delhi.
5. Integral Calculus - Shanti Narayan and P K Mittal, S. Chand and Co. Pvt. Ltd.,
6. Schaum's Outline Series - Frank Ayres and Elliott Mendelson, 5th ed. USA: Mc. Graw Hill., 2008.
7. Mathematical Analysis- S C Malik, Wiley Eastern.
8. A Course in Abstract Algebra- Vijay K Khanna and S K Bhambri, Vikas Publications.
9. Text Book of BSc Mathematics-G K Ranganath, S Chand Publications.

## B.Sc. Semester – II

**Subject: Mathematics**  
**Discipline Specific Course (DSC)**

### Course No.-2 (Practical)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-02	DSCC	Practical	02	04	52 hrs	3 hrs	25	25	50

Course No.2 (Practical): Title of the Course (Practical): **Practicals on Algebra -II and Calculus - II**

### Course Outcome (CO):

After completion of course (Practical), students will be able to:

- CO 1:** Learn Free and Open Source Software (FOSS) tools for computer programming
- CO 2:** Solve problem on algebra and calculus using FOSS softwares.
- CO 3:** Acquire knowledge of applications of algebra and calculus through FOSS.

### List of the Experiments for 52 hrs / Semesters

1. Program for verification of binary operations.
2. Program to construct Cayley table and test abelian for given finite set.
3. Program to find all possible cosets of the given finite group.
4. Program to find generators and corresponding possible subgroups of a cyclic group.
5. Programs to verification of Lagrange's theorem with suitable examples.
6. Program to verify the Euler's  $\phi$  function for a given finite group.
7. Program to check homogeneous function.
8. Program to verify the Euler's theorem and its extension.
9. Programs to construct series using Maclaurin's expansion for functions of two variables.
10. Program to evaluate the line integrals with constant and variable limits.
11. Program to evaluate the Double integrals with constant and variable limits.
12. Program to evaluate the Triple integrals with constant and variable limits.

**General instructions: Suggested Softwares:** Maxima/Scilab/Maple/MatLab/Mathematica/Python/R.

**Scheme of Practical Examination (distribution of marks): 25 marks for Semester end examination**

- 1. Programme writing and problem solving: 10 Marks**
- 2. Programme Execution: 5 Marks**
- 3. Viva: 5 Marks**
- 4. Journal: 5 Marks**

**Total 25 marks**

**Note: Same Scheme may be used for IA( Formative Assessment) examination**

Books recommended.

1. Scilab by example: M. Affouf 2012, ISBN: 978-1479203444
2. Scilab (A free software to Matlab): H. Ramchandran, A.S.Nair.2011S.Chand and Company
3. Scilab for very beginners. - [www.scilab-enterprises.com](http://www.scilab-enterprises.com)
4. Topics in Algebra- I N Herstein, Wiley Eastern Ltd., New Delhi.
5. Higher algebra - Bernard & Child, Arihant, ISBN: 9350943199/ 9789350943199.
6. Modern Algebra - Sharma and Vasishta, Krishna Prakashan Mandir, Meerut, U.P.
7. Differential Calculus - Shanti Narayan, S. Chand & Company, New Delhi.
8. Integral Calculus - Shanti Narayan and P K Mittal, S. Chand and Co. Pvt. Ltd.,
9. Schaum's Outline Series - Frank Ayres and Elliott Mendelson, 5th ed. USA: Mc. Graw Hill., 2008.
10. Mathematical Analysis- S C Malik, Wiley Eastern.
11. A Course in Abstract Algebra- Vijay K Khanna and S K Bhambri, Vikas Publications.
12. Text Book of BSc Mathematics-G K Ranganath, S Chand Publications.

## B.Sc. Semester – II

**Subject: Mathematics**  
**Open Elective Course (OEC-2)**  
**(OEC for other students)**

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
OEC-2	OEC	Theory	03	03	42 hrs	2 hrs	40	60	100

OEC-2: Title of the Course: **Business Mathematics-II**

### Course Outcome (CO):

After completion of course, students will be able to:

- CO 1:** Integrate concept in business concept with functioning of global trade.
- CO 2:** Understand the commercial arithmetic.
- CO 3:** Apply decision-support tools to business decision making.
- CO 4:** Apply knowledge of business concepts and functions in an integrated manner.

Syllabus- OEC: Title- Business Mathematics-II	Total Hrs: 42
<b>Unit-I</b>	<b>14 hrs</b>
<b>Commercial Arithmetic:</b> <i>Interest:</i> Concept of Present value and Future value, Simple interest, Compound interest, Nominal and Effective rate of interest, Examples and Problems <i>Annuity:</i> Ordinary Annuity, Sinking Fund, Annuity due, Present Value and Future Value of Annuity, Equated Monthly Installments (EMI) by Interest of Reducing Balance and Flat Interest methods, Examples and Problems.	
<b>Unit-II</b>	<b>14 hrs</b>
<b>Measures of central Tendency and Dispersion:</b> Frequency distribution: Raw data, attributes and variables, Classification of data, frequency distribution, cumulative frequency distribution, Histogram and ogive curves. Requisites of ideal measures of central tendency, Arithmetic Mean, Median and Mode for ungrouped and grouped data. Combined mean, Merits and demerits of measures of central tendency. Geometric mean: definition, merits and demerits, Harmonic mean: definition, merits and demerits, Choice of A.M., G.M. and H.M. Concept of dispersion, Measures of dispersion: Range, Variance, Standard deviation (SD) for grouped and ungrouped data, combined SD, Measures of relative dispersion: Coefficient of range, coefficient of variation. Examples and problems.	

<b>Unit-III</b>	<b>14 hrs</b>
<b>Correlation and regression:</b> Concept and types of correlation, Scatter diagram, Interpretation with respect to magnitude and direction of relationship. Karl Pearson's coefficient of correlation for ungrouped data. Spearman's rank correlation coefficient. (with tie and without tie) Concept of regression, Lines of regression for ungrouped data, predictions using lines of regression. Regression coefficients and their properties (without proof). Examples and problems.	

Books recommended.

1. Practical Business Mathematics S. A. Bari New Literature Publishing Company New Delhi
2. Mathematics for Commerce K. Selvakumar Notion Press Chennai
3. Business Mathematics with Applications Dinesh Khattar & S. R. Arora S. Chand Publishing New Delhi
4. Business Mathematics and Statistics N.G. Das & Dr. J.K. Das McFraw Hill New Delhi
5. Fundamentals of Business Mathematics M. K. Bhowal Asian Books Pvt. Ltd New Delhi
6. Mathematics for Economics and Finance: Methods and Modelling, Martin Anthony and Norman Biggs Cambridge University Press Cambridge
7. Financial Mathematics and Its Applications Ahmad Nazri Wahidudin Ventus Publishing ApS Denmark
8. Fundamentals of Mathematical Statistics Gupta S. C. and Kapoor V. K.: Sultan Chand and Sons 23, Daryaganj, New Delhi 110002
9. Statistical Methods Gupta S. P.: Sultan Chand and Sons 23, Daryaganj, New Delhi 110002
10. Applied Statistics Mukhopadhyaya Parimal New Central Book Agency Pvt. Ltd. Calcutta.
11. Fundamentals of Statistics Goon A. M., Gupta, M. K. and Dasgupta, B. World Press Calcutta.
12. Fundamentals of Applied Statistics Gupta S. C. and Kapoor V. K.: Sultan Chand and Sons 23, Daryaganj, New Delhi 110002



**Details of Formative assessment (IA) for DSCC theory/OEC: 40% weightage for total marks**

Type of Assessment	Weightage	Duration	Commencement
Written test-1	10%	1 hr	8 <sup>th</sup> Week
Written test-2	10%	1 hr	12 <sup>th</sup> Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	-----	--
Total	40% of the maximum marks allotted for the paper		

**Faculty of Science  
04 - Year UG Honors programme:2021-22**

**GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC  
(60 marks for semester end Examination with 2 hrs duration)**

**Part-A**

1. Question number 1-06 carries 2 marks each. Answer any 05 questions : 10marks

**Part-B**

2. Question number 07- 11 carries 05Marks each. Answer any 04 questions : 20 marks

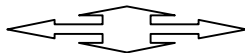
**Part-C**

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

**Total: 60 Marks**

**Note: Proportionate weightage shall be given to each unit based on number of hours prescribed.**





KARNATAK UNIVERSITY, DHARWAD  
ACADEMIC (S&T) SECTION  
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ  
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್ & ಟಿ) ವಿಭಾಗ



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NAAC Accredited  
'A' Grade 2014

website: kud.ac.in

No. KU/Aca(S&T)/SSL-394A/2022-23/1056

Date: 23 SEP 2022

ಅಧಿಸೂಚನೆ

ವಿಷಯ: 2022-23ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಎಲ್ಲ ಸ್ನಾತಕ ಕೋರ್ಸುಗಳಿಗೆ 3 ಮತ್ತು 4ನೇ ಸೆಮೆಸ್ಟರ್  
NEP-2020 ಮಾದರಿಯ ಪಠ್ಯಕ್ರಮವನ್ನು ಅಳವಡಿಸಿರುವ ಕುರಿತು.

- ಉಲ್ಲೇಖ: 1. ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿಗಳು(ವಿಶ್ವವಿದ್ಯಾಲಯ 1) ಉನ್ನತ ಶಿಕ್ಷಣ ಇಲಾಖೆ ಇವರ  
ಆದೇಶ ಸಂಖ್ಯೆ: ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ-1), ದಿ:7.8.2021.  
2. ವಿಜ್ಞಾನ & ತಂತ್ರಜ್ಞಾನ ನಿಖಾಯ ಸಭೆಯ ಠರಾವುಗಳ ದಿನಾಂಕ: 06.09.2022  
3. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂ. 01, ದಿನಾಂಕ: 17.09.2022  
4. ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶ ದಿನಾಂಕ: 22-09-2022

ಮೇಲ್ಕಾಣಿಸಿದ ವಿಷಯ ಹಾಗೂ ಉಲ್ಲೇಖಗಳನ್ವಯ ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶದ ಮೇರೆಗೆ, 2022-23ನೇ  
ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಅನ್ವಯವಾಗುವಂತೆ, ವಿಜ್ಞಾನ & ತಂತ್ರಜ್ಞಾನ ನಿಖಾಯದ ಎಲ್ಲ ಸ್ನಾತಕ ಕೋರ್ಸುಗಳ ರಾಷ್ಟ್ರೀಯ ಶಿಕ್ಷಣ ನೀತಿ  
(NEP)-2020 ರಂತೆ 3 ಮತ್ತು 4ನೇ ಸೆಮೆಸ್ಟರ್ಗಳಿಗಾಗಿ ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ಅನುಮೋದಿತ  
ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಪ್ರಕಟಪಡಿಸಿದ್ದು, ಸದರ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. [www.kud.ac.in](http://www.kud.ac.in) ಅಂತರ್ಜಾಲದಿಂದ ಡೌನ್‌ಲೋಡ  
ಮಾಡಿಕೊಳ್ಳಲು ಸೂಚಿಸುತ್ತಾ, ವಿದ್ಯಾರ್ಥಿಗಳು ಹಾಗೂ ಸಂಬಂಧಿಸಿದ ಎಲ್ಲ ಬೋಧಕರ ಗಮನಕ್ಕೆ ತಂದು ಅದರಂತೆ  
ಕಾರ್ಯಪ್ರವೃತ್ತಿಗಳು ಕವಿವಿ ಅಧೀನದ / ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ ಸೂಚಿಸಲಾಗಿದೆ.

ಅಡಕ: ಮೇಲಿನಂತೆ

ಕುಲಸಚಿವರು.

ಗೆ,

ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವ್ಯಾಪ್ತಿಯಲ್ಲಿ ಬರುವ ಎಲ್ಲ ಅಧೀನ ಹಾಗೂ ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ  
ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ. (ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ ಹಾಗೂ ಮಿಂಚಂಚೆ ಮೂಲಕ ಬಿತ್ತರಿಸಲಾಗುವುದು)

ಪ್ರತಿ:

1. ಕುಲಪತಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
2. ಕುಲಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
3. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ) ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
4. ಅಧೀಕ್ಷಕರು, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ / ಗೌಪ್ಯ / ಜಿ.ಎ.ಡಿ. / ವಿದ್ಯಾಂಡಳ (ಪಿ.ಜಿ.ಪಿ.ಎಚ್.ಡಿ) ವಿಭಾಗ, ಸಂಬಂಧಿಸಿದ  
ಕೋರ್ಸುಗಳ ವಿಭಾಗಗಳು ಪರಿಶೀಲನೆ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
5. ನಿರ್ದೇಶಕರು, ಕಾಲೇಜು ಅಭಿವೃದ್ಧಿ / ವಿದ್ಯಾರ್ಥಿ ಕಲ್ಯಾಣ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.



**KARNATAKUNIVERSITY, DHARWAD**

## **04-Year B.Sc.(Hons.) Program**

**\*\*\*SYLLA**

**BUS**

**Subject: Mathematics [Eff**

**ective from 2022-23]**

**DISCIPLINE SPECIFIC CORE COURSE (DSCC) FOR SEM III & IV**

**AND OPEN ELECTIVE COURSE (OEC) FOR SEM III & IV.**

**AS PER NEP-2020**

**Karnatak University, Dharwad**  
**Four Years Under Graduate Program in Mathematics for B.Sc.(Hons.)**  
**With Effect from 2022-23**

Sem	Type of Course	Theory/Practical	Instruction hours per week	Total hours of Syllabus /Sem	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks	Credits
III	DSCC: 5 033MAT011	Theory	04hrs	56	02hrs	40	60	100	04
	DSCC: 6 033MAT012	Practical	04hrs	52	03hrs	25	25	50	02
	OEC: 3 003MAT051	Theory	03hrs	42	02hrs	40	60	100	03
IV	DSCC: 7034MAT011	Theory	04hrs	56	02hrs	40	60	100	04
	DSCC: 8034MAT 012	Practical	04hrs	52	03hrs	25	25	50	02
	OEC-4 004MAT051	Theory	03hrs	42	02hrs	40	60	100	03

**III Semester**

**DSCC-5(033MAT011) : Ordinary Differential Equations and Real Analysis–I**

**DSCC-6(033MAT012) : Practicals on Ordinary Differential Equations and Real Analysis–I**

**OEC-: 3(003MAT051) : Quantitative Mathematics**

(for other students)

**IV Semester**

**DSCC-7(034MAT 011) : Partial Differential Equations and Integral Transforms**

**DSCC-8(034MAT012) : Practicals on Partial Differential Equations and Integral Transforms**

**OEC- 4(004MAT05) : Mathematical Finance**

(for other students)

## B.Sc.Semester–III

**Subject: Mathematics**  
**Discipline Specific Course(DSC)**

**The course Mathematics in III semester has two papers (Theory Paper–033MAT011 for 04 credits & Practical Paper-033MAT012 for 2 credits) for 06 credits: Both the papers are compulsory. Detail soft he courses are as under.**

**Course No.: 5**  
**Course Code (Theory): 033MAT011**

Course Code	Type of Course	Theory/ Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours /Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
033MAT011	DSCC	Theory	04	04	56hrs	2hrs	40	60	100

Title of the Course (Theory):**DSCC-5 :Ordinary Differential Equations and Real Analysis–I(033MAT011)**

### **CourseOutcome(CO):**

After completion of the course(Theory), students will be able to:

**CO1:**Solve first-order non-linear differential equations and linear differential equations.

**CO2:**To model problems in nature using Ordinary Differential Equations.

**CO3:**Formulate differential equations for various mathematical models

**CO 4:** Apply these techniques to solve and analyze various mathematical models.

**CO 5:**Understand the fundamental properties of the real numbers that lead to define sequence and series in the formal development of real analysis.

**CO 6:**Learn the concept of Convergence and Divergence of a sequence.

**CO 7:**Able to handle and understand limits and their use in sequences, series, differentiation, and integration.

**CO 8:**Apply the ratio, root, alternating series, and limit comparison tests for convergence and absolute convergence of an infinite series.

<b>Syllabus-Course(Theory): DSCC-5</b>	<b>Total Hrs:56</b>
<b>Title-033MAT011:Ordinary Differential Equations and Real Analysis–I</b>	
<b>Unit-I</b>	<b>14hrs</b>
<b>Ordinary Differential Equations:</b> Recapitulation of Differential Equations of the first order and first degree, Exact Differential equations, Necessary and sufficient condition for the equations to be exact, Reducible to the exact differential equations. Differential equations of the first order and higher degree: Equations solvable for p, x, y. Clairaut's equation and singular solution. Orthogonal trajectories of Cartesian and polar curves.	

<b>Unit-II</b>	<b>14hrs</b>
<b>Linear differential equations:</b> Linear differential equations of the $n^{\text{th}}$ order with constant coefficients. Particular Integrals when the RHS is of the form $e^{ax}$ , $\sin(ax+b)$ , $\cos(ax+b)$ , $x^n$ , $e^{ax} V$ and $x V$ (with proofs), where $V$ is a function of $x$ . Cauchy – Euler equations, Legendre differential equations, Method of variation of parameters. Simultaneous differential equations with two and more than two variables. Condition for integrability of total differential equations $Pdx+Qdy+Rdz=0$ .	
<b>Unit-III</b>	<b>14hrs</b>
<b>Sequences:</b> Sequences of real numbers, Bounded sequences. Limit of a sequence. convergent, divergent, and oscillatory sequences. Monotonic sequences. Algebra of convergent sequences. Limit points of a sequence. Bolzano Weierstrass theorem for sequence. Limit superior and limit inferior of sequences. Cauchy's first and second theorem on limits of a sequence. Cauchy's general principle for convergence of a sequence. Subsequence and their properties.	
<b>Unit-IV</b>	<b>14hrs</b>
<b>Infinite Series:</b> Definition of convergent, divergent, and oscillatory series. Series of non-negative terms, Cauchy's general principle of convergence. Geometric series, P-series (Harmonic series). Comparison tests for positive term series. D'Alembert's ratio test, Raabe's test. Cauchy's Root test and Cauchy's integral test. Alternating series. Leibnitz's theorem. Absolute convergence and conditional convergence of a series. Summation of series: Binomial, exponential, and logarithmic.	

#### Books recommended:

1. M. D. Raisinghania, Ordinary Differential Equations & Partial Differential Equations, S. Chand & Company, New Delhi.
2. J. Sinha Roy and S. P. Adhy: A course of Ordinary and Partial Differential Equation, Kalyani Publishers, New Delhi.
3. D. Murray, Introductory Course in Differential Equations, Orient Longman (India)
4. W. T. Reid, Ordinary Differential Equations, John Wiley, New Delhi.
5. M. L. Khanna and L. S. Varhiney, Real Analysis by, Jai Prakash Nath & Co. Meerut.
6. M. L. Khanna, Differential Equations, Jai Prakash Nath & Co. Meerut
7. S. L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, 1984.
8. R. G. Bartle and D. R. Sherbert, Introduction to Real Analysis, 3rd Ed., John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2015.
9. Gerald G. Bilodeau, Paul R. Thie, G. E. Keough, An Introduction to Analysis, 2nd Ed., Jones & Bartlett, 2010.
10. K. A. Ross, Elementary Analysis: The Theory of Calculus, (2<sup>nd</sup> edition), Springer, 2013
11. S. K. Berberian, A First Course in Real Analysis, Springer Verlag, New York, 1994.
12. T. Apostol, Mathematical Analysis, Narosa Publishing House.
13. E. Kreyzig, Advanced Engineering Mathematics, John Wiley, New Delhi.

## B.Sc.Semester–III

Subject: Mathematics Discipline Specific Course (DSC)

Course No.: 6

Course Code (Practical): 033MAT012

Course Code	Type of Course	Theory/Practical	Credits	Instruction hour per week	Total No. of Lectures/Hour s /Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
033MAT012	DSCC	Practical	02	04	52hrs	3hrs	25	25	50

Title of the Course (Practical): **DSCC-6: Practicals on Ordinary Differential Equations and Real Analysis-I (033MAT012)**

### Course Outcome (CO):

After completion of the course (Practical), students will be able to:

This course will enable the students to gain hands-on experience of

**CO 1:** Free and Open Source software (FOSS) tools or computer programming.

**CO 2:** Solving exact differential equations

**CO 3:** Plotting orthogonal trajectories

**CO 4:** Finding complementary functions and particular integral of linear and homogeneous differential equations.

**CO 5:** Acquire knowledge of applications of real analysis and differential equations.

**CO 6:** Verification of convergence/divergence of different types of series

### List of the Experiments for 52hrs/Semesters

Introduction to the software and commands related to the topic.

1. Fundamentals of Ordinary differential equations and Real analysis using FOSS.
2. Verification of exactness of a differential equation
3. Plot orthogonal trajectories for Cartesian and polar curves
4. Solutions of differential equations that are solvable for  $x, y, p$ .
5. To find the singular solution by using Clairaut's form.
6. Finding the Complementary Function and Particular Integral of linear and Homogeneous differential equations with constant coefficients and plot the solutions.
7. Finding the Particular Integral of differential equations upto second order and plot the solutions.
8. Solutions to the Total and Simultaneous differential equations and plot the solutions.
9. Test the convergence of sequences
10. Verification of exponential, logarithm, and binomial series.
11. Verification of geometric series,  $p$ -series, Cauchy's Integral test, root test, and D'Alembert's Test
12. Examples on a series of positive terms.
13. Examples on alternating series using Leibnitz's theorem.
14. Finding the convergence of series using Cauchy's criterion for partial sums.

## **Pedagogy**

**General instructions: Suggested Software: Maxima/Scilab/Maple/MatLab/Mathematica/Python/R.**

**Scheme of Practical Examination (distribution of marks): 25 marks for Semester end examination**

**1. Program writing and problem-solving: 10 Marks**

**2. Programme Execution: 5 Marks**

**3. Viva: 5 Marks**

**4. Journal: 5 Marks**

**Total 25 marks**

**Note: Same Scheme may be used for IA (Formative Assessment) examination**

### **Books recommended:**

1. Scilab by example: M. Affouf 2012, ISBN: 978-1479203444
2. Scilab (A free software to Matlab): H. Ramchandran, A. S. Nair. 2011 S. Chand and Company
3. Scilab for very beginners. - www.scilab-enterprises.com
4. M. Kanagasabapathy, Introduction to Maxima for Scientific Computers, BPB Publishers.
5. Kalyanarao Takale, Computational Mathematics using Maxima Software, Nirali Publishers.
6. Vaisak Vena, Maxima, The Computer Algebra System, Notion Press.
7. M. D. Raisinghania, Ordinary Differential Equations & Partial Differential Equations, S. Chand & Company, New Delhi.
8. J. Sinha Roy and S. Padhy: A course of Ordinary and Partial Differential Equation, Kalyani Publishers, New Delhi.
9. D. Murray, Introductory Course in Differential Equations, Orient Longman (India)
10. W. T. Reid, Ordinary Differential Equations, John Wiley, New Delhi.
11. M. L. Khanna and L. S. Varhiney, Real Analysis, Jai Prakash Nath & Co. Meerut.
12. M. L. Khanna, Differential Equations, Jai Prakash Nath & Co. Meerut.



## B.Sc.Semester–III

Subject: Mathematics

Open Elective Course (OEC-3)  
(OEC for other students)

Course Code(OEC): : 003MAT051

Course Code	Type of Course	Theory/ Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours /Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
003MAT051	OEC	Theory	03	03	42hrs	2hrs	40	60	100

### OEC-3 (OEC for other students): 003MAT051

Title of the Course: **Quantitative Mathematics**

#### Course Outcome (CO):

After completion of the course, students will be able to:

**CO1:** Understand numbers system and fundamental operations

**CO2:** Understand the concept of linear quadratic and simultaneous equations and their applications in real-life problems.

**CO3:** Understand and solve the problems based on Age.

**CO4:** Solve Speed and Distance related problems.

Syllabus-003MAT051: Title-Quantitative Mathematics	Total Hrs:42
<b>Unit-I</b>	<b>14hrs</b>
<b>Number System:</b> Numbers, Operations on Numbers, Tests on Divisibility, HCF, and LCM of numbers. Decimal Fractions, Simplification, Square roots, and Cube roots - Problems thereon. Surds and Indices. Illustrations thereon.	
<b>Unit-II</b>	<b>14hrs</b>
<b>Theory of equations</b> Linear equations, quadratic equations, simultaneous equations in two variables, simple application problems - Problems on Ages, Problems on conditional Age calculations, Present & Past age calculations.	
<b>Unit-III</b>	<b>14hrs</b>
<b>Quantitative Aptitude</b> Percentage, Average, Average Speed-problems. Time and distance, problems based on trains, problems on work and time, work and wages, clock and calendar.	

#### Books recommended:

1. R.S. Aggarwal, Quantitative Aptitude, S. Chand and Company Limited, New Delhi-110055.

2. Abhijit Guha, Quantitative Aptitude, 5<sup>th</sup> Edition, Mc.Grawhill publications. 2014.
3. R. V. Praveen, Quantitative Aptitude and Reasoning, PHI publishers.
4. R. S. Aggarwal, Objective Arithmetic, S.Chand & Company Ltd.
5. Qazi Zameeruddin, Vijay K. Khanna, S. K. Bhambri, Business Mathematics-II Edition, S. Chand & Company Ltd.
6. S.K.Sharma and Gurmeet Kaur, Business Mathematics, S.Chand & Sons.
7. Hazarika Padmalochan, A Text Book of Business mathematics for B.Com. and BBACourse, S. Chand & Company Ltd.
8. J. K. Thukrol, Business Mathematics, abcibook:2020, First Edition, The world book depot, India
9. N. G. Das and J.K.Das, Business Mathematics and Statics, McGraw Hill Education, 2017.

**DetailsofFormativeassessment(IA)forDSCCtheory/OEC:40%weightagefortotalmarks**

TypeofAssessment	Weightage	Duration	Commencement
Writtentest-1	10%	1hr	8 <sup>th</sup> Week
Writtentest-2	10%	1hr	12 <sup>th</sup> Week
Seminar	10%	10minutes	--
Casestudy/Assignment / Fieldwork/ Projectwork/Activity	10%	-----	--
Total	40%ofthemaximummarksallottedforthe paper		

**FacultyofScience  
04-YearUGHonorsprogramme:2022-23**

**GENERALPATTERNOFTHEORYQUESTIONPAPERFORDSCC/OEC  
(60marksforsemesterendExaminationwith2hrsduration)**

**Part-A**

1. Questionnumber1-6carries2markseach.Answerany5questions :10marks

**Part-B**

2. Questionnumber7-11carries5 markseach.Answerany4questions :20marks

**Part-C**

3. Questionnumber12-15carries10 markseach.Answerany3questions :30marks(Mini

imum1questionfromeachunitand10marksquestionmayhavesub questionsfor7+3or6+4or5+5ifnecessary)

**Total:60Marks**

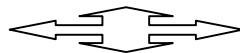
**Format for Model question paper Unit wise**

**033MAT011: Ordinary Differential Equations and Real Analysis–I**

Question Number	Number of questions to be set in Unit	Number of questions to be answered	Marks for each question	Max marks for the question
1	Unit-I -----2 Unit-II -----1 Unit-III-----1 Unit-IV-----2 Total: 6	5	2	10
2	Unit-I -----1 Unit-II-----2 Unit-III-----1 Unit-IV-----1 Total: 5	4	5	20
3	Unit-I -----1 Unit-II-----1 Unit-III-----1 Unit-IV-----1 Total: 4	3	10	30

**003MAT051 Quantitative Mathematics**

Question Number	Number of questions to be set in Unit	Number of questions to be answered	Marks for each question	Max marks for the question
1	Unit-I -----2 Unit-II -----2 Unit-III-----2 Total: 6	5	2	10
2	Unit-I -----1 Unit-II-----2 Unit-III-----2 Total: 5	4	5	20
3	Unit-I -----2 Unit-II-----1 Unit-III-----1 Total: 4	3	10	30

**B.Sc.Semester–IV**

**Subject:**  
**Mathematics Discipline Specific Course (DSCC)**

The course Mathematics in IV semester has two papers (Theory Paper for 04 credits & Practical paper for 2 credits) for 06 credits: Both papers are compulsory. Details of the courses are as under.

**Course No.: 7**  
**Course Code (Theory): 034MAT011**

Course Code	Type of Course	Theory/ Practical	Credits	Instruction hour per week	Total No. of Lectures/Hour s /Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
034MAT011	DSCC	Theory	04	04	56hrs	2hrs	40	60	100

Title of the Course (Theory): **DSCC-7: Partial Differential Equations and Integral Transforms (034MAT011)**

**Course Outcome (CO):**

After completion of the course (Theory), students will be able to:

- CO1:** Solve the Partial Differential Equations of the first order and second order.
- CO2:** Formulate, classify and transform partial differential equations into canonical form.
- CO3:** Solve linear and non-linear partial differential equations using various methods; and apply these methods to solving some physical problems.
- CO4:** Able to take more courses on wave equation, heat equation, and Laplace equation.
- CO5:** Solve PDE by Laplace Transforms and Fourier Transforms.

<b>Syllabus-(Theory): DSCC-7</b>	<b>Total Hrs: 56</b>
<b>Title-034MAT011: Partial Differential Equations and Integral Transforms</b>	
<b>Unit-I</b>	<b>14hrs</b>
Basic concepts – Formation of partial differential equations by elimination of arbitrary constants and functions, Solution of partial differential equations – Solution by Direct integration, Lagrange’s linear equations of the form $Pp + Qq = R$ , Standard types of first order non-linear partial differential equations. The integrals of the non-linear equation by Charpit’s method	
<b>Unit-II</b>	<b>14hrs</b>
Homogeneous linear partial differential equations with constant coefficients. Partial differential equations of the second order. Classification of second-order partial differential equations, canonical forms. Classification of second-order linear equations as hyperbolic, parabolic, and elliptic. Solutions of the Heat equation, Laplace equation, and Wave equation (using separation of variables).	
<b>Unit-III</b>	<b>14hrs</b>

<b>Laplace Transforms</b> Definition, Basic Properties. Laplace transforms of some standard functions. Laplace transform of Periodic functions. Laplace transform of derivative and integral of a function. Heaviside function. Dirac-delta function. Convolution theorem. Inverse Laplace transforms and its properties. Solution of differential equations by using Laplace transforms	
<b>Unit-IV</b>	<b>14hrs</b>
<b>Fourier Series and Transforms:</b> Periodic functions. Fourier Coefficients. Fourier series of functions with period $2\pi$ and period $2L$ . Fourier series of even and odd functions. Half range Cosine and Sine series. Fourier Transforms - Finite Fourier Cosine and Sine transform. Transforms of derivatives. Applications of Fourier Transforms.	

### Books recommended:

1. D. A. Murray, Introductory Course in Differential Equations, Orient and Longman
2. H.T.H. Piaggio, Elementary Treatise on Differential Equations and their Applications, CBS Publisher & Distributors, Delhi, 1985.
3. G.F. Simmons, Differential Equations, Tata McGraw Hill.
4. S.L. Ross, Differential Equations, 3<sup>rd</sup> Ed., John Wiley and Sons, India, 2004.
5. M. D. Raisinghania, Ordinary Differential Equations & Partial Differential Equations, S. Chand & Company, New Delhi.
6. K. Sankara Rao, Introduction to Partial Differential Equations, PHI, Third Edition, 2015.
7. I.N. Sneddean, Elements of Partial differential equations, McGraw-Hill International Editions, 1986.
8. Murray R. Spiegel (Schaum's Series), Laplace Transforms, McGraw-Hill International Editions.
9. Goel and Gupta, Laplace Transform, Pragati Prakashan, Meerut, India.
10. Sudhir Kumar Pundir, Integral Transform Methods in Science & Engineering, CBS Engineering Series, 2017, New Delhi.
11. Murray R. Spiegel (Schaum's Series), Fourier Transforms, McGraw-Hill International Editions.
12. Earl David Rainville and Philip Edward Bedient—A short course in Differential Equations, Prentice Hall College Div; 6<sup>th</sup> Edition.
13. Sathya Prakash, Mathematical Physics, S. Chand and Sons, New Delhi.

## B.Sc.Semester–IV

Subject:

Mathematics Discipline Specific Course (DSCC)

Course No.: 8

Course Code (Practical): 034MAT012

CourseCode	TypeofCourse	Theory/Practical	Credits	Instructionhour perweek	Total No. ofLectures/Hour s /Semester	DurationofExam	Formative AssessmentMarks	Summative Assessment Marks	Total Marks
034MAT012	DSCC	Practical	02	04	52hrs	3hrs	25	25	50

Title of the Course (Practical) **DSCC-8: Practical on Partial Differential Equations and Integral Transforms (034MAT012)**

**Course Outcome (CO):**

After completion of the course (Practical), students will be able to:

- CO1:** Learn Free and Open Source software (FOSS) tools or computer programming.
- CO2:** Solve problems on Partial Differential Equations and Integral Forms.
- CO3:** To find Laplace transform of various functions.
- CO 4:** To find the Fourier Transform of periodic functions
- CO 5:** To solve partial differential equations by using Integral transforms.

### List of the Experiments for 52hrs/Semesters

- 1 Solutions of Linear Partial differential equations of type 1 to type 4 and Lagrange's method.
- 2 Solutions of the partial differential equation using Charpit's method.
- 3 Solutions of Second-order homogenous partial differential equation with constant coefficients.
- 4 Solutions to the partial differential equations using the separation of variables method (Heat/ Wave/ Laplace).
- 5 Finding the Laplace transforms of some standard and periodic functions.
- 6 Finding the inverse Laplace transform of simple functions
- 7 Verification of Convolution Theorem.
- 8 To solve ordinary linear differential equations using Laplace transforms.
- 9 To solve the Integral equation using Laplace transform.
- 10 To find full range Fourier series of some simple functions with period  $2\pi$  and  $2L$
- 11 To find Half range sine and cosine series of some simple functions and plotting them.
- 12 To find Cosine Fourier transforms.
- 13 To find Sine Fourier transforms.

**General instructions: Suggested Softwares:** Maxima/Scilab/Maple/MatLab/Mathematica/Python/R.

**Scheme of Practical Examination (distribution of marks): 25 marks for Semester end examination**

**1. Program writing and problem solving: 10 Marks**

**2. Programme Execution: 5 Marks**

**3. Viva: 5 Marks**

**4. Journal: 5 Marks**

**Total 25 marks**

**Note: Same Scheme may be used for IA (Formative Assessment) examination**

Books recommended.

1. Scilab by example: M. Affouf 2012, ISBN: 978-1479203444.
2. Scilab (A free software to Matlab): H. Ramchandran, A. S. Nair. 2011 S. Chand and Company.
3. Scilab for very beginners. - [www.scilab-enterprises.com](http://www.scilab-enterprises.com)
4. M. Kanagasabapathy, Introduction to Maxima for Scientific Computers, BPB Publishers.
5. Kalyanarao Takale, Computational Mathematics using Maxima Software, Nirali Publishers.
6. Vaisak Vena, Maxima, The Computer Algebra System, Notion Press.
7. P. N. de Souza, R. J. Fateman, J. Moses and C. Yapp, The Maxima Book.
8. M. D. Raishanania, Ordinary Differential Equations & Partial Differential Equations, S. Chand & Company, New Delhi.
9. I. N. Sneddean, Elements of Partial differential equations, McGraw-Hill International Editions, 1986.
10. Murray R. Spiegel (Schaum's Series), Laplace Transforms, McGraw-Hill International Editions.
11. Murray R. Spiegel (Schaum's Series), Fourier Transforms, McGraw-Hill International Editions.



## B.Sc.Semester –IV

**Subject:**  
**Mathematics Open Elective Course (OEC**  
**-4)**  
**(OEC for other students)**

**Course Code (OEC): 004MAT051**

Course Code	Type of Course	Theory/ Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours /Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
004MAT051	OEC	Theory	03	03	42hrs	2hrs	40	60	100

**OEC-4 (for other students): 004MAT051:**

Title of the Course: **Mathematical Finance**

**Course Outcome (CO):**

After completion of the course, students will be able to:

- CO1:** Understand how to compute profit and loss, discount, and Banker's discount.
- CO2:** Understand the concept of Linear equations and inequalities and their use in the Solving the Linear Programming Problems.
- CO3:** Formulation of Transportation Problem and its application in the routing problem. Integrate the concept in business concept with the functioning of global trade.
- CO4:** Understand commercial arithmetic.
- CO5:** Apply decision-support tools to business decision-making.
- CO6:** Apply knowledge of business concepts and functions in an integrated manner.

<b>Syllabus-OEC</b> <b>Title-004MAT051: Mathematical Finance</b>	<b>Total Hrs:42</b>
<b>Unit-I</b>	<b>14hrs</b>
<b>Commercial Arithmetic</b> Bill of exchange, Bill of the discounting procedure. Basic formula related to profit, loss, discount and brokerage, Successive discount, True discount, Banker's discount.	
<b>Unit-II</b>	<b>14hrs</b>
<b>Linear Programming</b> Linear equations and inequalities- Rectangular coordinates, straight line, parallel and intersecting lines, and linear inequalities. Introduction to linear programming, Mathematical formulation of LPP, Solution of an LPP by graphical method, special cases in the graphical method.	

<b>Unit-III</b>	<b>14hrs</b>
<b>Transportationproblem</b> Introduction, Formulation of Transportation problem, Initial basic feasible solution, Steps in solving a transportation problem, optimality check, special cases in Transportation problem. The Traveling salesman Problem (RoutingProblem).	

**Booksrecommended:**

1. R. S. Aggarwal, Objective Arithmetic, S.Chand& Company Ltd.
2. A. Mizrahi and M. Sullivan, Mathematics for Business and Social Sciences and Application approach, JohnWiley and Sons, India.
3. QaziZameeruddin, Vijay K. Khanna, S. K. Bhambri, Business Mathematics- II Edition, Vikas Publishing House.
4. S.Kalavathy,OperationResearch, Fourth edition,Vikas publication house Pvt. Ltd.
5. Sreenivasa Reddy M, Operations Research, 2<sup>nd</sup>edition, Sanguine Technical publishers Bangalore.
6. S.D.Sharma, OperationResearch,KedarNath Ram Nath, Meerut.

**DetailsofFormativeassessment(IA)forDSCCtheory/OEC:40%weightagefortotalmarks**

TypeofAssessment	Weightage	Duration	Commencement
Writtentest-1	10%	1hr	8 <sup>th</sup> Week
Writtentest-2	10%	1hr	12 <sup>th</sup> Week
Seminar	10%	10minutes	--
Casestudy/Assignment/Field work/Projectwork/Activity	10%	-----	--
Total	40%ofthemaximummarks allottedforthepaper		

**FacultyofScience  
04-YearUGHonorsprogramme:2022-23**

**GENERALPATTERNOFTHEORYQUESTIONPAPERFORDSCC/OEC  
(60marksforsemesterendExaminationwith2hrsduration)**

**Part-A**

1. Questionnumber1-6carries2markseach.Answerany5questions :10marks

**Part-B**

2. Questionnumber7-11carries5Markseach.Answerany4questions :20marks

**Part-C**

3. Questionnumber12-15carries10Markseach.Answerany3questions :30marks(

Minimum1questionfromeachunitand10marksquestionmayhavesub questionsfor7+3or6+4or5+5ifnecessary)

**Total:60Marks**

**Format for Model question paper Unit wise**

**DSCCTheory: 034MAT011: Partial Differential Equations and Integral Transforms**

Question Numbers	Number of questions to be set in Unit	Number of questions to be answered	Marks for each question	Max marks for the question
1	Unit-I: ----- 2 Unit-II ----- 1 Unit: III-----1 Unit: IV-----2 Total: 6	5	2	10
2	Unit-I -----1 Unit-II -----1 Unit-III -----2 Unit-IV -----1 Total: 5	4	5	20
3	Unit-I -----1 Unit-II -----1 Unit-III-----1 Unit-IV-----1 Total: 4	3	10	30

**OEC4:004MAT051: Mathematical Finance**

Question Number	Number of questions to be set in Unit	Number of questions to be answered	Marks for each question	Max marks for the question
1	Unit-I -----2 Unit-II -----2 Unit-III-----2 Total: 6	5	2	10
2	Unit-I -----2 Unit-II -----1 Unit-III-----2 Total : 5	4	5	20
3	Unit-I -----1 Unit-II -----2 Unit-III-----1 Total: 4	3	10	30

