BENGALURU CITYUNIYERSITY

CHOICE BASED CREDIT SYSTEM

Semester Scheme with Multiple Entry and Exit Options for

Under Graduate Course)

Syllabus for Mathematics

(I&II Semester)

2021-22 onwards

Syllabus for B.A/B.Sc (Honors) Mathematics

Name of the Degree Program : B.Sc.

Discipline Cours: Mathematics

Starting Year of Implementation : 2021-22

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

PO 1	Disciplinary Knowledge : Bachelor degree in Mathematics is the culmination of in-depth knowledge of Algebra, Calculus, Geometry, differential equations and several other branches of pure and applied mathematics. This also leads to study the related areas.
PO 2	Communication Skills: Ability to communicate various mathematical concepts effectively using examples and their geometrical visualization. The skills and knowledge gained in this program will lead to the proficiency in analytical reasoning which can be used for modeling and solving of real life problems.
PO 3	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.
PO 4	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
PO 5	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.
PO 6	Information/digital Literacy: The completion of this programme will enable the learner to use appropriate softwares to solve system of algebraic equations and differential equations.
PO 7	Self – directed learning: The student completing this program will develop an ability of working independently and to make an in-depth study of various notions of Mathematics.

PO 8	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 general.
PO 9	Lifelong learning: This programme provides self directed learning and lifelong learning skills. This programme helps the learner to think independently and develop algorithms and computational skills for solving real world problems.
PO 10	Ability to peruse advanced studies and research in pure and applied Mathematical sciences.

Assessment

Weightage for the Assessments (in percentage)

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

Contents of Courses for B.A./B.Sc. with Mathematics as Major Subject &B.A./B.Sc. (Hons) Mathematics
Model IIA

	Course No.			Paper Title	Marks		Remark
					S.A.	I.A.	
I	MATDSCT1.1	Theory	4	Algebra - I and Calculus - I	60	40	Approved with Syllabus
	MATDSCP1.1	Practical	2	Theory based Practical's on Algebra- I and Calculus - I	25	25	
II	MATDSCT2.1	Theory	4	Algebra - II and Calculus - II	60	40	
	MATDSCP2.1	Practical	2	Theory based Practical's on Algebra - II and Calculus - II	25	25	
Exit Option with Certificate							
III	MATDSCT3.1	Theory	4	Ordinary Differential Equations and Real Analysis-I	60	40	To be approved in subsequent BOS
	MATDSCP3.1	Practical	2	Theory based Practical's on Ordinary Differential Equations and Real	25	25	
	MATOET3.1	Theory	3	(A) Ordinary Differential Equations (B) Quantitative Mathematics	60	40	
IV	MATDSCT4.1	Theory	4	Partial Differential Equations and Integral Transforms	60	40	
	MATDSCP4.1	Practical	2	Theory based Practical's on Partial Differential Equations and Integral Transforms	25	25	
	MATOET4.1	Theory	3	(A) Partial Differential Equations (B) Mathematical Finance	60	40	
Exit Option with Diploma							
V	MATDSCT5.1	Theory	3	Real Analysis and Complex analysis	60	40	To be approved in subsequent BOS
	MATDSCP5.1	Practical	2	Theory based Practical's on Real Analysis and Complex Analysis	25	25	
	MATDSCT5.2	Theory	3	Ring Theory	60	40	

	MATDSCP5.2	Practical	2	Theory based Practical's on Ring theory	25	25	
	MATDSET5.1	Theory	3	(A) Vector Calculus (B) Mechanics (C) Mathematical Logic	60	40	
VI	MATDSCT6.1	Theory	3	Linear Algebra	60	40	
	MATDSCP6.1	Practical	2	Theory based Practical's on Linear Algebra	25	25	To be approved in subsequent BOS
	MATDSCT6.2	Theory	3	Numerical Analysis	60	40	
	MATDSCP6.2	Practical	2	Theory based Practical's on Numerical Analysis	25	25	
	MATDSET6.1	Theory	3	(A) Analytical Geometry in3D (B) Number Theory (C) Special Functions (D) History of Bhârtîya gaṇita	60	40	
	Exit Option with Bachelor of Arts, B.A./ Bachelor of Science, B.Sc. Degree						
VII	MATDSCT7.1	Theory	3	Discrete Mathematics	60	40	
	MATDSCP7.1	Practical	2	Theory based Practical's on Discrete Mathematics	25	25	To be approved in subsequent BOS
	MATDSCT7.2	Theory	3	Advanced Ordinary Differential Equations	60	40	
	MATDSCP7.2	Practical	2	Theory based Practical's on Advanced Ordinary Differential Equations	25	25	
	MATDSCT7.3	Theory	4	Advanced Analysis	60	40	
	MATDSET7.1	Theory	3	(A) Graph Theory (B) Entire and Meromorphic Functions (C) General Topology (D) Bhâratîya TrikoṇmitiŚâstra	60	40	
	MATDSET7.2	Theory	3	Research Methodology in Mathematics	60	40	
VIII	MATDSCT8.1	Theory	4	Advanced Complex Analysis	60	40	
	MATDSCT8.2	Theory	4	Advanced Partial Differential Equations	60	40	

	MATDSCT8.3	Theory	3	Fuzzy Sets and Fuzzy Systems	60	40	To be approved in subsequent BOS
	MATDSET8.1	Theory	3	(A) Operations Research (B) Lattice theory and Boolean Algebra (C) Mathematical Modelling (D) Aṅkapâśa(Combinatorics)	60	40	
	MATDSET8.2	Research Project	6 (3 + 3)	Research Project* OR Any Two of the following electives (A) Finite Element Methods (B) Cryptography (C) Information Theory and Coding (D) Graph Theory And Networking	120 OR 60 60	80 OR 40 40	
	Award of Bachelor of Arts Honours, B.A. (Hons)/ Bachelor ofScience Honours, B.Sc.(Hons) Degree inMathematics						

OPEN ELECTIVES FOR FIRST TWO SEMESTERS

Course			Paper Title	Marks(SA)	MarksI(IA)	Remark
MATOET1	Theory	3	Corporate Mathematics	60	40	Approved with Syllabus
MATOET2	Theory	3	Mathematics - I	60	40	
MATOET3	Theory	3	Mathematics- II	60	40	
MATOET4	Theory	3	Commercial Mathematics	60	40	

CURRICULUM STRUCTURE FOR UNDERGRADUATE DEGREEPROGRAM

Name of the Degree Program : B.A. / B.Sc.(Honors)
Discipline/Subject : Mathematics
Starting Year of Implementation: 2021-22

PROGRAM ARTICULATION MATRIX

Course number		Program outcomes that courses addresses	Prerequisite courses	Pedagogy *	Assessment **
I	MATDSCT1.1	PO 1,PO 2,PO 3	---------	MOOC PROBLEM SOLVING SEMINAR PROJECT BASED LEARNING ASSIGNMENTS GROUP DISCUSSION	CLASS TESTS SEMINAR QUIZ ASSIGNMENT TERM END EXAM VIVA-VOCE
II	MATDSCT2.1	PO 1,PO 2,PO 3 ,PO 8	MATDSCT1.1		
III	MATDSCT3.1	PO 1,PO 4,PO 7 PO 8	----------		
IV	MATDSCT4.1	PO 1,PO 4,PO 7, PO 8	MATDSCT3.1		
V	MATDSCT5.1	PO 1, PO 2, PO 3, PO 5	---------		
V	MATDSCT5.2	PO 3,PO 4, PO 7, PO 10	MATDSCT2.1		
VI	MATDSCT6.1	PO 6, PO 7, PO 10	MATDSCT5.1		
VI	MATDSCT6.2	PO 3,PO 4, PO 5, PO 8 PO 9, PO 10	MATDSCT1.1 & MATDSCT2.1		
VII	MATDSCT7.1	PO 3,PO 4, PO 5, PO 7, PO 9	MATDSCT1.1 & MATDSCT2.1		
VII	MATDSCT7.2	PO 2,PO 4, PO 5, PO 10	MATDSCT3.1		
VII	MATDSCT7.3	PO 2,PO 4, PO 5, PO 10	MATDSCT3.1		
VIII	MATDSCT8.1	PO 2,PO 4, PO 5, PO 10	MATDSCT5.1		
VIII	MATDSCT8.2	PO 2,PO 4, PO 5, PO 10	MATDSCT4.1		
VIII	MATDSCT8.3	PO 2,PO 4, PO 5, PO 10	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 like Seminar, Term Paper or MOOC.

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

B.A./B.Sc. with Mathematics as Minor in the 3rd Year

Semester	Course No.		Credits	Paper Title	Marks	
					S.A	I.A.
V3	MATDSCMT5.1	Theory		Complex Analysis	60	40
	MATDSCMP5.12	Practical		Theory based Practical's on Complex Analysis	25	2
V3	MATDSCMT6.1	Theory		Numerical Analysis	60	40
	MATDSCMP6.12	Practical		Theory based Practical's on Numerical Analysis	25	1

Abbreviation for MATDSCMT5.1 / MATDSCMP5.1
MAT – Mathematics; DSC – Discipline Core; M – Minor; T – Theory /P –Practical; 5 – Fifth Semester; .1 – Course1

Credit Distribution for B.A./B.Sc.(Honors) with Mathematics as Major inthe 3rd Year
(For Model IIA)

Subject		Major/ Minor in the 3rd Year	Credit						
			Discipline Specific Core (DSC)		Open (OE)	Discipline Specific & Elective (DSE)	AECC Elective Languages	Skill Enhancement Courses (SEC)	Total Credits
Mathematics	I-IV	Major	4 Courses (4+2)x		4Courses 3 x 4 =12	---	(4+4=8) Courses 8x(3+1) = 32	2 Courses 2x(1+1)= 4	72
Other Subject		Minor	24		--	--	--	--	24
									96
Mathematics	V & VI	Major	4 Courses 4x(3+2)=24		-----	2Courses 2 x 3 =06	---	2Courses 2 x 2 =4	30
Other Subject		Minor	10		--	--	--	--	10
(96+40)=136									
Mathematics	VII & VIII	Major	2 Courses2x(3+2)=1 3 Courses 3 x 4 = 12 1Course1 x 3 =3 Total=25		-----	2 Courses 2 x 3 = 6 Res.Meth1 x 3 =3 2Courses 2 x 3 =6 Total= 15	----	-----	40
Total No. of courses			14		04	07	08	04	
									136+40=176

Syllabus for B.A./B.Sc. with Mathematics as Major Subject &B.A./B.Sc. (Hons) Mathematics

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 find rank of a matrix.
- Solve the system of homogeneous and non-homogeneous linear system of ' m' equations in' n' variables by using concept of rank of matrix, finding eigenvalues and eigen vectors
- be familiar with the techniques of finding nth derivatives of some standard functions
- Identify and apply the intermediate value theorems and L'Hospital's rule.
- learn partial differentiation, Jacobians and related properties.
- learn expansion of Taylor's and Maclaurin's series of functions of 2 variables and maxima and minima of functions of 2 variables.

Algebra-I

Unit-I: Matrices: Recapitulation of Symmetric and Skew Symmetric matrices, Algebra of Matrices; Row and column reduction to Echelon form. Rank of a matrix; Finding rank of a matrix by reducing to row reduced echolen form and normal form;Solution of system of linear equations; Criteria 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, standard properties; Cayley- Hamilton theorem(With Proof), inverse of matrices by Cayley- Hamilton theorem, finding A^2, A^3,A^{-1}, A^{-2}.

14 Hours

Calculus I

Unit-II:-Limits, Continuity, Differentiability and properties. Properties of continuous functions. n^{th} 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.

14Hours

Unit-III: Mean Value Theorems : Intermediate value theorem, Rolle's Theorem, Lagrange's Mean Value theorem, Cauchy's Mean value theorem and examples. Taylor's theorem, Maclaurin's series, Indeterminate forms and evaluation of limits using L'Hospital's rule. 14 Hours

Unit-IV: **Partial Differentiation:** 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

Reference Books:

1. University Algebra -N.S. Gopala Krishnan, New Age International (P) Limited
2. Theory of Matrices - B S Vatsa, New Age InternationalPublishers.
3. Matrices - A R Vasista, Krishna PrakashanaMandir.
4. Differential Calculus - Shanti Narayan, S. Chand & Company, NewDelhi.
5. Applications of Calculus, DebasishSengupta, Books and Allied (P) Ltd.,2019.
6. Calculus – LipmanBers, 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.

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
- Solve problem on algebra and calculus theory studied in MATDSCT 1.1 by using FOSS softwares
- Acquire knowledge of applications of algebra and calculus through FOSS

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

Suggested Software's: Maxima/Scilab/Maple/MatLab/Mathematica/Python/R. Introduction to the software and commands related to the topic.

Practical -I

1. Basics of software with simple examples.

2. Basics of software with simple examples.

3. Matrices –Algebra of Matrices with problems.

4.Computation of rank of a matrix by row reduced and normal forms.

5.Solving the system of homogeneous and non- homogeneous linear equations.

6.Computation of inverse of a matrix using Cayley-Hamilton theorem.

7. Finding the nth derivatives of functions without Leibnitz theorem.

8. Finding the nth derivatives of functions with Leibnitz's theorem.

9. Partial Differentiation of some standard functions and Jacobians.

10. Verification of Euler's theorem with examples.

11. Finding the Taylor's and Maclaurin's expansion of the given function.

12. Indeterminate forms and evaluation of limits using L-Hospital's rule.

Note: Each problem given in the Lab-manual has to be solved manually.

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, normal subgroups and factor groups.
- Learn the quotient groups, concepts of homomorphism, isomorphism and properties related to isomorphism.
- Learn solve problems related to angle between radius vector and tangent, angle between two curves.
- Learn expressing the curves in pedal form, derivative of an arc
- Learn the center of curvature, asymptotes, evolutes and envelops of the given curve
- Learn the reduction formulae
- Learn to find length of an arc, area of plane curves and surface area, volume of revolution

Algebra-II

Unit-I: Groups-I-Definition o f a group with examples and properties, congruence, problems. Subgroups, center of groups, order of an element of a groupand its related theorems, cyclic groups, Coset decomposition, Factor groups, Lagrange's theorem and its consequences. Fermat's theorem and Euler's ϕ function.

14 Hours

Unit-II: Groups-II-Normal Subgroups-Examples & Problems –Quotient group-Homomorphism & Isomorphism of groups – kernel & image of a homomorphism – Normality of the kernel –Fundamental theorem of homomorphism – Properties related to isomorphism – Permutation group – Cayley's Theorem.

14 Hours

CALCULUS-II

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 and polar and pedal forms- center of curvature, asymptotes, evolutes and envelops.

14 Hours

Unit-IV: Integral Calculus: Recapitulation of definite integrals and its properties. Reduction formulae- $\int \sin^n x \, dx$, $\int \cos^n x \, dx$, $\int \sin^n x \, \cos^n x \, dx$, $\int_0^{\frac{\pi}{2}} \sin^n x \, dx$, $\int_0^{\frac{\pi}{2}} \cos^n x \, dx$, $\int_0^{\frac{\pi}{2}} \sin^n x \, \cos^n x \, dx$, problems, computation of length of an arc, Area of plane curves, surface area and volume of revolution in Cartesian and polar forms.

14 hours

Reference Books:

1. Elements of Number Theory; I. M. Vinogradov.
2. Differential Calculus, Shanti Narayan, S. Chand & Company, NewDelhi.
3. Integral Calculus, Shanti Narayan and PK Mittal, S. Chand and Co. Pvt. Ltd.,
4. Schaum's Outline Series, Frank Ayres and Elliott Mendelson, 5th ed. USA:Mc. Graw Hill.,2008.
5. Mathematical Analysis, S C Malik, WileyEastern.
6. A Course in Abstract Algebra, Vijay K Khanna and S K Bhambri,Vikas Publications.

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 problems on algebra and calculus by using FOSS.
- Acquire knowledge of applications of algebra and calculus

through FOSSPractical/Lab Work to be performed in

Computer Lab.

Suggested Software's: Maxima/Scilab/Maple/MatLab/Mathematica/Python

MATDSCP2.1:

Practicals-II

1. Program to construct Cayley's table and test commutatively for a 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. Program to verify Lagrange's theorem with suitable examples.
5. Program to verify Euler's φ Function for a given finite group.
6. Program to verify the given function is homomorphism and isomorphism.
7. Program to solve problems using reduction formulae.
8. Program to compute surface area.
9. Program to compute volume of revolution.
10. Finding the angle between the radius vector and tangent.
11. Finding the angle between two curves.
12. Finding the radius of curvature of the given curve.

Open Elective 1

MATOET 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 row and column operations, rank of matrix
- Learn to solve system of linear equations.
- Solve the system of homogeneous and non homogeneous m linear equations by ,finding eigenvalues and eigenvectors.
- Students will be familiar with the techniques of differentiation of function withreal variables.
- Identify and apply the intermediate value theorems andL'Hospital's rule.
- Learn to evaluate integrals , find arc -lengths , areas and volume.

Unit-I: Matrices: : Recapitulation of Symmetric and Skew Symmetric matrices, Algebra of Matrices; Row and column reduction to Echelon form. Rank of a matrix; Finding rank of a matrix by reducing to row reduced echolen form and normal form ;Solution of system of linear equations; Criteria for existence of non-trivial solutions of homogeneous system of linear equations. Solution of non-homogeneous system of linear equations. Eigenvalues and Eigen vectors of square matrices, Cayley- Hamilton theorem(Without Proof), inverse of matrices by Cayley-Hamilton theorem.

14Hours

Unit-II: Differential Calculus: Limits, Continuity, Differentiability and properties. Intermediate value theorem(statement only with examples), Rolle's Theorem(statement only with examples), Lagrange's Mean Value eorem(statement only with examples), Cauchy's Mean value theorem (statement only with examples) and examples. Taylor's theorem(without proof), Maclaurian's series and L'Hospital's rule-problems.

14 Hours

Unit-III: Integral Calculus: Recapitulation of Definite integrals and its properties. Computation of length of arc, area of plane curves, surface area and volume of revolution in Cartesian form.

14 Hours

Open Elective 2

MATOET 1: **Corporate Mathematics**	
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 types of equations and methods to solve linear, quadratic equations.
- Learn how to represent data through graphs and analyze.
- Learn frequency distribution , mean, median and mode.
- Learn GM,HM,AM concepts
- Learn formation and solution of LPP through graphical methods.

Unit I:

Theory of Equations:

Introduction meaning and types of equations. Simple linear equations, simultaneous equations (only two variables) elimination method, Substitution method and rule of cross multiplication (RCM). Quadratic equations, factorization method formula method and application problems.

14hours

Unit II:

Statistical Methods:

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

Unit IV:

Data Interpretation:

Tabulation, Bar graphs, Pie charts, line graphs and application problems.

Linear Programming:

Meaning, linear inequalities and their graphs, Formation of LPP and solution of linear programming problems by graphical method.(only two variables)

14 hours

Open Elective 3

MATOET3: 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

- learn how to find the roots of equations.
- relation between roots and coefficients.
- Learn Descartes' rule of signs to find roots.
- Understand the concept of partial differentiation, Jacobians and Taylors and Meclaurin's expansion.
- Find the extreme values of functions of two variables.
- To understand the concepts of multiple integrals and their applications.

Unit-I: Theory of Equations- Euclid's Algorithm- Polynomials with integral coefficients- Remainder theorem- Factor theorem- Fundamental theorem of algebra(statement only) –Irrational and complex roots occurring in conjugate pairs – Relation between roots and coefficients of a polynomial equations, symmetric functions – Transformation- Reciprocal equations- Descartes' rule of signs- multiple roots.

14 Hours

Unit-II: Partial Differentiation-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, 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-Definition of line integral and basic Properties ,examples on evaluation of line integrals. Double integral- Definition of Double integrals and its conversion to iterated integrals. Computation of plane surface areas. Triple integral- Definition of triple integrals and evaluation, volume as triple integral.

14 Hours

Open elective 4

MATOET 4: Commercial Mathematics	
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 concepts of set ,types of sets and Venn diagrams.
- Learn concepts of Relations and functions
- Learn concept of permutation and combination with application problems.
- Learn concept of probability, definitions of events , occurrences of events.
- Learn some rules of probability and application problems
- Learn to calculate percentage and ratios in application problems.
- learn definitions of proportions and properties.
- apply these concepts in commercial problems.

Unit-I: Set theory:

Sets, subset, empty set, power set, operations on sets, Venn diagrams, relations, types of relations, domain and range of a relations, functions, types of functions, binary operations.

14 hours

Unit - II: Permutation ,Combinations and probability

Fundamental principle of counting ,Factorial, permutation and combinations, simple applications. Random experiments,

Introduction to probability, sample spaces(Set representation),events; the probability of an event, some rules of probability .Occurrences of events. 'not', 'AND','OR' events, exhaustive events, mutually exclusive events. Axiomatic(set theoretic) probability ;probability of 'and', 'or', 'not', events and conditional probability.

14 Hours

Unit - III: Percentage, Ratio &Proportions: Percentage-Definition, Calculation of percentage, Ratios-Types of Ratios-Duplicate, Triplicate & Sub-duplicate of a ratio. Proportions-Definition &properties-cross product property &reciprocal property, united proportions-continued proportion-compound proportions, examples on commercial Mathematics.

14 Hours

Reference books for open electives:

1. Algebra, Natarajan, Manicavasagam pillay and Ganapathi
2. Differential Calculus, Shanti Narayan, S. Chand & Company, New Delhi.
3. Integral Calculus, Shanti Narayan and PK Mittal, S. Chand and Co. Pvt. Ltd.,
4. University Algebra - N.S. Gopala Krishnan, New Age International (P)
5. Theory of Matrices - B S Vatsa, New Age International Publishers.
6. M.K. Jain, S.R. K Iyengar and R.K .Jain, Numerical methods for Scientific and engineering Computations, 4thed.New Delhi, India, New age International,2012
7. John Kisulas,Numerical methods in engineering with python3, Cambridge University press,2013
8. Practical Business Mathematics, S. A. Bari New Literature Publishing Company, New Delhi
9. Mathematics for Commerce, K. Selvakumar Notion Press, Chennai
10. Business Mathematics with Applications, Dinesh Khattar& S. R. Arora S. Chand Publishing New Delhi
11. Business Mathematics and Statistics, N.G. Das &Dr. J.K. Das McGraw Hill New Delhi
12. Fundamentals of Business Mathematics, M. K. Bhowal, Asian Books Pvt.Ltd New Delhi
13. Statistical Methods, Gupta S. P.: Sultan Chand andSons, New Delhi.
14. Fundamentals of Statistics, Goon A. M., Gupta, M. K. and Dasgupta, B. World Press Calcutta.
15. Statistical methods: An introductory text, New Age.

Question paper pattern for all semesters(Core paper)

Theory Paper

PART - A (questions from all units)	6 questions out of 8 questions	6*2=12 marks
Part-B		
Unit - I	3 questions out of 5 questions	3*4=12 marks
Unit - II	3 questions out of 5 questions	3*4=12 marks
Unit - III	3 questions out of 5 questions	3*4=12 marks
Unit - IV	3 questions out of 5 questions	3*4=12 marks
Total		**60 marks**

Distribution of IA marks: Assignment - 5 marks
: Conducting Student Seminar -5 marks
: Two internal Tests - 30 marks

Open Elective Paper

PART - A (questions from all units)	5 questions out of 9 questions	5*3=15 marks
Part-B		
Unit - I	3 questions out of 5 questions	3*5=15 marks
Unit - II	3 questions out of 5 questions	3*5=15 marks
Unit - III	3 questions out of 5 questions	3*5=15 marks
Total		**60 marks**

Distribution of IA marks: Assignment - 5 marks
:Two internal Tests - 30 marks
: Conducting Student Seminars - 5 marks

Practical Question Paper

PART-I 1 question out of 2 questions	1*5=5 marks
PART-II 1 question out of 2 questions	1*5=5 marks
PART-III 1 question out of 2 questions	1*5=5 marks
PART-IV 1 question out of 2 questions	1*5=5 marks
Record	5 marks
Total	**25 marks**

Distribution of IA marks: Observation Book - 5 marks
: Two Internal Tests - 20 marks

Note: Distribution of Marks for manual work and execution will be done proportionately.

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BENGALURU CITY UNIVERSITY

BENGALURU CITY UNIVERSITY, BENGALURU

DEPARTMENT OF MATHEMATICS

Syllabi for Mathematics Papers of

BSc Third and Fourth Semesters

Under

National Education Policy 2020

Effective from the academic year
2022 – 2023

Syllabus for B.A./B.Sc. with Mathematics as Major Subject
&
B.A./B.Sc. (Hons) Mathematics

SEMESTER – III
(2022-23 onwards)

MATDSCT 3.1: Ordinary Differential Equations and Real Analysis – I	
Teaching Hours: 4 Hours/Week	Credits: 4
Total Teaching Hours: 56 Hours	Max. Marks: 100 (SEE- 60 + I.A. - 40)

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

- Solve first-order non-linear differential equations and linear differential equations.
- To model problems in nature using Ordinary Differential Equations.
- Formulate differential equations for various mathematical models
- Apply these techniques to solve and analyze various mathematical models.
- Understand the fundamental properties of the real numbers that lead to define sequence and series, the formal development of real analysis.
- Learn the concept of Convergence and Divergence of a sequence.
- Able to handle and understand limits and their use in sequences, series, differentiation, and integration.
- Apply the ratio, root, alternating series, and limit comparison tests for convergence and absolute convergence of an infinite series.

Ordinary Differential Equations:

Unit I: Recapitulation of differential equations of first order and first degree, Exact Differential equations, Necessary and sufficient condition for the equations to be exact. 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. 14 Hours

Unit II: Linear differential equations of the n^{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, where V is a function of x. Cauchy–Euler equations, Method of variation of parameters. Simultaneous differential equations with two variables. Condition for integrability of total differential equations $Pdx + Qdy + Rdz = 0$. 14 Hours

Real Analysis – I:

Unit III: Sequences: Sequences of real numbers, Bounded sequences. Limit of a sequence. convergent, divergent, and oscillatory sequences. Monotonic sequences. Algebra of convergent sequences. Bolzano Weierstrass theorem for sequence (statement only), Cauchy's first and second theorem on limits of a sequence. Cauchy's general principle for convergence of a sequence.

14 Hours

Unit IV: Infinite Series: 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, Alternating series, Leibnitz's theorem. Absolute convergence and conditional convergence of a series. Summation of series: Binomial, exponential and logarithmic. 14 Hours

Reference Books:

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

PRACTICAL

MATDSCP 3.1: Practicals on Ordinary Differential Equations and Real Analysis – I	
Teaching Hours: 4 Hours/Week	Credits: 2
Total Teaching Hours: 56 Hours	Max. Marks: 50 (SEE - 25 + I.A. – 25)

Course Learning Outcomes: This course will enable the students to gain hands-on experience of

- Free and Open Source software (FOSS) tools or computer programming.
- Solving exact differential equations
- Plotting orthogonal trajectories
- Finding complementary function and particular integral of linear and homogeneous differential equations.
- Acquire knowledge of applications of real analysis and differential equations.
- Verification of convergence/divergence of different types of series

Practicals/Lab Work to be performed in Computer Lab

Use open-source software to executive the practical problems. (Maxima/ Scilab/Matlab /Mathematica/Python)

1. Verification of exactness of a differential equation
2. Solutions of differential equations that are solvable for x, y, p.
3. To find the singular solution by using Clairaut's form.
4. Finding the Complementary Function and Particular Integral of non-homogeneous linear differential equations with constant coefficients and plot the solutions.
5. Solutions to the Total and Simultaneous differential equations and plot the solutions.
6. Convergence of sequences.
7. Convergence of geometric series.
8. Convergence of p-series and D'Alembert's Test.
9. Examples on alternating series using Leibnitz's theorem.
10. Finding the convergence of series using Cauchy's criterion for partial sums.
11. Summation of exponential and logarithmic series.
12. Summation of binomial series.

OPEN ELECTIVE COURSE

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

MATOET3.1(A) Ordinary Differential Equations	
Teaching Hours: 3 Hours/Week	Credits: 3
Total Teaching Hours: 42 Hours	Max. Marks: 100 (SEE - 60 + I.A. – 40)

Course Learning Outcomes: This course will enable the students:

1. To understand the concept of differential equation and their classification.
2. To know the meaning of the solution of a differential equation.
3. To solve exact differential equations
4. To Solve Bernoulli differential equations.
5. To find the solution to higher-order linear differential equations.

Unit I: Recapitulation of Differential Equations of first order and first degree, Exact Differential equations, Necessary and sufficient condition for the equations to be exact. 14 Hours

Unit II: 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. 14 Hours

Unit III: Linear differential equations of the n^{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(x) and xV(x) (with proofs). 14 Hours

Reference Books:

1. M. D. Raisinghania, Ordinary Differential Equations & Partial Differential Equations, S. Chand & Company, New Delhi.
2. J. Sinha Roy and S Padhy: 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, Differential Equations, Jai Prakash Nath & Co. Meerut.
6. Shepley L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, 1984.
7. Kreyzig, Advanced Engineering Mathematics, John Wiley, New Delhi.

OPEN ELECTIVE COURSE

(For students of other than Science stream)

MATOET 3.1(B): Quantitative Mathematics	
Teaching Hours : 3 Hours/Week	Credits: 3
Total Teaching Hours: 42 Hours	Max. Marks: 100 (SEE - 60 + IA - 40)

Course Outcomes: This course will enable the students to:

- Understand number system and fundamental operations
- Understand the concept of linear, quadratic and simultaneous equations & their applications in real life problems
- Understand and solve the problems based on age.
- Solve speed and distance related problems.

Unit-I: Number System

Numbers, Operations on numbers, Tests on Divisibility, HCF and LCM of numbers. Decimals, Fractions, Simplification, Square roots and Cube roots - Problems thereon. Surds and Indices. Illustrations thereon. 14 Hours

Unit-II: Theory of equations

Linear equations, quadratic equations, simultaneous equations in two variables, simple application problems - Problems on ages, Problems on conditional age calculations, Present & Past age calculations. 14 Hours

Unit-III: Quantitative Aptitude

Percentage, Average, Average Speed-problems. Time and distance, problems based on trains, problems on-work and time, work and wages, clock and calendar. 14 Hours

Reference Books:

1. R.S. Aggarwal, Quantitative Aptitude, S. Chand and Company Limited, NewDelhi.
2. A. Guha, Quantitative Aptitude, 5th Edition, Mc.Grawhillpublications.2014.
3. R V Praveen, Quantitative Aptitude and Reasoning, PHI publishers.
4. R S Aggarwal, Objective Arithmetic, S. Chand & Company Ltd.
5. Q. Zameerddin,V. K. Khanna, S K Bhambri, Business Mathematics-II Edition.
6. S. K. Sharma and G. Kaur, Business Mathematics, Sultan Chand & Sons.
7. H. Padmalochan, A Text Book of Business mathematics for B.Com and BBA Course, Chand Publication.
8. J K Thukrol, Business Mathematics, abci book:2020 First Edition.
9. N. G. Das and J. K. Das, Business Mathematics and Statics, Mc Graw Hill Education, 2017.

OPEN ELECTIVE COURSE
(For Students of other than Science Stream)

MATOET 3.1(C): Vedic Mathematics	
Teaching Hours : 3 Hours/Week	Credits: 3
Total Teaching Hours: 42 Hours	Max. Marks: 100 (S.A.- 60 + I.A. – 40)

Course Outcomes: This course will enable the students to:

- Understand the vedic methods of arithmetic.
- Understand the vedic methods of division with two/three digit divisor.
- Understand the vedic methods of power and root power of two digit numbers.

Unit-I: Multiplication:

1. Ekadhikenpurven method (multiplication of two numbers of two digits).
2. Eknunenpurven method (multiplication of two numbers of three digits).
3. Urdhvatiragbhyam method (multiplication of two numbers of three digits).
4. Nikhilam Navtashchramam Dashtaha (multiplication of two numbers of three digits).
5. Combined Operations. 14 Hours

Unit-II: Division and Divisibility

Part A: Division

1. NikhilamNavtashchramamDashtaha (two digits divisor)
2. ParavartyaYojyet method (three digits divisor)

Part B**: Divisibility**

1. Ekadhikenpurven method (two digits divisor)
2. Eknunenpurven method (two digits divisor) 14 Hours

Unit-III: Power and Root Power:

1. Square two digit numbers)
2. Cube (two digit numbers).

Root:

1. Square root (four digit number)
2. Cube root (six digit numbers).
3. Solution of linear simultaneous equations. 14 Hours

Reference Books:

1. Vedic Mathematics, Motilal Banarsi Das, New Delhi.
2. Vedic Ganita: Vihangama Drishti-1, SikshaSanskritiUthana Nyasa, New Delhi.
3. Vedic GanitaPraneta, Siksha Sanskriti Uthana Nyasa, New Delhi.
4. Vedic Mathematics: Past, Present and Future, Siksha Sanskriti Uthana Nyasa, New Delhi.
5. Leelavati, ChokhambbaVidya Bhavan, Varanasi.
6. Bharatiya Mathematicians, Sharda Sanskrit Sansthan, Varanasi.

SEMESTER – IV

MATDSCT 4.1: Partial Differential Equations and Integral Transforms	
Teaching Hours: 4 Hours/Week	Credits: 4
Total Teaching Hours: 56 Hours	Max. Marks: 100 (SEE - 60 + I.A. – 40)

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

- Formulate, classify and transform partial differential equations into canonical form.
- Solve the partial differential equations of the first order and second order
- Solve linear and non-linear partial differential equations using various methods; and apply these methods to solving some physical problems.
- Able to take more courses on wave equation, heat equation and Laplace equation.
- Solve PDE by Laplace transforms.

Partial Differential Equations

Unit I: Basic concepts–Formation of a 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.

14 Hours

Unit II: 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. 14 Hours

Integral Transforms

Unit III: Laplace transforms: 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 their properties. Solutions of differential equations by using Laplace transforms and their properties. 14 Hours

Unit IV: Fourier series and Transforms: Periodic functions. Fourier Coefficients. Fourier series of functions with period 2π 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 derivates. Inverse Fourier transforms. 14 Hours

Reference Books:

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, 3rd 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. R. Murray and L. Spiegal, Laplace Transforms, Schaum's Series
9. Sudhir Kumar, Integral Transform Methods in Science & Engineering, CBS Engineering Series, 2017.
10. Murray R. Spiegal L, Fourier Transforms, Schaum' Series,
11. Earl David Rainville and Philip Edward Bedient–A short course in Differential Equations, Prentice Hall College Div; 6th Edition.
12. Sathya Prakash, Mathematical Physics, S Chand and Sons, New Delhi.

PRACTICALS

MATDSCP 4.1: Practical's on Partial Differential Equations and Integral Transforms	
Practical Hours : 4 Hours/Week	Credits: 2
Total Teaching 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 or computer programming.
- Solve problems on Partial Differential Equations and Integral Forms
- To find Laplace transform of various functions
- To find the Fourier Transform of periodic functions
- To solve differential equations by using Integral transforms.

Programs using Scilab/Maxima/Python:

1 Solutions of linear partial differential equations of type 1 to type 3.
2 Solutions of Linear Partial differential equations of type 4 and Lagrange's method
3 Solutions of partial differential equation using Charpit's method.
4 Solutions of Second order non-homogenous partial differential equation with constant coefficients.
5 Solutions to the heat equation using separation of variables.
6 Solutions to the wave & Laplace equation using separation of variables method.
7 Finding the Laplace transforms of some standard and periodic functions.
8 Finding the inverse Laplace transform of simple functions.
9 Solution of ordinary linear differential equation using Laplace transform.
10 To find full range Fourier series of some simple functions with period 2π and $2L$
11 To find half range sine and cosine series of some simple functions and plotting them
12 To find cosine and sine Fourier transforms.

OPEN ELECTIVE COURSE

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

MATOET4.1(A): Partial Differential Equations	
Teaching Hours: 3 Hours/Week	Credits: 3
Total Teaching Hours: 42 Hours	Max. Marks: 100 (SEE-60 + I.A. – 40)

Course Learning Outcomes: This course will enable the students to

- Understand the concept of the partial differential equation.
- Classify the partial differential equations concerning their order and linearity.
- Understand the meaning of the solution of a partial differential equation.
- Solve a partial differential equation by Charpits method.
- Find the solution to higher-order linear differential equations.

Unit I: Basic concepts–Formation of a partial differential equations by elimination of arbitrary constants and functions – Solution of partial differential equations –Direct integration, Lagrange's linear equations of the form $Pp + Qq = R$. 14 Hours

Unit II: Standard types of first order non-linear partial differential equations, the integrals of the non-linear equation by Charpit's method. Homogeneous linear partial differential equations with constant coefficients. 14 Hours

Unit III: 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. 14 Hours

Reference Books:

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, C.B.S Publisher & Distributors, Delhi,1985.
3. G.F.Simmons, Differential Equations, Tata McGraw Hill 14
4. S.L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, India, 2004.
5. M.R. Speigel, Schaum's outline of Laplace Transform
6. M. D. Raisinghania, Ordinary Differential equations & Partial differential equations, S. Chand & Company, New Delhi.
7. K.Sankara Rao, Introduction to Partial Differential Equations: PHI, Third Edition, 2015.
8. I. N. Snedden, Elements of Partial differential equations,

OPEN ELECTIVE COURSE

(For students of other than science stream)

MATOET4.1(B) : Mathematical Finance	
Teaching Hours: 3Hours/week	Credits: 3
Total Teaching Hours:42Hours	Max.Marks:100 (S.A-60+I.A.-40)

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

- Understand how compute profit and loss, discount and Banker's discount.
- Understand the concept of linear equations and inequalities and their use in the solving the linear programming problems.
- Formulation of transportation problem and its application in routing problem.

Unit-I: Commercial Arithmetic

Bill of exchange, Bill of discounting procedure. Basic formula related to profit, loss, discount and brokerage, Successive discount, True discount, Banker's discount. 14 Hours

Unit-II: Linear Programming

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 a LPP by graphical method, special cases in graphical method. 14 Hours

Unit-III: Transportation Problem

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 (Routing Problem). 14 Hours

Reference Books:

1. R S Aggarwal, Objective Arithmetic, S. Chand & Company Ltd.
2. Mizrahi and Sullivan, Mathematics for Business and Social Sciences an Application approach.
3. Qazi Zameeruddin, Vijay K Khanna, S K Bhambri, Business Mathematics- II Edition, Vikas Publishing House.
4. S. Kalavathy, Operation Research, Fourth edition, Vikas publication house Pvt. Ltd.
5. Sreenivasa Reddy M, Operations Research 2nd edition, Sanguine Technical publishers, Bangalore.
6. S. D. Sharma, Operation Research,

OPEN ELECTIVE COURSE

(For students other than science stream)

MATOET 4.1 (C): Mathematics for Social Sciences	
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:

- Understand the mathematical concept of sets and counting problems.
- Understand the concept of Probability and its applications in social sciences.
- Understand the concept of limits and continuity of functions and its applications in business and social sciences.

Unit-I

Sets, counting, permutations, combinations, counting problems, binomial theorem and problems thereon. Probability – Introduction, sample space and assignment of probabilities, properties of the probability of an event, probability of equally likely events, conditional probability, Baye's formula and examples thereon. 14 Hours

Unit II

Limit and continuity, Derivative- interpretation, derivative formulas, general derivatives for differentiation, composite functions, higher order derivatives and problems thereon. 14 Hours

Unit III

Applications of the derivative – Relative maxima and Relative minima, Absolute maximum and Absolute minimum, Applied problems, Concavity, Asymptotes, Marginal analysis, Models- Maximizing tax revenue, Optimal trade-in time, and minimizing inventory cost. 14 Hours

Reference books

1. Abe Mizrahi and Michael Sullivan, Mathematics for Business and Social Sciences and Applied Approach – Third Edition, Wiley.
2. Carl P. Simon and Lawrence Blume, Mathematics for Economists, Viva Books Private Limited, New Delhi, 2015.
3. L. Peccati, M. D'Amico and M. Cigola , Maths for Social Sciences, , Springer.