BENGALURU NORTH UNIVERISTY

Syllabus for Bachelor of Science(Basic/Honors)
I & II Semester Mathematics Courses
Under- Graduate (UG) Program

Framed according to the National Education Policy (NEP-2020)

DEPARTMENT OF MATHEMATICS
Bengaluru North University
Tamaka, Near NH 75 in Kolar
KARNATAKA

September – 2021

BENGALURU NORTH UNIVERSITY
Department of Mathematics

Date: 29-09-2021

PROCEEDING OF THE BOS (UG) MATHEMATICS

The meeting of the Board of Studies in UG Mathematics for the year 2021-22 was held on Wednesday, 29th September 2021 at 11.00am in the Department of Mathematics, GFGC, K R Puram, Bengaluru North University, Bengaluru. The following members attended the meeting:

1.	Dr. B. Chaluvaraju	Chairman
2.	Prof. Madhulatha Moses	Member
3.	Dr. Shivasharanappa Sigarkanti	Member
4.	Prof. Nagaraddi B. Y.	Member
5.	Prof. Mariya Khibthiya	Member
6.	Prof. Kemparaju R.	Member
7.	Dr. Abraham V. M	Member
8.	Prof. C. Keshava Reddy	Member (Retired)
9.	Prof. Thajmull Pasha	Member (Retired)

Agenda and Resolution:

1. Final draft of the BNU-NEP-UG-Mathematics was checked and discussion held. The suggestions given by the BOS members and Senior Subject Experts Dr. Kemparaju S and Prof. Suguna H G, were incorporated.
2. The syllabus framed as per NEP-2020 and Karnataka State Higher Education Council guidelines. The syllabus prepared by teachers with a practical component (Mathematics practical with FOSS tools for programming). The BOS also resolved to change the list of practical experiments each year. Finally, the syllabus was approved by all the members.
3. The committee approved the updated panel examiners of UG (Mathematics).

The Chairman thanked the members for their cooperation.

[Dr. B. CHALUVARAJU] 29/09/21
CHAIRMAN
BNU-BOS in UG-Mathematics

Dr. B. CHALUVARAJU
M.Sc. Ph.D
Professor
Department of Mathematics
Bangalore University, Jnanabharathi
BENGALURU - 560 056.

Copy to:

1. The Registrar, Bengaluru North University, Bengaluru
2. The PS to the Vice-Chancellor, Bengaluru North University, Bengaluru

PREAMBLE

The subject wise expert committee to draft model curriculum contents in Mathematics constituted by the Department of Higher Education, Government of Karnataka, Bangalore vide GO No. ED 260 UNE 2019 (PART-1) DATED 13.08.2021 is pleased to submit its partial report on the syllabus for the First Year (First & Second Semesters) B.Sc. (Basic/Honors) Mathematics and detailed Course Structure for B.Sc. (Honors) Mathematics and M.Sc. (One Year) Mathematics.

The committee discussed various models suggested by the Karnataka State Higher Education Council in its joint meetings with the Chairpersons of Board of Studies of all state universities in Karnataka and resolved to adopt **Model IIA** (Model Program Structure for the Bachelor of Science (Basic/Hons.) for the subjects with practical's with Mathematics as Major/Minor.

To achieve the core objectives of the National Education Policy 2020 it is unanimously resolved to introduce computer based practical's for the Discipline Core (DSC) courses by using Free and Open Source Software's (FOSS) tools for implementation of theory based on DSC courses as it is also suggested by the LOCF committee that the papers may be taught using various Computer Algebra System (CAS) software's such as Mathematica, MATLAB, Maxima, Python and R to strengthen the conceptual understanding and widen up the horizon of students' self-experience. In view of these observations the subject expert committee suggested the software's Phython /R / Maxima/ Scilab/ Maple/MatLab/Mathematica for hands on experience of implementation of mathematical concepts in computer based lab.

The expert committee suggests the implementation this curriculum structure in all the Departments of Mathematics in Universities/Colleges in Karnataka. The subject expert committee designed the Course Learning Outcome (CO) to help the learners to understand the main objectives of studying the courses by keeping in mind of the Programme Outcomes (PO) of the graduate degree with honors in Mathematics or a graduate degree with Mathematics as a major subject.

As the Mathematics subject is a vast with several branches of specializations, it is difficult for every student to learn each branch of Mathematics, even though each paper has its own importance. Hence the subject expert committee suggests number of elective papers (for both Discipline electives and Open Electives) along with Discipline Core Courses. The BoS in Mathematics of universities may include additional electives based on the expertise of their staff and needs of the students'.

A student can select elective paper as per her/his needs and interest. The subject expert committee in Mathematics suggests that the concerned Department/Autonomous Colleges/Universities to encourage their faculty members to include necessary topics in addition to courses suggested by the expert committee.

MISSION AND VISION OF THE NEW SYLLABUS IN MATHEMATICS

Mission

- Improve retention of mathematical concepts in the student.
- To develop a spirit of inquiry in the student.
- To improve the perspective of students on mathematics as per modern requirement.
- To initiate students to enjoy mathematics, pose and solve meaningful problems, to use abstraction to perceive relationships and structure and to understand the basic structure of mathematics.
- To enable the teacher to demonstrate, explain and reinforce abstract mathematical ideas by using concrete objects, models, charts, graphs, pictures, posters with the help of FOSS tools on a computer.
- To make the learning process student-friendly by having a shift in focus in mathematical teaching, especially in the mathematical learning environment.
- Exploit techno-savvy nature in the student to overcome math-phobia.
- Propagate FOSS (Free and open source software) tools amongst students and teachers as per vision document of National Mission for Education.
- To set up a mathematics laboratory in every college in order to help students in the exploration of mathematical concepts through activities and experimentation.
- To orient students towards relating Mathematics to applications.

Vision

- To remedy Math phobia through authentic learning based on hands-on experience with computers.
- To foster experimental, problem-oriented and discovery learning of mathematics.
- To show that ICT can be a panacea for quality and efficient education when properly integrated and accepted.

- To prove that the activity-centered mathematics laboratory places the student in a problemsolving situation and then through self-exploration and discovery habituates the student into providing a solution to the problem based on his or her experience, needs, and interests.
- To provide greater scope for individual participation in the process of learning and becoming autonomous learners.
- To provide scope for greater involvement of both the mind and the hand which facilitates cognition?
- To ultimately see that the learning of mathematics becomes more alive, vibrant, relevant and meaningful; a program that paves the way to seek and understand the world around them. A possible by-product of such an exercise is that math-phobia can be gradually reduced amongst students.
- To help the student build interest and confidence in learning the subject.

Support system for Students and Teachers in understanding and learning FOSS TOOLS:

As a national level initiative towards learning FOSS tools, IIT Bombay for MHRD, Government of India is giving free training to teachers interested in learning open source software's like scilab, maxima, python, octave, geogebra and others.

(Website: http://spoken-tutorial.org ; email: contact@spoken-tutorial.org ; info@spokentutorial.org)

B.Sc. MATHEMATICS (BASIC/HONORS)

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 indepth knowledge of Algebra, Calculus, Geometry, differential equations and several other branches of pure and applied mathematics. This also leads to study the related are as 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 form modeling 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 modeling ability, problem solving skills.
PO5	**Research related skills:** The completing this programme develop 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 softwares to solve system of algebraic Equation and differential equations.

PO7	**Self–directed learning**: The student completing this program will develop ability of working independently and to make an indepth study of various notions of Mathematics.
PO8	**Moral and ethical awareness/reasoning:** The student completing this program will 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.
PO9	**Lifelong learning**: This programme provides self-directed learning and lifelong learnings kills. This programme helps the learner to think independently and develop algorithms and computational skills for solving real word problems.
PO10	Ability to per use advanced studies and research in pure and applied Mathematical sciences.

ASSESSMENT

WeightagefortheAssessments(inpercentage)

TypeofCourse	**FormativeAssessment/ I.A.**	**SummativeAssessment(S.A.)**
Theory	40%	60%
Practical	50%	50%
Projects	40%	60%
ExperientialLearning (Internshipetc.)	--	--

ContentsofB.Sc., (Basic/Honors)withMathematicsasMajorSubject (ModelIIA)

Semester	CourseNo.	Theory/Practical	Credits	PaperTitle	Marks	
					S.A.	I.A.
I	MATDSCT1.1	Theory	4	Algebra-IandCalculus-I	60	40
	MATDSCP1.1	Practical	2	TheorybasedPractical'sonAlgebra-IandCalculus–I	25	25
	MATOET1.1	Theory	3	(A) Mathematics–I (B) BusinessMathematics–I	60	40
II	MATDSCT2.1	Theory	4	Algebra-IIandCalculus-II	60	40
	MATDSCP2.1	Practical	2	TheorybasedPractical'sonAlgebra-IIandCalculus-II	25	25
	MATOET2.1	Theory	3	(A) Mathematics–II (B) BusinessMathematics-II	60	40
ExitOptionwithCertificate						
III	MATDSCT3.1	Theory	4	OrdinaryDifferentialEquationsand RealAnalysis-I	60	40
	MATDSCP3.1	Practical	2	TheorybasedPractical'sonOrdinaryDifferentialEquationsandReal Analysis-I	60	40
	MATOET3.1	Theory	3	(A) OrdinaryDifferentialEquations (B) QuantitativeMathematics	60	40
IV	MATDSCT4.1	Theory	4	PartialDifferentialEquationsand IntegralTransforms	60	40
	MATDSCP4.1	Practical	2	TheorybasedPractical'sonPartial DifferentialEquationsandIntegralTransforms	25	25
	MATOET4.1	Theory	3	(A) PartialDifferentialEquations (B) MathematicalFinance	60	40
ExitOptionwithDiploma						
V	MATDSCT5.1	Theory	3	RealAnalysisandComplexAnalysis	60	40
	MATDSCP5.1	Practical	2	TheorybasedPractical'sonReal AnalysisandComplexAnalysis	25	25
	MATDSCT5.2	Theory	3	RingTheory	60	40
	MATDSCP5.2	Practical	2	TheorybasedPractical'sonRing Theory	25	25
	MATDSET5.1	Theory	3	(A) VectorCalculus (B) Mechanics (C) MathematicalLogic	60	40
VI	MATDSCT6.1	Theory	3	LinearAlgebra	60	40
	MATDSCP6.1	Practical	2	TheorybasedPractical'sonLinear Algebra	25	25

	MATDSCT6.2	Theory	3	NumericalAnalysis	60	40
	MATDSCP6.2	Practical	2	TheorybasedPractical'son NumericalAnalysis	25	25
	MATDSET6.1	Theory	3	(A) AnalyticalGeometryin3D (B) NumberTheory (C) SpecialFunctions (D) HistoryofBhârtîyaGaṇita	60	40
ExitOptionwithBachelorofScience(B.Sc.,) Basic Degree						
VII	MATDSCT7.1	Theory	3	DiscreteMathematics	60	40
	MATDSCP7.1	Practical	2	TheorybasedPractical'sonDiscrete Mathematics	25	25
	MATDSCT7.2	Theory	3	AdvancedOrdinaryDifferential Equations	60	40
	MATDSCP7.2	Practical	2	Theory based Practical's onAdvancedOrdinaryDifferential Equations	25	25
	MATDSCT7.3	Theory	4	AdvancedAnalysis	60	40
	MATDSET7.1	Theory	3	(A) GraphTheory (B) EntireandMeromorphicFunctions (C) GeneralTopology (D) BhâratîyaTrikoṇmitiŚâstra	60	40
	MATDSET7.2	Theory	3	ResearchMethodologyin Mathematics	60	40
VIII	MATDSCT8.1	Theory	4	AdvancedComplexAnalysis	60	40
	MATDSCT8.2	Theory	4	AdvancedPartialDifferential Equations	60 60	40 40
	MATDSCT8.3	Theory	3	FuzzySetsandFuzzySystems	60	40
	MATDSET8.1	Theory	3	(A) OperationsResearch (B) LatticetheoryandBooleanAlgebra (C) MathematicalModelling *(D) Aṅkapâśa(Combinatorics)*	60	40
	MATDSET8.2	ResearchProject	6(3+3)	ResearchProject* OR AnyTwoofthefollowingelectives (A) FiniteElementMethods (B) Cryptography (C) InformationTheoryandCoding (D) GraphTheoryandNetworking	120 OR 60 60	80 OR 40 40
AwardofBachelorofScience (B.Sc.,)HonorsDegreeinMathematics						

CURRICULUM STRUCTUREFORUNDERGRADUATE DEGREE PROGRAM

NameoftheDegreeProgram : B.Sc.,(Basic/Honors)
Discipline/Subject : Mathematics
StartingYearofImplementation : 2021-22

PROGRAMARTICULATIONMATRIX

Semester	CourseNo.	ProgrammeOutcomes thatthe CourseAddresses	Pre-RequisiteCourse(s)	Pedagogy*	Assessment**
I	MATDSCT1.1	PO1,PO2,PO3	----	MOOC	CLASSTESTS
II	MATDSCT2.1	PO1,PO2,PO3, PO8	MATDSCT1.1	PROBLEM SOLVING	
III	MATDSCT3.1	PO1,PO4,PO7, PO8	-----	SEMINAR	SEMINAR
IV	MATDSCT4.1	PO1,PO4,PO7, PO8	MATDSCT3.1	PROJECT BASED LEARNING	QUIZ
V	MATDSCT5.1	PO1,PO2,PO3, PO5	----		ASSIGNMENT
V	MATDSCT5.2	PO 3, PO 4, PO 7,PO10	MATDSCT2.1	ASSIGNMENTS	
VI	MATDSCT6.1	PO6, PO 7, PO10	MATDSCT5.2	GROUPDISCUSSION	
VI	MATDSCT6.2	PO3,PO 4,PO5, PO 8, PO 9, PO10	MATDSCT1.1 & MATDSCT2.1		TERM ENDE XAM
VII	MATDSCT7.1	PO3,PO4,PO5, PO7,PO9.	MATDSCT1.1 & MATDSCT2.1		
VII	MATDSCT7.2	PO2,PO 4,PO5, PO10	MATDSCT3.1		
VII	MATDSCT7.3	PO2,PO 4,PO5, PO10	MATDSCT3.1		
VIII	MATDSCT8.1	PO2,PO4,PO5, PO10	MATDSCT5.1		
VIII	MATDSCT8.2	PO2,PO 4,PO5, PO10	MATDSCT4.1		VIVA-VOCE
VIII	MATDSCT8.3	PO2,PO4,PO5, PO10	MATDSCT7.3		

**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 likeSeminar, 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).

B.Sc., (Basic/Honors)withMathematicsasaMinorinthe3rdYear

Semester	CourseNo.	Theory/Practical	Credits	PaperTitle	Marks	
					S.A.	I.A.
V	MATDSCMT5.1	Theory	3	ComplexAnalysis	60	40
	MATDSCMP5.1	Practical	2	TheorybasedPractical'sonComplexAnalysis	25	25
VI	MATDSCMT6.1	Theory	3	NumericalAnalysis	60	40
	MATDSCMP6.1	Practical	2	TheorybasedPractical'sonNumericalAnalysis	25	25

AbbreviationforMATDSCMT5.1/MATDSCMP5.1: MAT–Mathematics;**DSC**–DisciplineCore;**M**–Minor; **T**–Theory/**P**–Practical;**5**–FifthSemester;**.1**–Course1

CreditDistributionforB.Sc., (Basic/Honors)withMathematicsasMajor inthe3rdYear(ForModelIIA)

Subject	Semester	Major/Minorin the3rd Year	Credits					
			DisciplineSpecific Core(DSC)	OpenElective (OE)	DisciplineSpecificElective(DSE)	AECC &Languages	SkillEnhancementCourses(SEC)	Total Credits
Mathematics	I-IV	Major	4Courses(4+2)x4=24	4Courses 3x4 =12	---	(4+4=8)Courses8x(3+1)=32	2Courses 2x(1+1)=4	72
OtherSubject		Minor	24	--	--	--	--	24
96								
Mathematics	V&VI	Major	4Courses 4x(3+2)=20	-----	2Courses 2x3= 06	---	2Courses 2x2=4	30
OtherSubject		Minor	10	--	--	--	--	10
(96+40)**=136**								
Mathematics	VII& VIII	Major	2 Courses2x(3+2)=10 3 Courses 3x 4=12 1Course 1x3=3 Total=25	-----	2Courses 2x3=6 Res.Meth 1x3=3 2Courses 2x3=6 Total=15	----	-----	40
TotalNo.ofCourses			14	04	07	08	04	
136+40**=176**								

Syllabus for B.Sc., (Basic/ Honors) with Mathematics as Major & Minor Subject

SEMESTER – I

MATDSCT 1.1: Algebra - I and Calculus - I	
Teaching Hours: 4 Hours/Week	**Credits: 4**
Total Teaching Hours: 56 Hours	**Max. Marks: 100 (S.A.-60 + I.A. – 40)**

Course Learning Outcomes: This course will enable the students to

- Learn to solve system of linear equations.
- Solve the system of homogeneous and non-homogeneous linear of m equations in n variables by using concept of rank of matrix, finding eigen values and eigenvectors.
- Sketch curves in Cartesian, polar and pedal equations.
- Students will be familiar with the techniques of integration and differentiation of function with real variables.
- Identify and apply the intermediate value theorems and L'Hospital rule.

Unit-I: Matrix

Elementary row and column transformations (operations). Equivalent matrices, theorems on it. Row-reduced echelon form of a matrix. Rank of matrix, Problems.

Homogeneous and non-homogeneous system of m linear equations in n unknowns consistency criterion-criterion for uniqueness of solutions.

Eigen values and Eigen vectors of square matrix of order 2 and 3 standard properties, Matrix polynomial, Cayley-Hamilton theorem (with proof). Find A^{-1}, A^{-2} and A^2, A^3, A^4.

14 Hours

Unit-II: Differential Calculus-I

Limits, Continuity, Differentiability and properties. Properties of continuous functions. Intermediate value theorem, Rolle's Theorem, Lagrange's Mean Value theorem, Cauchy's Mean value theorem and examples. Taylor's theorem, Maclaurin's series (without proof), Indeterminate forms and evaluation of limits using L'Hospital rule.

14 Hours

Unit-III: Polar Co-ordinates

Polar coordinates, angle between the radius vector and tangent. Angle of intersection of two curves (polar forms), length of perpendicular from pole to the tangent, pedal equations. Derivative of an arc in Cartesian, parametric and polar forms, curvature of plane curve-

radius of curvature formula in Cartesian, parametric, polar, and pedal forms- center of curvatureand asymptotes.

14 Hours

Unit-IV:Successive Differentiation

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.

Extended polar co-ordinates-Singular and Multiple points.Tracing of curves (standard curves).

14 Hours

Reference Books:

1. University Algebra - N.S. Gopala Krishnan, New Age International (P) Limited, 1986.
2. Theory of Matrices - B S Vatsa, New Age International Publishers, 2005.
3. Matrices - A R Vasista, Krishna Prakashana Mandir, 2003.
4. Differential Calculus - Shanti Narayan, S. Chand & Company, New Delhi, 2005.
5. Applications of Calculus, Debasish Sengupta, Books and Allied (P) Ltd., 2019.
6. Calculus – Lipman Bers, Holt, Rinehart & Winston, 1969.
7. Calculus - S Narayanan & T. K. Manicavachogam Pillay, S. Viswanathan Pvt. Ltd., vol. I & II, 1996.
8. Schaum's Outline of Calculus - Frank Ayres and Elliott Mendelson, 5th ed. USA: Mc. Graw Hill., 2008.
9. Text Book of B.Sc. Mathematics, G K Ranganath, S Chand & Company, 2018
10. Text Book of B.Sc . Mathematics G B Gururajachar, Academic Excellence series, 2019

Web Resources:

1. http://www.nptelvideos.in/2012/11/mathematics.html
2. https://www.my-mooc.com/en/categorie/mathematics
3. http://ocw.mit.edu/courses/mathematics/

MATDSCP 1.1: Practical's on Algebra - I and Calculus – I	
Practical Hours : 4 Hours/Week	**Credits: 2**
Total Practical Hours: 56 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 problem on algebra and calculus theory studied in MATDSCT 1.1 by using FOSS software's.
- Acquire knowledge of applications of algebra and calculus through FOSS.

Practical/Lab Work to be performed in Computer Lab (FOSS)

Suggested Software's: Maxima/Python

1. Introduction to Python/Maxima.
2. Commands in Python/ Maxima.
3. Simple programs in Python/ Maxima
4. Matrices –Algebra of matrices.
5. Computation of rank of matrix.
6. Solving the system of homogeneous and non-homogeneous linear algebraic equations.
7. Computation of inverse of matrix using Cayley-Hamilton theorems.
8. Finding the angle between the radius vector and tangent and angle between two curves.
9. Finding the radius of curvature of the given curve.
10. Verification of mean value theorems.
11. Find the Taylor's and Maclaurin's expansion of the given function.
12. Indeterminate forms and evaluation of limits using L-Hospital Rule.
13. Finding the n^{th}derivative.
14. Tracing of standard curves.

OPEN ELECTIVE COURSE

(For students of Science stream who have not chosen Mathematics as one of Core subjects)

MATOET 1.1: Mathematics - I	
Teaching Hours : 3 Hours/Week	**Credits: 3**
Total Teaching Hours: 42 Hours	**Max. Marks: 100** **(S.A.-60 + I.A. – 40)**

Course Learning Outcomes: This course will enable the students to

- Learn to solve system of linear equations.
- Solve the system of homogeneous and non- homogeneous *m* linear equations by usingthe concept of rank of matrix, finding eigen values and eigen vectors.
- Students will be familiar with the techniques of differentiation of function with real variables.
- Identify and apply the intermediate value theorems and L'Hospital rule.
- Learn to trace some standard curves.

Unit-I: Matrix

Elementary row and column transformations (operations). Equivalent matrices, theorems on it. Row-reduced echelon form of a matrix. Rank of matrix, Problems.

Homogeneous and non-homogeneous system of m linear equations in n unknowns consistency criterion-criterion for uniqueness of solutions.

Eigen values and Eigen vectors of square matrix of order 2 and 3 standard properties, Matrix polynomial, Cayley-Hamilton theorem, (with proof). Find A^{-1}, A^{-2} and A^2, A^3, A^4.

14 Hours

Unit-II: Differential Calculus-I

Limits, Continuity, Differentiability and properties. Properties of continuous functions. Intermediate value theorem, Rolle's Theorem, Lagrange's Mean Value theorem, Cauchy's Mean value theorem and examples. Taylor's theorem, Maclaurin's series (without proof), Indeterminate forms and evaluation of limits using L'Hospital rule.

14 Hours

Unit-III:Differential Calculus-II

Successive Differentiation-nth Derivatives of Standard functionse^{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.

14 Hours

Reference Books:

1. University Algebra - N.S. Gopala Krishnan, New Age International (P) Limited, 1986.
2. Theory of Matrices - B S Vatsa, New Age International Publishers, 2005.
3. Matrices - A R Vasista, Krishna Prakashana Mandir, 2003.
4. Differential Calculus - Shanti Narayan, S. Chand & Company, New Delhi, 2005.
5. Applications of Calculus, Debasish Sengupta, Books and Allied (P) Ltd., 2019.
6. Calculus – Lipman Bers, Holt, Rinehart & Winston, 1969.
7. Calculus - S Narayanan & T. K. Manicavachogam Pillay, S. Viswanathan Pvt. Ltd., Vol. I & II, 1996.
8. Schaum's Outline of Calculus - Frank Ayres and Elliott Mendelson, 5th ed. USA: Mc. Graw Hill., 2008.
9. Text Book of B.Sc . Mathematics G B Gururajachar, Academic Excellence series, 2019

Web Resources:

1. http://www.nptelvideos.in/2012/11/mathematics.html
2. https://www.my-mooc.com/en/categorie/mathematics
3. http://ocw.mit.edu/courses/mathematics/

OPEN ELECTIVE COURSE

(For Students of other than Science Stream)

MATOE 1.1(B): Business Mathematics-I	
Teaching Hours: 3 Hours/Week	**Credits: 3**
Total Teaching Hours: 42 Hours	**Max. Marks: 100** **(S.A.- 60 + I.A. – 40)**

Course Learning Outcomes: This course will enable the students to

- Translate the real word problems through appropriate mathematical modeling.
- Explain the concepts and use equations, formulae and mathematical expression and relationship in a variety of context.
- Finding the extreme values of functions.
- Analyze and demonstrate the mathematical skill require in mathematically intensive areas in economics and business.

Unit-I: Algebra

Set theory and simple applications of Venn Diagram, relations, functions,indices, logarithms, permutations and combinations. Examples on commercial mathematics.

14 Hours

Unit - II: Matrices

Definition of a matrix, types of matrices, algebra of matrices. Properties of determinants; calculations of values of determinants upto third order, Adjoint of a matrix, elementary row and column operations, solution of a system of linear equations having unique solution and involving not more than three variables. Examples on commercial mathematics.

14 Hours

Unit - III: Percentage, Ratios and Proportions

Percentages:Definition, Calculation of percentage, Ratios- Types of Ratios, Duplicate, Triplicate and Sub-Duplicate of ratio, Proportions - Definitions and properties- cross product property and Reciprocal property, United proportions – Continued proportions – Compound proportions, Examples on commercial mathematics.

14 Hours

Reference Books:

1. Basic Mathematics, Allel R.G.A, Macmillan, New Delhi, 1938.
2. Mathematics for Economics, Dowling, E.T. , Schaum's Series, McGraw Hill,London,1992.
3. Quantitative Techniques in Management, Vohra, N.D., Tata McGraw Hill, NewDelhi, 1990.

4. Business Mathematics, Soni R.S., Pitamber Publishing House, Delhi, 1996.

Web Resources:

1. http://www.nptelvideos.in/2012/11/mathematics.html
2. https://www.my-mooc.com/en/categorie/mathematics
3. http://ocw.mit.edu/courses/mathematics/

SEMESTER – II

MATDSCT 2.1: Algebra - II and Calculus - II	
Teaching Hours : 4 Hours/Week	**Credits: 4**
Total Teaching Hours: 56 Hours	**Max. Marks: 100 (S.A.-60 + I.A. – 40)**

Course Learning Outcomes: This course will enable the students to

- Recognize the mathematical objects called Groups.
- Link the fundamental concepts of groups and symmetries of geometrical objects.
- Explain the significance of the notions of Cosets, subgroups and cyclic groups
- Understand the concept of differentiation and fundamental theorems in differentiationand various rules.
- Find the extreme values of functions of two variables.
- Understand the concept of integral calculus and their significance.

Unit-I: Groups

Definition of a group with examples and properties. Subgroups, center of groups, order of an element of a group and its related theorems, cyclic groups, Coset decomposition, Factor groups, Lagrange's theorem and its consequences. Fundamental of Congruence, Fermat's theorem and Euler's ϕfunction.

14 hours

Unit-II: Partial Derivatives

Functions of two or more variables-explicit and implicit functions, partial derivatives. Homogeneous functions- Euler's theorem, total derivatives, differentiation of implicit and composite functions, 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.

14 hours

Unit-III: Integral Calculus-I

Reduction formulae for $\int \sin^n x\ dx$, $\int \cos^n x\ dx$, $\int \tan^n x\ dx$, $\int \cot^n x\ dx$, $\int \sec^n x\ dx$, $\int \operatorname{cosec}^n x\ dx$, $\int \sin^m x \cos^n x\ dx$ with define limit –Problems. Application of integral Calculus: Computation of length of arc, plane area and surface area and volume of solids of revolutions for standard curves in Cartesian and polar forms.

14 hours

Unit-IV: Integral Calculus-II

Line integral: Definition of line integral and basic properties, examples on evaluation of lineintegrals. Double integral: Definition of Double integrals and basic properties, examples on evaluation of double integrals. Triple Integrals: Definition of triple integrals and basic properties, examples on evaluation of triple integral.

14 hours

Reference Books:

1. Topics in Algebra, I N Herstein, Wiley Eastern Ltd., New Delhi, 1991.
2. Higher algebra, Bernard & Child, Arihant, 1959.
3. Modern Algebra, Sharma and Vasista, Krishna Prakashan Mandir, Meerut, U.P., 2013.
4. Differential Calculus, Shanti Narayan, S. Chand & Company, New Delhi, 1962.
5. Integral Calculus, Shanti Narayan and P K Mittal, S. Chand and Co. Pvt. Ltd., 2013.
6. Schaum's Outline Series, Frank Ayres and Elliott Mendelson, 5th ed. USA: Mc. Graw Hill., 2008.
7. A Course in Abstract Algebra, Vijay K Khanna and S K Bhambri, VikasPublications.
8. Text Book of B.Sc. Mathematics, G K Ranganath, S Chand & Company, 2018
9. Text Book of B.Sc . Mathematics G B Gururajachar, Academic Excellence series, 2019

Web Resources:

1. http://www.nptelvideos.in/2012/11/mathematics.html
2. https://www.my-mooc.com/en/categorie/mathematics
3. http://ocw.mit.edu/courses/mathematics/

PRACTICAL

MATDSCP 2.1: On Algebra -II and Calculus – II	
Practical Hours : 4 Hours/Week	**Credits: 2**
Total Practical Hours: 56 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 problem on algebra and calculus by using FOSS software's.
- Acquire knowledge of applications of algebra and calculus through FOSS

Practical/Lab Work to be performed in Computer Lab

Suggested Software's: Maxima/Phython.

1. Program to construct Cayley's table and test abelian for given finite set.
2. Program to find all possible cosets of the given finite group.
3. Program to find generators and corresponding possible subgroups of a cyclic group.
4. Programs to verification of Lagrange's theorem with suitable examples.
5. Program to verify the Euler's ϕfunction for a given finite group.
6. Program to verify the Euler's theorem and its extension.
7. Program to find Jacobian.
8. Programs to construct series using Maclaurin's expansion for functions of two variables.
9. Program to verify the given Reduction formula with or without limits.
10. Program to evaluate the Surface area, volume of solid of revolutions for standard curves
11. Program to evaluate the line integrals with constant and variable limits.
12. Program to evaluate the Double integrals with constant and variable limits.
13. Program to evaluate the Triple integrals with constant and variable limits.

OPEN ELECTIVE COURSE

(For students of Science stream who have not chosen Mathematics as one of the Core subjects)

MATOET 2.1(A): Mathematics – II	
Teaching Hours : 3 Hours/Week	**Credits: 3**
Total Teaching Hours: 42 Hours	**Max. Marks: 100** **(S.A.- 60 + I.A. – 40)**

Course Learning Outcomes: This course will enable the students to

- Recognize the mathematical objects called Groups.
- Link the fundamental concepts of groups and symmetries of geometrical objects.
- Explain the significance of the notions of cosets, subgroups and cyclic groups.
- Understand the concept of differentiation and fundamental theorems in differentiationand various rules.
- Find the extreme values of functions of two variables.
- To understand the concepts of integralcalculus and their significance.

Unit-I: Groups

Definition of a group with examples and properties. Subgroups, center of groups, order of an element of a group and its related theorems, cyclic groups, Coset decomposition, Lagrange's theorem and its consequences. Fundamental of Congruence, Fermat's theorem and Euler's ϕfunction.

14 hours

Unit-II: Partial Derivatives

Functions of two or more variables-explicit and implicit functions, partial derivatives. Homogeneous functions- Euler's theorem, total derivatives, differentiation of implicit and composite functions, 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.

14 hours

Unit-III: Integral Calculus-I

Reduction formulae for $\int \sin^n x\ dx$, $\int \cos^n x\ dx$, $\int \tan^n x\ dx$, $\int \cot^n x\ dx$, $\int \sec^n x\ dx$, $\int \operatorname{cosec}^n x\ dx$, $\int \sin^m x \cos^n x\ dx$ with define limit –Problems. Application of integral Calculus:Computation of length of arc, plane area and surface area and volume of solids of revolutions for standard curves in Cartesian and polar forms.

14 hours

Reference Books:

1. Topics in Algebra, I N Herstein, 2nd Edition, Wiley Eastern Ltd., New Delhi, 1975.
2. Higher algebra, Bernard & Child, Arihant Pub, 1959.
3. Modern Algebra, Sharma and Vasishta, Krishna Prakashan Mandir, Meerut, U.P, 2013.
4. A Course in Abstract Algebra, Vijay K Khanna and S K Bhambri, Vikas Publications, 1998.
5. Differential Calculus, Shanti Narayan, S. Chand & Company, New Delhi, 1962.
6. Integral Calculus, Shanti Narayan and P K Mittal, S. Chand and Co. Pvt. Ltd., 2013.
7. Schaum's Outline Series, Frank Ayres and Elliott Mendelson, 5th ed. USA:McGraw Hill., 2008.
8. Text Book of B.Sc. Mathematics, G K Ranganath,S Chand & Company, 2018
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3. http://ocw.mit.edu/courses/mathematics/

OPEN ELECTIVE COURSE
(For Students of other than science stream)

MATOET 2.1(B): Business Mathematics-II	
Teaching Hours : 3 Hours/Week	**Credits: 3**
Total Teaching Hours: 42 Hours	**Max. Marks: 100** **(S.A.- 60 + I.A. – 40)**

Course Learning Outcomes: This course will enable the students to

- Integrate concept in international business concept with functioning of global trade.
- Evaluate the legal, social and economic environment of business.
- Apply decision-support tools to business decision making.
- Will be able to apply knowledge of business concepts and functions in an integrated manner.

Unit - I: Mathematical logic

Propositions, Truth values, Logical connectives, Truth table, Tautology and Contradiction, Logical equivalence, Negations, Converse, Inverse and Contrapositive of condition proposition and examples on commercial mathematics.

14 hours

Unit - II: Commercial Arithmetic

Interest: Concept of Present value and Future value, Simple interest, Compound interest, Nominal and Effective rate of interest, Examples and Problems Annuity: 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.

14 Hours

Unit - III: Measures of central Tendency and Dispersion

Frequency distribution: Raw data, attributes and variables, Classification of data, frequency distribution, cumulative frequency distribution, Histogram and give 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.

14 Hours

Reference Books:

1. Mathematics for Commerce, K. Selvakumar Notion Press Chennai, 2014.
2. Business Mathematics with Applications, Dinesh Khattar & S. R. Arora S. Chand Publishing New Delhi, 2001.
3. Business Mathematics and Statistics, N.G. Das &Dr. J.K. Das McGraw Hill New Delhi, 2017.
4. Fundamentals of Business Mathematics, M. K. Bhowal, Asian Books Pvt. Ltd New Delhi, 2009.
5. Mathematics for Economics and Finance: Methods and Modelling, Martin Anthony and Norman, Biggs Cambridge University Press Cambridge, 1996.
6. Financial Mathematics and its Applications, Ahmad Nazri Wahidudin Ventus Publishing APS Denmark, 2011.
7. Fundamentals of Mathematical Statistics, Gupta S. C. and Kapoor V. K.:, Sultan Chand and Sons, New Delhi, 2002.
8. Statistical Methods, Gupta S. P.: Sultan Chand and Sons, New Delhi, 2014.
9. Applied Statistics, Mukhopadhya,Primal New Central Book Agency Pvt. Ltd. Calcutta, 1999.
10. Practical Business Mathematics, S. A. Bari New Literature Publishing Company New Delhi.
11. Fundamentals of Statistics, Goon A. M., Gupta, M. K. and Dasgupta, B. World Press Calcutta, 2016.
12. Fundamentals of Applied Statistics, Gupta S. C. and Kapoor V. K.:, Sultan Chand and Sons, New Delhi, 2014.

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