The Kelkar Education Trust's

Vinayak Ganesh Vaze College of Arts, Science & Commerce

(AUTONOMOUS)

College with Potential for Excellence

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Syllabus for Program F.Y. B. Sc.

Mathematics

Syllabus as per Choice Based Credit System (NEP-2020)

(July 2023 Onwards)

Submitted by

Department of Mathematics
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Programme Structure and Course Credit Scheme :

Semester	Major		Minor	OE	VSC/SEC	AEC,VEC,IKS	OJT, FP,CEP,CC, RP	Total
	Mandatory	Elective						
I	4 Credit (2L+2P) (One Paper)	--	4 Credit (2L+2P) (One Paper)	4 Credit (3L+1P) (One Paper)	4 Credit VSC (2L+2P) (One Paper)	AEC - 2 Credit VEC-2 Credit IKS - 2 Credit (One Paper)	--	22
II	4 Credit (2L+2P) (One Paper)	--	4 Credit (2L+2P) (One Paper)	4 Credit (3L+1P) (One Paper)	4 Credit SEC (2L+2P) (One Paper)	AEC - 2 Credit VEC-2 Credit (One Paper)	CC-2	**22**
TOTAL	**8**		**8**	**8**	**8**	**10**	**2**	**44**

❖ Semester-wise Details of Mathematics Course

Semester - I									
Teaching Scheme (Hrs/Week)				**Continuous Internal Assessment (CIA) 40 marks**			**End Semester Examination Marks**		**Total**
Course	**L**	**P**	**Credit**	**CIA-1**	**CIA-2**	**CIA-3**	**Theory**	**Practical**	
Major	02	4	4.0	15	15	10	60	100	200
Minor	02	4	4.0	15	15	10	60	100	200
VSC	02	4	4.0	15	15	10	60	100	200
OE	03	2	4.0	15	15	10	60	50	150
CIA- II : Assignment/Project , CIA-III : APICID&A Max. Time, End Semester Exam (Theory) : 2 .00 Hrs.									

Semester - II									
Teaching Scheme (Hrs/Week)				**Continuous Internal Assessment (CIA) 40 marks**			**End Semester Examination Marks**		**Total**
Course	**L**	**P**	**Credit**	**CIA-1**	**CIA-2**	**CIA-3**	**Theory**	**Practical**	
Major	02	4	4.0	15	15	10	60	100	200
Minor	02	4	4.0	15	15	10	60	100	200
SEC	02	4	4.0	15	15	10	60	100	200
OE	03	2	4.0	15	15	10	60	50	150
CIA-II : Assignment/Project CIA-III : APICID&A Max. Time, End Semester Exam (Theory) : 2 .00 Hrs.									

- L - Lectures
- P - Practical
- C - Credits

SEMESTER-I			
CODE	COURSE TYPE	COURSE TITLE	CREDITS
VGVUSMMA101/ VGVUSNMA101	Major /Minor	Algebra-I	02
VGVUSMMAP101/ VGVUSNMAP101	Major /Minor	Algebra-I (Practical)	02
VGVUSVS103	Vocational Skill Course (VSC)	Calculus-I	02
VGVUSVSP103	Vocational Skill Course (VSC)	Calculus-I (Practical)	02
---	Skill Enhancement Course (SEC)	--	--
VGVUOE102	Open Elective (OE)	Basic Statistics	03
	Open Elective (OE)	Basic Statistics (Practical)	01

SEMESTER-II			
CODE	COURSE TYPE	COURSE TITLE	CREDITS
VGVUSMMA201/ VGVUSNMA201	Major /Minor	Algebra-II	02
VGVUSMMAP201/ VGVUSNMAP201	Major /Minor	Algebra-II (Practical)	02
--	Vocational Skill Course (VSC)	--	--
VGVUSSE203	Skill Enhancement Course (SEC)	Calculus-II	02
VGVUSSEP203	Skill Enhancement Course (SEC)	Calculus-II (Practical)	02
VGVUOE204	Open Elective (OE)	Data Analytics	03
	Open Elective (OE)	Data Analytics (Practical)	01

SEMESTER-I

F.Y.B.Sc. (Major/Minor)		
Title of the Course and Course Code VGVUSMMA101/ VGVUSNMA101	**ALGEBRA-I**	**No. of Credits: 02**

Unit No.	Content	No. of Lectures
I	**Unit – I (Matrices)** Definition of a Matrix, types of matrices, transpose of matrix and its properties, Orthogonal matrix (Definition), properties of orthogonal matrix, its determinant. Determinant and its properties, row echelon form of a matrix, elementary row operations, elementary matrices, rank of a matrix, System of linear equations in matrix form, System of m homogeneous linear equations in n unknowns has a non-trivial solution if $m < n$.	**10 Hrs.**
II	**Unit-II (Eigen Values and Eigen Vectors)** Characteristic polynomial, characteristics equation, minimal polynomial. standard formula to calculate characteristic polynomial of 2x2 and 3x3 matrices. characteristic and minimal polynomial of orthogonal matrix. Definition of eigen value, examples, Theorems on properties of eigen value. Algebraic multiplicity and geometric multiplicity, Eigen vector, examples (for distinct roots and for repeated roots)	**10 Hrs.**
III	**Unit -III (Application of eigen values and eigen vector)** Cayley Hamilton theorem, application of Cayley Hamilton theorem to find the inverse of a matrix. Diagonalization of matrices ,Derogatory Matrix, Finding n^{th} power of a matrix.	**10 Hrs.**

Learning Objectives:

1) To learn how to solve system of homogeneous and non-homogeneous equations with different methods.

2) To learn the concept of eigenvalues and eigenvectors and their importance in linear algebra.

3) To explore applications of eigen values in various fields such as physics, engineering and data analysis.

Learning Outcomes:

After learning this course, the learner will be able to

1. Develop the ability to solve systems of linear equations using various methods.
2. Differentiate between the types of matrices.
3. Solve the problems of finding inverse of matrix using Cayley's Hamilton theorem.

Recommended Books:

1) Linear Algebra by Nithya Sai NarayanaVipul Prakashan.

2) Linear Algebra, by Subhash Krishnan, Dr.Anil S.Vidya. , Sheth Publication.

Reference Books:

1. Matrix and Linear Algebra,by K. B. Datta, Prentice Hall of India Pvt. Ltd. New Delhi,2000.

2. A Text Book of Matrices, by Shanti Narayan, S. Chand Limited, 2010.

3. Schaum's Outline of Theory and Problems of Matrices, by Richord Bronson, McGraw-Hill, New York, 1989.

4. "Linear Algebra" by J.N. Sharma

5. "Matrix Algebra" by Abhay Bhattacharya and S.K. Jain

SEMESTER-I

F. Y.B.SC (Major/Minor)		
Title of the course and course code: VGVUSMMAP101/ VGVUSNMAP101	**ALGEBRA-I (PRACTICAL)**	**No. of Credits: 02**
Practical /Lab work to be performed in Computer Lab **List of Practicals to be done using SageMath/Scilab/Maxima/Python:**		

Sr.No	**Topics**
1	Identification of types of Matrices
2	Compute transpose, determinant and rank of a matrix
3	Orthogonal matrix and its characteristic polynomial
4	Elementary Matrices and row echelon form
5	Solving System of linear equations using rank of matrix
6	Eigen values for higher order matrix
7	Minimal polynomial of a various types of matrices
8	Computation of eigen values using formula
9	Eigen vector (for both repeated and non-repeated roots)
10	Problems on properties of eigen values
11	Finding inverse of matrix
12	Finding inverse of matrix using Cayley Hamilton Theorem
13	Problems on Diagonalization of matrices
14	Computation of derogatory matrix
15	Computation of n^{th} power of a matrix

SEMESTER-I

F.Y (VOCATIONAL SKILL COURSE (VSC))		
Title of the Course and Course Code : VGVUSVS103	**CALCULUS -I**	**No. of Credits: 02**

Unit No.	Content	No. of Lectures
I	**Real Number System** Real number system R and order properties of R , Absolute value and its properties, AM-GM inequality, Cauchy Schwarz inequality, Intervals and neighbourhoods, Hausdroff property, Bounded sets, supremum, infimum and their properties, statement of L.U.B. axiom, Archimedean property and its applications, Density of rationals in R, Existence of nth root of positive real numbers.	**10 Hrs.**
II	**Sequences** Definition of a sequence and examples, convergence and divergence of sequences, Boundedness of convergent sequence, Uniqueness of limit of a convergent sequence, Algebra of convergent sequences, Sandwich theorem, Monotone sequences, monotone convergence theorems and consequences. Subsequence, Cauchy sequence and examples. Every convergent sequence is a Cauchy sequence. Boundedness of a Cauchy sequence. Cauchy Completeness property.	**10 Hrs.**
III	**Limits and Continuity** Graphs of some standard functions such as $\|x\|, e^x, \sin x, \cos x, \tan x, \ln x, \frac{1}{x}$ over suitable intervals of R. limit of a function, $(\varepsilon - \delta)$ definition of limit of a function, Evaluation of limit of simple functions using $(\varepsilon - \delta)$ definition, uniqueness of limit when it exists, Algebra of limits, Sandwich theorem for limits, one sided limit, non-existence of limits, limit at infinity and infinite limits. Continuous functions: Continuity of a real valued function on a set in terms of limits, examples, Continuity of a real valued function at end points of domain, Sequential continuity, Algebra of continuous functions, discontinuous functions, examples of removable and essential discontinuity.	**10 Hrs.**

Learning Objectives:

1) Understand the relationships between natural numbers, integers, rational numbers, and irrational numbers as subsets of the real numbers.

2) Understand the domain and range of a sequence.

3) Classify a sequence as finite or infinite.

4) To understand the behavior of a function as its independent variable approaches a specific value.

Learning Outcomes:

After learning this course, the learner will be able to

1) Understand many properties of the real line $\mathbb{R}$ and learn to define sequence in terms of functions from $\mathbb{R}$ to a subset of $\mathbb{R}$..

2) Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence.

3) Calculate the limit and examine the continuity of a function at a point.

4) Sketch curves in Cartesian and polar coordinate systems.

Recommended Books:

1) Calculus ,Vipul Prakashan,Latika Bonde, Nithya Sai Narayana.

2)Calculus,Sheth Publication, Dr.Neena A. Joshi, Dr.Anil S.Vaidya.

Reference Books:

1. Robert G. Bartle, Donald R. Sherbert, Introduction to Real Analysis, third edition, John Wiley & Sons, Inc.

2. R. R. Goldberg, Methods of real analysis, Indian Edition, Oxford and IBH publishing, New Delhi.

3. Tom M. Apostol, Calculus Vol.1, Second edition, John Wiley & Sons.

4. Ajit Kumar, S. Kumaresan, A Basic Course in Real Analysis, CRC Press.

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SEMESTER-I

Vocational Skill Course (VSC)		
Title of the course and course code : VGVUSVSP103	**CALCULUS-I (PRACTICAL)**	**No.of credits:02**
Practical /lab work to be performed in computer lab. **List of practicals to be done using SageMath/Scilab/Maxima/Python.**		
1) Order properties, absolute value		
2)AM-GM inequality		
3) Hausdorff property.		
4) Bounded sets		
5) Supremum and Infimum		
6) Archimedian property		
7) Convergent sequences .		
8) Divergent sequences .		
9) Sandwich theorem.		
10) Monotone sequences		
11) Cauchy sequences		
12) Subsequences		
13) Drawing graphs of functions.		
14) Limits and Continuity of functions.		
15) Non-existence of limits .		

SEMESTER-I

(OPEN ELECTIVE (OE)) **(For Arts and Commerce Students)**		
Title of the Course and Course Code -VGVUOE102	**BASIC STATISTICS**	**No. of Credits: 03**

Unit No.	**Content**	**No. of Lectures**
I	**Summarization Measures**	**15 Hrs.**
	• Measures of Central Tendencies: Definition of Average, Types of Averages: Arithmetic Mean, Median, and Mode for grouped as well as ungrouped data. Quartiles, Deciles and Percentiles. Using Ogive locate median and Quartiles. Using Histogram locate mode. Combined and Weighted mean. **• Measures of Dispersion:** Concept and idea of dispersion. Various measures: Range, Quartile Deviation, Mean Deviation, Standard Deviation, Variance, Combined Variance.	
II	**Bivariate Linear Correlation and Regression**	**15 Hrs.**
	Correlation Analysis: Meaning, Types of Correlation, Determination of Correlation: Scatter diagram, Karl Pearson's method of Correlation Coefficient and Spearman's Rank Correlation Coefficient. **Regression Analysis:** Meaning, Concept of Regression equations, Slope of the Regression Line and its interpretation. Regression Coefficients, Relationship between Coefficient of Correlation and Regression Coefficients, Finding the equations of Regression lines by method of Least Squares.	
III	**Time series and Index Numbers**	**15 Hrs.**
	Time Series: Concepts and components of a time series. Representation of trend by Freehand Curve Method, Estimation of Trend using Moving Average Method and Least Squares Method. Estimation of Seasonal Component using Simple Arithmetic Mean for Additive Model only	

	(For Trend free data only). Concept of Forecasting using Least Squares Method. **Index Numbers:** Concept and usage of Index numbers, Types of Index numbers, Aggregate and Relative Index Numbers, Lasperye's, Paasche's, Dorbish Bowley's, Marshall-Edgeworth and Fisher's ideal index numbers, Test of Consistency: Time Reversal Test and Factor Reversal Test. Chain Base Index Nos. Shifting of Base year. Cost of Living Index Numbers, Concept of Real Income, Concept of Wholesale Price Index Number.	

Learning objective

1. The main objective of this course is to introduce statistics to undergraduate students of commerce, so that they can use them in the field of commerce and Industry to solve the real life problems.
2. To analyze the result by data handling.
3. To judge the reliability of measures of central tendency and measures of dispersions.
4. To introduce time series using moving average method and least square method.

Learning outcomes

1. Understand the operations research methodology and the problem solving approach.
2. Understand what are Mean, Median and Mode and how to calculate it.
3. Understand how all of alternative measures differ and why.
4. Calculate and interpret the correlation between two variables.
5. Determine whether the correlation is significant.
6. Calculate the simple linear regression equation for a set of data and know the basic assumptions behind regression analysis.
7. Determine whether a regression model is significant.
8. Differentiate among simple index numbers, unweighted aggregate price index numbers, weighted aggregate price index numbers, Laspeyres price index numbers, and Paasche price index numbers by defining and calculating each.

Recommended Books:

1)Mathematical & Statistical Techniques by Manan Prakashan.
2)Mathematical & Statistical Techniques by Dr.Neena Joshi, Dr.N.N.Pandey. Sheth Publication.

Reference Books

1. Operations Research by Gupta and Kapoor Operations Research by Schaum Series
2. Fundamentals of Statistics - D. N. Elhance.
3. Statistical Methods - S.G. Gupta (S. Chand & Co.
4. Statistics for Management - Lovin R. Rubin D.S. (Prentice Hall of India)
5. Statistics - Theory, Method & Applications D.S.Sancheti& V. K. Kapoor.

SEMESTER-I

(OPEN ELECTIVE (OE)) **(For Arts and Commerce Students)**		
Title of the Course And Course code	**BASIC STATISTICS (PRACTICAL)**	**No. of Credits: 01**
Practical/Lab work to be performed in Computer Lab. **List of practicals to be done using Excel:**		
1. Computation of Measures of Central tendency for raw data.		
2. Computation of Measures of Central tendency for discrete and continuous data.		
3. Computation of Measures of dispersion for raw data.		
4. Computation of Measures of dispersion for discrete and continuous data		
5. Graphical Presentation of data (Histogram, Frequency polygon, Ogives)		
6. Computation of Correlation coefficients		
7. Plotting of scatter diagram		
8. Computation of regression lines		
9. Measurement of trend by method of moving averages.		
10. Measurement of trend by method of least squares.		
11. Measurement of seasonal indices by the method of Ratio to trend.		
12. Computation of index numbers.		
13. Computation of real income.		
14. Computation of weighted and unweighted price index number.		
15. Computation of Lasperye's, Paasche's, Dorbish Bowley's, Marshall-Edgeworth and Fisher's ideal index numbers.		

SEMESTER-II

F.Y.B.Sc (Major/Minor)		
Title of the Course and Course Code VGVUSMMAP201/ VGVUSNMAP201	**ALGEBRA -II**	**No. of Credits: 02**

Unit No.	Content	No. of Lectures
I	**Number theoretic functions and Divisibility of integers** Number theoretic functions: Euler's ϕ function, statements of Euler's theorem, tau function, sigma function. Divisibility in integers, division algorithm, greatest common divisor (g.c.d.) and least common multiple (l.c.m.) of two integers, basic properties of g.c.d. such as existence and uniqueness of g.c.d. of integers a & b and that the g.c.d. can be expressed as $ma + nb$ for some $m, n \in \mathbb{Z}$, Euclidean algorithm. Euclid's lemma,Primes, Fundamental theorem of arithmetic, the set of primes is infinite. Congruences, Fermat's theorem, Gauss theorem and Wilson's theorem and their applications.	**10 Hrs.**
II	**Equivalence Relations and Functions** Binary operation, properties, examples. Equivalence relation, Equivalence classes, properties such as two equivalences classes are either identical or disjoint, Definition of partition, every partition gives an equivalence relation and vice versa. Definition of a function, domain, co-domain and range of a function, composite functions, examples, injective, surjective, bijective functions, Composite of injective, surjective, bijective functions when defined, invertible functions, bijective functions are invertible and conversely. Types of functions such as constant, identity, projection, inclusion.	**10 Hrs.**
III	**Polynomials** Definition of polynomials over $\mathbb{Z}$, $\mathbb{Q}$, $\mathbb{R}$ *or* $\mathbb{C}$, Algebra of polynomials, degree of polynomial, basic properties. Division algorithm in F[x], g.c.d. of two polynomials and its basic properties , Euclidean algorithm, applications, Roots of a polynomial, relation between roots and coefficients, multiplicity of a root, Remainder theorem, Factor theorem.	**10 Hrs.**

Learning Objectives:

1) To learn the number theoretic functions and their application in various contexts such as cryptography.
2) To provide a framework to analyze and understand the properties of prime numbers, congruences and deep understanding of number theory.
3) To study functions to learn how to study graphs and analyze their properties such as intercepts and symmetry.
4) To Understand polynomial in finding roots, solving equations, and simplifying complex expressions.

Learning Outcomes:

After learning this course, the learner will be able to

- Apply relations and functions in business.
- Provide a framework for analyzing number sequences, patterns other number sequences using concepts like divisibility and congruences.
- Differentiate between the types of functions.
- Learn the algebraic properties of polynomial.

Recommended Books:

1)Algebra by Nithya Sai Narayana,Vipul Prakashan.

2)Algebra by Subhash Krishnan, Dr.Anil S.Vidya.Sheth Publication.

Reference Books:

1. David M. Burton, Elementary Number Theory, Seventh Edition, McGraw Hill Education (India) Private Ltd.
2. Norman L. Biggs, Discrete Mathematics, Revised Edition, Clarendon Press, Oxford
3. Ajit kumar S. Kumaresan & B.K. Sarma, A Foundation Course in Mathematics, Narosa publishing House .
4. N. S. Gopalkrishnan, University Algebra, New Age International Ltd
5.. I.N. Herstein, Topics in Algebra, John Wiley

SEMESTER-II

F.Y.B.SC (Major/Minor)		
Title of the course and course code : VGVUSMMAP201/ VGVUSNMAP201	**ALGEBRA-II (PRACTICAL)**	**No. of Credits: 02**

Practical /Lab work to be performed in Computer Lab

List of Practicals to be done using SageMath/Scilab/Maxima/Python:

Sr.No	Topics
1	Finding divisors and number of divisors using tau and sigma function.
2	Finding GCD of two integers
3	Problems on Fermat's theorem and Gauss theorem
4	Problems on Wilson theorem
5	Finding last digit and remainder using Fermat's and Wilson theorem.
6	Problems on binary operation and its property
7	Equivalence relation and partition
8	Identification of types of functions
9	Problems on injection, surjection and bijection of function
10	Composition of function
11	Algebra of polynomials
12	Computation of GCD of polynomials.
13	Relation between roots and coefficients
14	Problems on Remainder theorem
15	Problems on Factor theorem

SEMESTER-II

F.Y.B.Sc [SKILL ENHANCEMENT COURSE (SEC)]		
Title of the Course and Course Code : VGVUSSE203	**CALCULUS -II**	**No. of Credits: 02**

Unit No.	Content	No. of Lectures
I	**Series** Infinite series of real numbers, convergent series, divergent series. Necessary condition for convergence of series. Algebra of convergent series, harmonic series, p-harmonic series, Comparison test, Limit comparison test, ratio test (without proof), root test (without proof) and examples, alternating series, Leibnitz test for alternating series, absolute convergence, conditional convergence.	**10 Hrs.**
II	**Continuity and Its Applications** Continuity of real valued functions with domain as intervals in R, examples, continuity of functions at end points of interval, Sequential continuity, Algebra of continuous functions, continuity of composite functions. Discontinuous functions, examples of removable and essential discontinuities. Sign preserving property of continuous function. Intermediate value theorem and its applications. Bolzano Weierstrass Theorem	**10 Hrs.**
III	**Differentiability and Its Applications** Notion of differentiability with geometrical and physical interpretation, non-differentiable functions, necessary condition for differentiability of real valued function, algebra of differentiable functions, derivative of inverse functions, chain rule. Higher order derivatives, Leibnitz rule, implicit differentiation, Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, increasing and decreasing functions, extreme values, stationary points, first derivative test, second derivative test, point of inflection, convex and concave functions	**10 Hrs.**

Learning Objectives:

1) Defining continuity on an interval.

2) Understanding, and investigating uses of the Intermediate Value Theorem.

3) Understanding the types of functions that are always continuous over their entire domain.

4) The learning objectives of differentiability and its application include understanding the concepts like continuity at a point, continuity on an interval, derivative of functions and many more.

5) Differentiability has many applications in real life. For example, it can be used to find the maximum or minimum value of a function. It can also be used to find the rate of change of a function.

Learning Outcomes:

On studying the syllabi, the learner will be able to understand

• Convergence and divergence of Series

• Absolute & conditional convergence.

• Continuity & Sequential continuity

• Intermediate value theorem and Bolzano Weierstrass Theorem

• Differentiability with geometrical and physical interpretation

• Mean value theorem & its applications

Recommended Books:

1) Calculus by Latika Bonde, Nithya Sai Narayana, Vipul Prakashan,

2) Calculus by Dr.Neena A. Joshi, Dr.Anil S.Vaidya, Latika Bonde, Nithya Sai Narayana.

Reference Books :

1.Robert G. Bartle, Donald R. Sherbert, Introduction to Real Analysis, third edition, John Wiley & Sons, Inc.

2. R. R. Goldberg, Methods of real analysis, Indian Edition, Oxford and IBH publishing, New Delhi.

3. Tom M. Apostol, Calculus Vol.1, Second edition, John Wiley & Sons

4. Ajit Kumar, S. Kumaresan, A Basic Course in Real Analysis, CRC Press.

SEMESTER-II

F.Y.B.SC [Vocational Skill Course (VSC)]		
Title of the course and course code : VGVUSNMAP201	**CALCULUS-II (PRACTICAL)**	**No.of credits:02**
Practical /lab work to be performed in computer lab. **List of practicals to be done using SageMath/Scilab/Maxima/Python.**		
1. Learning series of real numbers.		
2. Check behavior of series using sequence of partial sums.		
3. Some tests for convergence.		
4. Alternating series.		
5. Continuous functions ε -δ definition.		
6. Sequential continuity.		
7. Applications of continuous functions.		
8. Leibnitz theorem,		
9. Mean value theorems..		
10. Increasing and decreasing functions.		
11. Extreme values.		
12. Stationary points.		
13. point of inflection.		
14. Convex and Concave functions.		
15. Taylor's Theorem.		

SEMESTER-II

(OPEN ELECTIVE (OE)) (For Arts and Commerce Students)		
Title of the Course and Course Code -VGVUOE204	**DATA ANALYTICS**	**No. of Credits: 03**
Unit No.	**Content**	**No. of Lectures**
I	**Spread Sheet**	
	a) Creating and Navigating worksheets and adding information to worksheets • Types of data, entering different types of data such as texts, numbers, Date, functions. • Quick way to add data Auto complete, Autocorrect, Auto fill, Auto fit. Undo and Redo. • Moving data, contiguous and non-contiguous selections, Selecting with keyboard. Cut-Copy, Paste. Adding and moving columns or rows. Inserting columns and rows. • Find and replace values. Spell check. • Formatting cells, Numbers, Date, Times, Font, Colors, Borders, Fills. **b) Multiple Spreadsheets** • Adding, removing, hiding and renaming worksheets. • Add headers/Footers to a Workbook. Page breaks, preview. • Creating formulas, inserting functions, cell references, Absolute, Relative (within a worksheet, other worksheets and other workbooks). **c) Functions** • Financial functions: FV, PV, PMT, PPMT, IPMT, NPER, RATE • Mathematical and statistical functions. ROUND, ROUNDDOWN, ROUNDUP, CEILING, FLOOR, INT, MAX, MIN, MOD, SQRT, ABS, SUM, COUNT, AVERAGE **d) Data Analysis**	**15 Hrs.**

	• Sorting, Subtotal. Pivot Tables- Building Pivot Tables, Pivot Table regions, Rearranging Pivot Table.	
II	**Advanced Spread Sheet**	**15 Hrs.**
	a) Multiple Spread sheets • Creating and using templates, Using predefined templates, Adding protection option. • Creating and Linking Multiple Spreadsheets. • Using formulas and logical operators. • Creating and using named ranges. • Creating Formulas that use reference to cells in different worksheets. **b) Functions** • Database Functions LOOKUP, VLOOKUP, HLOOKUP • Conditional Logic functions IF, Nested IF, COUNTIF, SUMIF, AVERAGEIF, String functions LEFT, RIGHT, MID, LEN, UPPER,LOWER, PROPER, TRIM, FIXED • Date functions TODAY, NOW, DATE, TIME, DAY, MONTH, YEAR, WEEKDAY, DAYS360 • Statistical Functions COUNTA, COUNTBLANK, CORREL, LARGE, SMALL **c) Data Analysis** • Filter with customized condition. • The Graphical representation of data Column, Line, Pie and Bar charts. • Using Scenarios, creating and managing a scenario. • Using Goal Seek, Using Solver • Understanding Macros, Creating, Recording and Running Simple Macros. Editing a Macro (concept only)	
III	**Database and MySQL**	**15 Hrs.**
	a) Introduction: Introduction to Databases, Relational and Non-relational database system MySQL as a Non-procedural Language. View of data. **b) MySQL Basics :**	

	Statements (Schema Statements, Data statements, Transaction statements), names (table & column names), data types (Char, Varchar, Text, Mediumtext, Long text, Smallint, Bigint, Boolean, Decimal, Float, Double, Date, Date Time, Timestamp, Year, Time), Creating Database, inserting data, updating data, Deleting data, expressions, built-in-functions – lower, upper, reverse length, Ltrim, Rtrim, trim, left, right, mid, concat, now, time, date, curdate, day, month, year, dayname, monthname, abs, pow, mod, round, sqrt missing data (NULL and NOT NULL DEFAULT values) CREATE,USE, ALTER (Add, Remove, Change columns), RENAME, SHOW, DESCRIBE (CREATE TABLE, COLUMNS, STATUS and DATABASES only) and DROP (TABLE, COLUMN, DATABASES statements), PRIMARY KEY FOREIGN KEY (One and more columns) Simple Validity checking using CONSTRAINTS. **c) MySQL Simple queries:** The SELECT statement (From, Where, Group By, Having, Order By,Distinct, Filtering Data by using conditions. Simple and complex conditions using logical, arithmetic and relational operators (=, !,=, <, >, < >, AND, OR, NOT, LIKE) Aggregate Functions: count, sum, avg, max, min. **d) Multi-table queries:** Simple joins (INNER JOIN), SQL considerations for multi table queries (table aliases, qualified column names, all column selections self joins). **e) Nested Queries (Only up to two levels) :** Using sub queries, sub query search conditions, sub queries & joins,nested sub queries, correlated sub queries, sub queries in the HAVING clause. Simple Transaction illustrating START, COMMIT, and ROLLBACK.	

Learning objective

1. To provide basic knowledge of MS-Excel for Statistical Techniques to the students.
2. To identify spreadsheet terminology and concepts, create formulas and functions, use formatting features, and generate charts, graphs, and reports.
3. To analyse numerical data by using statistical tools and functions.
4. Be able to write SQL statements that create database objects.

Learning outcomes

1. Understand the various database structures.
2. Create database, and perform various commands related to database.
3. Plot Column, Line, Pie and Bar charts for the given data.
4. Understand how to use excel and its features.
5. After completing the practical course students are getting knowledge about the MS-Excel, Students are able to draw diagram and graphs by using MS-Excel.Write complex SQL queries to retrieve information from databases with many tables to support business decision making.

Recommended Books:

1) Computer system & Applications by Manan Prakashan.

2) Computer system & Applications by Sheth Publication.

3) Computer Systems and Applications Faiyaz Gadiwala ,Sheth Publication.

4) Computer Systems and Applications, Verus D'sa, Marvel Publication.

Reference books

1."Applied Data Communications And Networks" By B Buchanan.

2.Mysql: The Complete Reference By Vaswani, Mcgraw Hill.

3.Mysql: Sql Database Programming For Beginners By By Kevin Lioy

SEMESTER-II

(OPEN ELECTIVE (OE)) **(For Arts and Commerce Students)**		
Title of the Course And Course code	**DATA ANALYTICS (PRACTICAL)**	**No. of Credits: 01**
Practical/Lab work to be performed in Computer Lab. **List of practicals to be done using Excel and MySql :**		
1.Perform following : i) Create Worksheet ii) Rename the worksheet iii) Hide the worksheet iv) Add and Delete the worksheet v) Cut-Copy, Paste. vi) Add data Auto complete vii) Autocorrect viii) Auto fill, Auto fit. Undo and Redo. ix) Cut-Copy, Paste. x) Save the worksheet		
2.Perform following : i) Inserting columns and rows. ii) Find and replace values iii) Check. Formatting cells, Numbers, Date, Times, Font, Colors, Borders, Fills.		
3. Creating multiple spreadsheets with Adding, removing, hiding and renaming worksheets &Add headers/Footers to a Workbook. Page breaks, preview. Creating formulas, inserting functions, cell references, Absolute, Relative (within a worksheet, other worksheets and other workbooks).		
4. Computation of data using Financial functions: FV, PV, PMT, PPMT, IPMT, NPER, RATE		
5. Computation of data using Mathematical and statistical functions.		
6. Sorting of data, finding Subtotal of data, creating Pivot Tables.		
7.Computation of data using Database Functions LOOKUP, VLOOKUP, HLOOKUP Conditional Logic functions IF, Nested IF, COUNTIF, SUMIF,AVERAGEIF,		
8. Computation of data using String functions, Date functions, Statistical Functions.		
9. The Graphical representation of data Column, Line, Pie and Bar charts.		
10. Creating database in MySQL.		
11. Build functions in MySQL.		
12. Alter, delete, drop, clauses in MySQL.		
13. Aggregate functions in MySQL.		
14. Multitable (Join, groupby, having) queries in MySQL.		
15. Nested queries in MySQL.		

THEORY EXAMINATION PATTERN FOR (MAJOR/MINOR/VSC/SEC/OE)		
Que.1 A)	Attempt Any One:	(7 Marks)
	i) Theory Question based on Unit-I	
	ii) Theory Question based on Unit-I	
B)	Attempt Any Two:	(8 Marks)
	i) Problems based on Unit-I	
	ii) Problems based on Unit-I	
	iii) Problems based on Unit-I	
Que.2 A)	Attempt Any One:	(7 Marks)
	i) Theory Question based on Unit-II	
	ii) Theory Question based on Unit-II	
B)	Attempt Any Two:	(8 Marks)
	i) Problems based on Unit-II	
	ii) Problems based on Unit-II	
	iii) Problems based on Unit-II	
Que.3 A)	Attempt Any One:	(7 Marks)
	i) Theory Question based on Unit-III	
	ii) Theory Question based on Unit-III	
B)	Attempt Any Two:	(8 Marks)
	i) Problems based on Unit-III	
	ii) Problems based on Unit-III	
	iii) Problems based on Unit-III	
Q.4)	Solve the following.	(15 marks)
	i) Problems based on Unit-I	

Semester End Examinations Practicals: At the end of the Semester, I & II Practical examinations of three hours duration and 100 marks shall be conducted for Major/Minor, VSE/SEC, courses.
Marks for Journals and Viva: For each Major/ Minor, VSE/SEC, courses. **1. Journals: 10 marks.** **2. Viva: 10 marks**. **3. 40 Marks Computer based exam.** **4. 40 Marks Practical theory exam.**

PRACTICAL EXAMINATION PATTERN FOR THEORY

Que.1	Attempt any 8 objectives out of 12 from the following:	(8 x 3=24 Marks)
Que.2	Attempt any two from the following:	(8 x 2 =16 Marks)
	a) Based on unit-I	
	b) Based on unit-II	
	c) Based on unit-III	

OPEN ELECTIVE PRACTICAL EXAMINATION PATTERN

Semester End Examinations Practicals: At the end of the Semester, I & II Practical examinations of three hours duration and **50** marks shall be conducted for OE paper.
Marks for Journals and Viva: For each Open Elective (OE) course. **1. Journals: 10 marks.** **2. Viva: 10 marks**. **3. 30 Marks Computer based exam.**