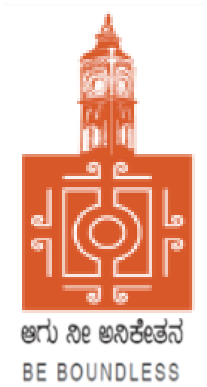

BENGALURU CITY UNIVERSITY

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

BENGALURU CITY UNIVERSITY

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

Name of theDegreeProgram : B.A./B.Sc.
DisciplineCourse : Mathematics
Starting YearofImplementation :2021-22

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

PO 1	Disciplinary Knowledge : Bachelor degree in Mathematics is theculmination 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 relatedareas.
PO 2	CommunicationSkills:Abilitytocommunicatevarious mathematicalconcepts effectively usingexamplesandtheirgeometrical visualization.The skills and knowledgegainedin thisprogramwillleadtothe proficiency in analytical reasoning which canbeused for modeling and solving of real life problems.
PO 3	Critical thinking and analytical reasoning: The students undergoing thisprogramme acquire ability of critical thinking and logical reasoning and capability of recognizing and distinguishing the various aspectsof real life problems.
PO 4	Problem Solving : The Mathematical knowledge gained by the studentsthroughthisprogrammedevelop an ability toanalyzethe problems, identify and define appropriate computing requirements forits solutions. This programme enhances students overall development
PO 5	Research related skills: The completing this programme develop thecapability 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 willenable the learner to use appropriate softwares to solve systemof algebraic equations and differential equations.
PO 7	Self – directed learning: The student completing this programwill 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 thisprogram 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 andlifelong learningskills. This programme helps thelearnerto think independently and develop algorithms and computational skillsfor solving real world problems.
PO 10	Ability to peruse advanced studies and research in pure and appliedMathematical 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	
	MATOET1.1	Theory	3	(A) Mathematics –I (B) Business Mathematics –I	60	40	
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	
	MATOET2.1	Theory	3	(A) Mathematics –II (B) BusinessMathematics-II	60	40	
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) OrdinaryDifferential Equations (B) QuantitativeMathematics	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 DifferentialEquations (B) MathematicalFinance	60	40	
Exit Option with Diploma							
V	MATDSCT5.1	Theory	3	Real Analysis and ComplexAnalysis	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) VectorCalculus (B) Mechanics (C) MathematicalLogic	60	40	
VI	MATDSCT6.1	Theory	3	Linear Algebra	60	40	
	MATDSCP6.1	Practical	2	Theory based Practical's on LinearAlgebra	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) NumberTheory (C) SpecialFunctions (D) History of BhârtîyaGaṇita	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	
	MATDSET 7.1	Theory	3	(A) Graph Theory (B) Entire and Meromorphic Functions (C) General Topology (D) Bhâratîya TrikoṇmitiŚâstra	60	40	
	MATDSET 7.2	Theory	3	Research Methodology in Mathematics	60	40	
	MATDSCT 8.1	Theory	4	Advanced Complex Analysis	60	40	
	MATDSCT 8.2	Theory	4	Advanced Partial Differential	60	40	

VIII				Equations			
	MATDSCT 8.3	Theory	3	Fuzzy Sets and Fuzzy Systems	60	40	To be approved in subsequent BOS
	MATDSET 8.1	Theory	3	(A) Operations Research (B) Lattice theory and Boolean Algebra (C) Mathematical Modelling (D) Aṅkapâśa (Combinatorics)	60	40	
	MATDSET 8.2	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 of Science Honours, B.Sc.(Hons) Degree inMathematics							

CURRICULUM STRUCTURE FOR UNDERGRADUATE DEGREE PROGRAM

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.	Theory/ Practical	Credits	Paper Title	Marks	
					S.A.	I.A.
V 3	MATDSCMT5.1	Theory		Complex Analysis	60	40
	MATDSCMP5.1 2	Practical		Theory based Practical's on Complex Analysis	25	25
V 3 I	MATDSCMT6.1	Theory		Numerical Analysis	60	40
	MATDSCMP6.1 2	Practical		Theory based Practical's on Numerical Analysis	25	15

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 in the 3rd Year
(For Model IIA)

Subject		Major/ Minor in the 3rd Year	Credit					
			Discipline Specific Core (DSC)	Open (OE) Elective	Discipline Specific & AECC Elective (DSE) 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)= 2	---- -	2Courses 2 x 3 =06	---	2 Courses 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 1Course 1 x 3 =3 Total=25	---- -	2 Courses 2 x 3 = 6 Res.Meth 1 x 3 =3 2Courses 2 x 3 =6 Total= 15	----	---- -	40
Total No. of	urses		14	04	07	08	04	
								136+40=176

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 rank of a matrix.
- 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 eigen vectors
- Students will be familiar with the techniques of find nth derivatives of .
- Identify and apply the intermediate value theorems and L'Hospital's rule.

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. Eigen values 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}.

Calculus I

14 Hours

Unit-II:-Limits, Continuity, Differentiability and properties. Properties of continuous functions. 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.

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'srule.

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, Debasish Sengupta, Books and Allied (P) Ltd.,2019.
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.

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 Matrix 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.

Open Elective

(For students 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 using the 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'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. Eigen values and Eigen vectors of square matrices, Cayley-Hamilton theorem(Without Proof), inverse of matrices by Cayley-Hamilton theorem.

14 Hours

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 theorem(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.

14Hours

Reference Books:

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. Applications of Calculus, Debasish Sengupta, Books and Allied (P) Ltd., 2019.
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.

Open Elective

(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 world problems through appropriate mathematical modellling.
- Explain the concepts and use equations, formulae and mathematical expressions and relationship in various context.
- Finding the extreme values of functions.
- Analyze and demonstrate the mathematical skills required in mathematically intensive areas in economics and business problems.

Unit-I: Algebra – Simple Linear Equations, Quadratic Equations, simultaneous equations in 2 variables, application problems.

14 Hours

Unit - II: Matrices: Definition of a matrix, types of matrices and algebra of matrices. Calculation of values of determinants upto third order, Adjoint and inverse of a square matrix, 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, 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:

1. Basic Mathematics, Allel R.G.A, Macmillan, New Delhi.
2. Mathematics for Economics, Dowling, E.T. , Schaum's Series, McGraw Hill, London.
3. Quantitative Techniques in Management, Vohra, N.D., Tata McGraw Hill, New Delhi.
4. Business Mathematics, Soni R.S., Pitamber Publishing House, Delhi

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.
- Understand the concept of differentiation and fundamental theorems in differentiation.
- Find the extreme values of functions of two variables.

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 group and its related theorems, cyclic groups, Coset decomposition, Factor groups, Lagrange's theorem and its consequences. Fermat's theorem and Euler's ϕfunction.

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.

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14 hours

Unit-IV: Integral Calculus: Recapitulation of definite integrals and its properties. Reduction formulae- $\int \sin^n x dx, \int \cos^n x dx, \int \sin^m x \cos^n x \, dx$ with limits, 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. Topics in Algebra, I N Herstein, Wiley Eastern Ltd., NewDelhi.
2. Higher algebra, Bernard & Child, Arihant, ISBN: 9350943199/9789350943199.
3. Modern Algebra,Sharmaand Vasista, Krishna Prakashan Mandir, Meerut, U.P.
4. Differential Calculus, Shanti Narayan, S. Chand & Company, NewDelhi.
5. Integral Calculus, Shanti Narayan and PK 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, WileyEastern.
8. 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 FOSS

Practical/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
(For students who have not chosen Mathematics as one of the Core subjects)

MATOET2.1(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

- 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 differentiation.
- 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

Reference books:

1. Natarajan, manicavasagam pillay and ganapathi-algebra
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, 5thed. USA: McGraw Hill.,2008.
5. Mathematical Analysis, S C Malik, WileyEastern.

Open Elective
(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 enablethe students to

- Learn the Concepts of propositions, truth values and properties.
- Solving the commercial mathematics problems using the concept of Mathematical logic.
- Having the knowledge of commercial arithmetic enable to calculate the interest, annuity, EMI etc.
- Learn measures of central tendency, concept of dispersion and thus solve related commercial mathematics problems.

Unit –I: Mathematical Logic: Propositions, truth values, Logical connectives ,truth tables, tautology and contradiction, logical equivalence, negation, converse, inverse and contra positive of a conditional proposition, rules of inference and examples on commercial mathematics.

14 Hours

Unit -II: Commercial Arithmetic: 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. 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. 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. 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 McGraw Hill New Delhi
5. Fundamentals of Business Mathematics, M. K. Bhowal, Asian Books Pvt. Ltd NewDelhi
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, New Delhi.
9. Statistical Methods, Gupta S. P.: Sultan Chand and Sons, New Delhi.
10. Applied Statistics, Mukhopadhya 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 Statistics, Goon A. M., Gupta, M. K. and Dasgupta, B. World Press Calcutta.
13. Fundamentals of Applied Statistics, Gupta S. C. and Kapoor V. K.:, Sultan Chand and Sons, New Delhi.

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 - 10 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 - 10 marks
Two internal Tests - 30 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.