KADI SARVA VISHWAVIDYALAYA
GANDHINAGAR

Syllabus for
M.Sc. Mathematics

June 2013

(*2 Years Full Time: 4 Semesters Programme*)

LDRP Campus, Sector – 15, Nr. *KH* – 5 Circle,
Gandhinagar - 382015

About the Trust

"Sarva Vishwavidhyalaya Kelavani Mandal" the trust which has been in existence for more than eight decades is a well reputed prestigious educational trust in North Gujarat. The alumni of SVKM has managed and nurtured the trust to its present eminence.

The trust was formed in 1919, and commenced its activities with a school and student residential "Ashram" at Kadi in 1921 through the generous donation from the society and through the visionary efforts of "Chhaganbha" who is the establisher of the Mandal.

Sarva Vishwavidhyalaya Kelavani Mandal was established to provide quality education to the needy people of the State of Gujarat at Kadi, at a time when people of the state were not inclined to send their children to school. It was from the stage, the growth came about. The trust has continued its endeavors for providing excellent educational facilities to the people of the state by establishing its campuses in various places of Gujarat viz., Vadnagar, Kalol, Visnagar and Gandhinagar. The trust has setup as many as 30 different educational institutions, ranging from Primary schools to postgraduate courses.

Engaged in the right pursuit of contributing to the noble cause of education the trust, which started with a school and a handful of students, has today to its credit two mega campuses at Kadi and Gandhinagar. More than 40,000 young students are being groomed at these campuses.

Having provided primary, secondary and higher secondary for almost seven decades, the trust has started imparting higher education and being sensitive to the needs of environment, has added technology, management and computer oriented courses to prepare youth of the region to take up the challenges of the future.

Be it quality of students, quality of faculty or quality of infrastructure at **Sarva Vishwavidhyalaya Kelavani Mandal**, nothing would be less par excellence. With the co-operation from its Alumni settled across the globe, the trust is committed to attain higher and higher standards of quality education to serve the coming generation.

Kadi Sarva Vishwavidhyalaya

MASTER OF SCIENCE (MATHEMATICS)

(1) Learning outcomes (objectives and aim)

This program leading to this degree provides the opportunities to develop and demonstrate knowledge and understanding of the fundamental and advanced content in Mathematics which will be determined by his /her particular choice of courses, according to his/her particular needs and interests.

Cognitive skills:
When one has completed this degree he/she will be able to:

- Understand how to solve some problems using the methods taught
- Assimilate complex mathematical ideas and arguments
- Develop abstract mathematical thinking
- Develop mathematical and physical intuition.

Practical and/or professional skills and Key Skills:
When one has completed this degree he / she will be able to demonstrate the following skills:

- The ability to advance your own knowledge and understanding through independent learning
- Communicate clearly knowledge, ideas and conclusions about mathematics
- Develop problem- solving skills and apply them dependently to problems in pure, applied and applicable mathematics
- Communicate effectively in writing about the subject
- Improve his/her own learning and performance.

(2) D**uration of the course:**

The CBCS pattern M.Sc. programme with multidisciplinary approach in Mathematics is offered on a fulltime basis. The duration of the course is of two academic years consisting of four semesters each of 15 weeks duration.

(3) **Techning and learning methods:**

All relevant material is provided and taught in the course texts through the study of set books. Various Modern resources will be provided to enhance his/her skill. One will build up knowledge gradually, with sufficient in text examples to support one's understanding. He/ She will be able to assess his/her own progress and understanding by using the in- text problems and exercised at the end of each unit. Opportunity to

engage with what is taught is provided by means of the assignment questions and understanding will be reinforced by personal feedback from the teacher in the form of comments based on the answers to one's assignments, seminars, unit tests and project.

(4) Course of study:

The curriculum has seven major components:

1. Core/Principal/Fundamental Mathematical courses
2. Pure Mathematical Courses
3. Applied Mathematical Courses
4. Applicable/Application Oriented Mathematical Courses (disciplinary)
5. Soft Skill Based Courses (Inter-disciplinary)
6. Cognitive Skill- Work Based Courses

There are twenty seven courses prescribed in the following classification to be studied to acquire M.Sc. Degree in Mathematics.

(I) **Principal /Core/Compulsory Courses (HARD CORE) (MTCG 1 to 8)**

All Basic/Core courses carry 4 credits in 4 hours per week teaching and in each semester, any two core courses to be selected from the list of MTCG Group (various groups are listed in detail syllabus) with no repetitions i.e there are total 10 Mathematical Core Courses to be selected from semester- I to semester IV.

(II) **Elective Disciplinary courses (SOFT CORE): (MTEG 1 to 8)**

All elective coursed carry 3 credits in 3 Hours per week teaching. During the span of the program, there are 10 Mathematical Elective Courses which are covering the three major components Pure Mathematical. Group, Applied Mathematical Group, Inter disciplinary Group & Applicable Mathematical Group.

(III) **Soft Skill Based Courses: (SSG-1 to 6)**

All soft skill based coursed carry 2 credits in 2 hours per week teaching and 3 credit for Practical in 3 hours per week. There are total 3 different Courses to be chosen from the list of SSG.

(IV) **Cognitive Skills Work Project/Dissertation Work for Research Problem**

This is also described in detail syllabus at the end.

(5) A**ssessment and examination method**:

A candidate understands of principals and concepts will be assessed through CIA and UE pattern as follow:

- **Continuous internal assessment (cia) :**

The CIA is done by the course teaches and this will evaluated any five/six from the following NINE academic components having equal Weightage.

1. Assignment, Quiz (announced or unannounced)
2. Individual viva or group viva.
3. Short duration objective types tests/snap tests.
4. Short answer/problem solving (15 to 30 minutes for assessment of cognitive ability)
5. Seminar (once in a semester is compulsory)
6. Unit test (Written or oral)/internal test
7. Laboratory/field/practical work
8. Group Discussion (Once in a semester to assed originality, creativity, initiative, communication skills…etc)

- **University Examination (UE) :**

There shall be four semester examinations, one at the end of each semester in each academic year. A candidate who does not pass the examination in any course (s) in a semester will be permitted to appear in such failed course (s) also, with subsequent semester examinations: University Examination (UE) only.
There is no Continuous Internal Assessment for any SSB Theory/practical. Also External University Examination for SSB Practical is of 50 Marks. Apart from this department also conduct Mid -semester Examination (**MSE**)

Classifications of CIA & UE for different courses of different credits are:
1. Courses of 4 Credits = 70 (UE) +20 (MSE) +10 (CIA) = 100 marks.
2. Courses of 3 Credits = 50 (UE) +20 (MSE) +05 (CIA) = 75 marks.
3. Courses of 2 Credits = 50 (UE) +00 (MSE) +00 (CIA) = 50 marks.
4. Courses of 9 Credits = 00 (UE) +00 (MSE) +225 (CIA) = 225 marks.

(6) Rules and regulations

1. Candidates for admission to the Master of Science (Mathematics) must have a Bachelor's degree with Mathematics as principle subject of minimum three year duration.

2. The duration of the course will be full time two academic years. The examination for the Master of Science (Mathematics) course will be conducted under the semester

system. For this purpose the academic year will be divided into two semesters. No candidate will be allowed to join any other fulltime course simultaneously.

3. No candidates will be admitted to any semester examination for Master of Science (Mathematics) unless it is certified by the HOD, M.Sc.(Maths) that he/she has attended the courses of study to the satisfaction of the HOD, M.Sc. (Maths).For granting the terms, minimum attendance of 70% of the theory, lectures and practical's will be required out of the total number of lectures and practical's conducted in the terms.

4. Candidates desirous of appearing at any semester examination of the M.Sc.(Maths) course must forward their application in the prescribed form to the Registrar, through the HOD, M.Sc. (Maths) on or before the date prescribed for the purpose under the relevant intimation of the University.

5. For any Semester, the maximum marks in any subject(s) for the internal and external assessments shall be shown in the teaching and examination scheme for each individual subjects. For the purpose of internal assessment, tests, quizzes, assignment or any other suitable methods of continuous evaluation may be used by the department. If a student keeps term and does not appear for examinations as well as if he/she fail to reappear in the re-test (block test) examination in the same academic session, his/her internal in the relevant subject(s) would be considered as ABSENT (INCOMLETE grade "I"). The department will submit the internal marks of all subject(s) as per the notification of the University.

6. No candidate will be permitted to reappear at any semester examination, which he/she has already passed.

7. To obtain the Degree of Master of Science (Mathematics), student should clear all the four semester examinations within a period of four years from the date of his/her Registration. Failing which, he/she shall be required to register himself/herself as a fresh candidate and keep the attendance and appear and pass in the four semester examinations afresh from first semester onwards in order to obtain the Degree of Master of Science (Mathematics).

8. There shall be an Examination at the end of each of the four semesters to be known as First semester Examination, Second semester Examination, Third semester

Examination and Fourth semester Examination respectively, at which a student shall appear in that portion of papers practical and Viva- Voce if any, for which he/she has kept the semester in accordance with the regulations in this behalf.

A candidate, whose term is not granted for whatsoever reason, shall be required to keep attendance for that semester or terms when the relevant papers are actually taught at the department.

9. No candidates will be allowed to reappear in a subject/course in which he/she has already passed. He /She can reappear only for the examination i.e. Internal or University examination in which he/she has failed. His/ Her marks in the examination passed will be carried forwarded.

(7) Rules for grading

1. Theory Subjects and Practical Subjects are allotted credits as per the hours allocated to them per week. (i.e. 1 hr/week = 1 Credit = 25 Marks).
2. To pass a subject in any Semester a candidate must obtain a minimum of 40% of marks under each head of the subject and minimum of 40% in the individual subject head.
3. If a candidate fails in any heads of a subject, he has to appear for that particular head to pass. (That is, for example if candidate fails in midterm exam of a subject, he has to reappear for midterm of that subject.)
4. The performance of each candidate in all the subjects will be evaluated on 7-point scale in term of grades as follow:

Grading Scheme				
Sr.No.	**Grades**	**Percentage according to Grade**	**Grade Points**	**Qualitative Meaning of Grade**
1	A +	90-100	10	Outstanding
2	A	80-89	9	Excellent
3	A-	70-79	8	Very Good
4	B +	60-69	7	Good
5	B	50-59	6	Average
6	B-	45-49	5	Fair
7	F	Less Than 45	0	Fail
8	I	Incomplete		

Award of class:

The class awarded to a student with his/her M.Sc. (Maths) course is decided by his/her final CPI as per the following table:

Distinction	CPI not less than 7.50
First Class	CPI less than 7.50, but not less than 6.50
Second Class	CPI less than 6.50, but not less than 5.50
Pass Class	CPI less than 5.50, but not less than 5.00

Semester Performance Index (SPI)

- The performance of a student in a semester is expressed in terms of the Semester Performance Index (SPI).
- The Semester Performance Index (SPI) is the weighted average of course grade points obtained by the student in the courses taken in the semester. The weights assigned to course grade points are the credits carried by the respective courses.

$$SPI = \frac{g1\ c1 + g2\ c2 + \ldots\ldots}{c1 + c2 + ...}$$

- Where g1, g2 …… are the grade points obtained by the student in the semester, for courses carrying credits c1, c2 …… respectively.

Cumulative Performance Index (CPI)

The cumulative performance of a student is expressed in terms of the Cumulative Performance Index (CPI). This index is defined as the weightage average of course grade points obtained by the students for all courses taken since his admission to the program, where the weights are defined in the same way as above.
If a student repeats a course, only the grade points obtained in the latest attempt are counted towards the Cumulative Performance Index.

5. For any Semester the maximum marks for the internal and external assessments shall be shown in the teaching and examination scheme. For the purpose of internal assessment, tests, quizzes, assignments or any other suitable methods assessment may be used by a department.

6. **Semester Passing Scheme**:

- For each semester examination, a candidate will be considered as pass/clear if he/she has secured "B-" OR above grade in the Internal as well as in the University Examination separately in each course of theory, practical and project work.
- For each semester examination, a candidate will be considered as fail if he/she has secured "F" grade in any or all of the subject(s).
- If the candidate does not fulfill the subject requirements, he/she will be given I-grade and the candidate will have to complete the course requirement before the commencement of the next semester-end examination. If the candidate does not clear I grade in any subject, he/she will be considered fail – F grade. Candidate has to clear his / her 'F' grade or 'I' grade, if any, in the next examination.

7. Semester Promotion Scheme

A candidate will be promoted to the subsequent Semester according to following scheme:

- A candidate would be granted admission to the Second Semester irrespective of the result of First Semester. He/She will be permitted to pursue his/her study of the Second Semester, provided his/her term for the first semester is granted and applied for the university examination.
- A candidate would be granted admission to the Third Semester if and only if he/she has cleared all the subjects of First Semester and irrespective of the result of Second Semester. He/She will be permitted to pursue his/her study of the Third Semester, provided his/her term for second semester is granted and applied for the university examination.
- A candidate would be granted admission to the Fourth Semester if and only if he/she has cleared all the subjects of Second Semester. He/She will be permitted to pursue his/her study of the Fourth Semester, provided his/her term for third semester is granted and applied for the university examination.
- The final degree would be awarded to the student on successful completion of all the Semester.

8. Following criteria would be followed for awarding the mark statement of any Semester:

- The Grade (Mark) sheet will contain separate grades internal and University examination for each of compulsory papers (subjects), Practical work, Project Work and overall grade for all the subjects combined.
- It will also contain percentage and the class obtained. The percentage will be calculated on the basis of cumulative performance index (CPI) obtained by candidate.
- CPI will be shown in each semester's Grade (mark) sheet for each end-semester examination.

9. Subject wise Grade and grade points will be calculated based on the Grading Scheme defined. For example:-

FOR SEMESTER-1

Subjects	Total Marks (Int+Ext)	Marks secured (Int+Ext)	In percentage	Grade	Points as per grade	Subject wise credit points	Product of credit points and grade points(Total credits)
A	100	75	75.00	A-	8	4	32
B	100	64	64.00	B+	7	4	28
C	100	82	82.00	A	9	4	36
D	100	54	54.00	B	6	4	24
E	150	73	49.00	B-	5	6	30
F	100	80	80.00	A	9	4	36
G	100	72	72.00	A-	8	4	32
Total						30	218

SPI: 218 / 30 = 7.27 , **CPI** = 7.27

FOR SEMESTER-2

Subjects	Total Marks (Int+Ext)	Marks secured (Int+Ext)	In percentage	Grade	Points as per grade	Subject wise credit points	Product of credit points and grade points(Total credits)
A	100	82	82.00	A	9	4	36
B	100	76	76.00	A-	8	4	32
C	100	71	71.00	A-	8	4	32
D	100	65	65.00	B+	7	4	28
E	150	45	30.00	F	0	6	0
F	100	52	52.00	B	6	4	24
G	100	44	44.00	B-	5	4	20
Total						30	172

SPI: 172 / 30 = 5.73, **CPI**: 6.50 (As Follow)

Semester	Points of sem (SPI)
Sem-I	7.27
Sem-II	5.73
Total SPI	13.00
CPI	6.50

In this case, the candidate is failing in one subject i.e. Project-II, and he/she has secured 5.23 SPI for semester II and 7.27 CPI for semester I and II both. Whenever

the candidate clears the subject i.e. Project-II in the next semester examination, the total credits for that subject will be add to CPI of the candidate.

10. To calculate the final grade of the course, CPI will be calculated as follows:–

SEMESTER	POINTS OF SEM (SPI)
SEM-1	6.79
SEM-2	5.30
SEM-3	8.33
SEM-4	5.56
Total SPI	25.98
CPI	6.50

CPI: 6.50

Class of M.Sc. Maths Course will be now – **'First'** as it falls in that range.

(8) Career scope

There are numbers of opportunities in various fields after successfully completed the program. Mathematics is the basic need of any natural sciences so this course has significant role in the society.

Teaching or Research

Tutor or Academician is the foundation of any educational institute, so one can achieve such profession .There is need of good Mathematics researcher in Universities and research institute.

Actuarial science

Actuarial science takes mathematics and statistics and applies them to finance and insurance. Actuarial science includes a number of interrelating disciplines, including probability and statistics, finance, and economics.

Computer science

Computer science is the study of the theoretical foundations of information and computation and their implementation and application in computer systems. Mathematicians, with the training in logical and precise thinking, are highly prized in this field.

Biomathematics

Mathematical biology or biomathematics is an interdisciplinary field of study. It models natural and biological processes using mathematical techniques and tools. Results have been applied to areas such as cellular neurobiology, epidemic modeling, and population genetics.

Finance

Finance is a field that studies and addresses the ways in which individuals, businesses, and organizations raise, allocate, and use monetary resources over time, taking into account the risks entailed in their projects. Mathematicians can build models to help explain and predict the behavior of financial markets.

(9) Recognition of lecturer, examiner & evaluator

Expert with the following qualifications and experience shall be eligible to be recognized to teach, examine and evaluate:

(A) Ph.D. holder in Mathematics or Person having M.Phil degree in Mathematics or Person having M.Sc. degree in mathematics and who has cleared NET or SLET Examination are eligible as full time Assistant professor.

(B) Person having B+ (Minimum 55%) at M.Sc. in Mathematics and having 5 years experience of teaching at graduate level are eligible as examiner or evaluator.

(10) Course structure

Semester 1

Subject Code	Title of the Course	Course Credit	No. of Hrs per week	Weightage for MSE+CIA	Weightage for UE	Total Marks	Duration of Semester Exam in hrs.
MTCG-1	Algebra-1	4	4	30	70	100	3
MTCG-2	Complex Analysis	4	4	30	70	100	3
MTCG-3	Statistical Methods	4	4	30	70	100	3
MTEG-1	Advanced Linear Algebra	3	3	25	50	75	2
SSG-1	Introduction to MATLAB	2	2	-	50	50	2
SSG-2	Programming in MATLAB (Practical)	3	3	25	50	75	2
		20	20			500	

Semester 2

Subject Code	Title of the Course	Course Credit	No. of Hrs per week	Weightage for MSE+CIA	Weightage for UE	Total Marks	Duration of Semester Exam in hrs.
MTCG-4	Topology	4	4	30	70	100	3
MTCG-5	Combinatorics & Graph Theory	4	4	30	70	100	3
MTCG-6	Measure Theory	4	4	30	70	100	3
MTEG-2	Special Functions	3	3	25	50	75	2
SSG-3	Introduction to 'C' Language	2	2	-	50	50	2
SSG-4	Programming in 'C' and Applications (Practical)	3	3	25	50	75	2
		20	20			500	

Semester 3

Subject Code	Title of the Course	Course Credit	No. of Hrs per week	Weightage for MSE+CIA	Weightage for UE	Total Marks	Duration of Semester Exam in hrs.
MTCG-7	Differential Equations	4	4	30	70	100	3
MTCG-8	Number Theory	4	4	30	70	100	3
MTEG-6	Research Methodology	3	3	25	50	75	2
MTEG-4	Classical Mechanics	3	3	25	50	75	2
SSG-5	Introduction to LATEX	2	2	-	50	50	2
SSG-6	Programming in LATEX (Practical)	3	3	25	50	75	2
		19	19			475	

Semester 4

Subject Code	Title of the Course	Course Credit	No. of Hrs per week	Weightage for MSE+CIA	Weightage for UE	Total Marks	Duration of Semester Exam in hrs.
MTEG-3	Mathematical Logic	3	3	25	50	75	2
MTEG-5	Integral Transforms	3	3	25	50	75	2
MTEG-7	Mathematical Modeling	3	3	25	50	75	2
MTEG-8	Operations Research	3	3	25	50	75	2
MTPD	Project work	9	9	75	150	225	0.75
		21	21			525	

List of courses in various groups offered in different semesters.

MTCG

1. Algebra -1 (Solvable group & Ring Theory)
2. Complex Analysis
3. Statistical Methods
4. Topology
5. Combinatorics & Graph Theory
6. Measure Theory
7. Differential Equations
8. Number Theory

MTEG

1. Advanced Linear Algebra
2. Special Functions
3. Mathematical Logic
4. Classical Mechanics
5. Integral Transforms
6. Research Methodology
7. Mathematical Modeling
8. Operations Research

SSG

1. Introduction to MATLAB
2. Programming in MATLAB (Practical)
3. Introduction to ‘C’ Language
4. Programming in ‘C’ and Applications (Practical)
5. Introduction to LATEX
6. Programming in LATEX (Practical)

Cognitive Skills Work Project/Dissertation Work for Research Problem

1. Project work (MTPD)

FIRST YEAR

DETAIL SYLLABUS

SEMESTER 1

Name of Course: Algebra - I

Subject Code	Title of the Course	Course Credits	No. of Hrs. Per Week	Weightage For MSE+CIA	Weightage For UE	Total Marks	Duration Of Semester end Exam in hrs.
MTCG–1	Algebra-1	4	4	30	70	100	3

Course Objectives

The objective of this course is

- To understand and be able to apply the conceptual structure of group theory.
- To gain skill in problem solving and critical thinking.
- the definition of various types of ring, and be familiar with a number of examples, including numbers, polynomials, and matrices

Learning Outcomes

On successful completion of the course, students should be able to

- Incorporate equivalence relations into group theoretic structures, particularly factor groups.
- Determine subgroups and determine whether given subsets of a group are subgroups.
- Use the Fundamental Theorem of Cyclic Groups to classify and determine subgroup structure of non-cyclic groups.
- Use the skills of proof by contradiction, proof by contraposition, proof of set equality, and proof using both forms mathematical induction.
- Recognize and use the Sylow Theorems to characterize certain finite groups.

Course Content:

Unit - 1

Revision: Group, Sub group, Normal Subgroups, Quotient groups, Homomorphism of groups, Isomorphic groups, Permutation groups, Direct product of groups, Cayley's theorem, Conjugacy relation on a group and its applicants, Solvable groups.

Unit - 2

Group actions, Sylow's theorem, Finite abelian groups, Simple groups.

Unit - 3

Revision: Ring, Sub rings, Ring homeomorphisms, Ideals and Quotient rings, Prime and Maximal ideals, Polynomial rings.

Unit – 4

Polynomial ring over a rational field, Irreducibility criteria, Polynomial ring over a cumulative ring, Unique factorization domain.

Text Book: Topics in Algebra by I. N. Herstein, John Wiley and Sons Inc., 2nd Edition.

Reference Books:

(1) "Basic Abstract Algebra" by Bhattacharya, Jain and Nagpal, 2nd Edition.

(2) "Algebra" by S. Mcclane and G. Birkhoff, 2nd Edition.

(3) "Basic Algebra" by N. Jacbson, Hind, Pub. Corp, 1984.

(4) "A first course in Abstract Algebra" by John Fraleigh (3rd Edition), Narossa Publishing House, New Delhi.

Name of Course: Complex Analysis

Subject Code	Title of the Course	Course Credits	No. of Hrs. Per Week	Weightage For MSE+CIA	Weightage For UE	Total Marks	Duration Of Semester end Exam in hrs.
MTCG-2	Complex Analysis	4	4	30	70	100	3

Course Objective

- This is an introductory course in complex analysis which provide a working knowledge of the basic definitions and theorems of the differential and integral calculus of functions of a complex variable and know the similarities and differences between real and complex analysis.

Learning Outcome

On successful completion of the course, students should be able to

- Develop facility with complex numbers and the geometry of the complex plane culminating in finding the n nth roots of a complex number.
- Set up and directly evaluate contour integrals
- Identify and classify zeros and singular points of functions.

Course Content:

Unit - 1

Revision: Complex numbers and its polar and exponential forms, powers and roots, Regions in the complex plane, Continuity and differentiability of complex functions, Analytic functions, Cauchy- Riemann equations, Harmonic Functions of two variables, Infinite series of complex numbers, Power series functions.

Unit- 2

The elementary Functions: Exponential, Trigonometric, Hyperbolic functions, Logarithmic functions and its branches rectifiable arcs, Complex line integral, Complex contour integral, Cauchy's theorem for triangular contours, Anti derivatives.

Unit -3

Cauchy's integral formula, Derivative of analytic functions, Morera's theorem, Liouville's theorem, Fundamental theorem of algebra, Taylor expansions, Laurent expansions.

Unit -4

Singularities, Zeros of analytic functions, Poles, Residues, Residue Theorem, Residue at poles, Evaluations of improper integrals.

Reference Books:

(1) John Duncan, The Elements of Complex Analysis, John Wiley and Sons Ltd.London(1968).

(2) L V Ahlfors, Complex Analysis,3rd edition, McGraw Hill, International Ed. (1966).

(3) J B Conway, Functions of one complex variables, 2nd edition, Springer Verlag, New York (1967) [Indian edition: Narosa Publication House, New Delhi (1982)].

(4) Serge Lang, Complex Analysis, Addison- Wesley, Publishing Co. (1997).

(5) B Choudhary, The Elements of Complex, Analysis, 2nd edition, New Age International Ltd Publishers, New Delhi (1992).

Name of the Course: STATISTICAL METHODS

Subject Code	Title of the Course	Course Credits	No. of Hrs. Per Week	Weightage For MSE+CIA	Weightage For UE	Total Marks	Duration Of Semester end Exam in hrs.
MTCG-3	Statistical Methods	4	4	30	70	100	3

Course Objective

The objective of this course is to

- To provide an understanding for the graduate business student on statistical concepts to include measurements of location and dispersion, probability, probability distributions, sampling, estimation, hypothesis testing, regression, and correlation analysis, multiple regression and business/economic forecasting.

Learning Outcome

- By completing this course the student will learn to perform the following:
- How to calculate and apply measures of location and measures of dispersion grouped and ungrouped data cases.
- How to apply discrete and continuous probability distributions to various business problems.
- Perform Test of Hypothesis as well as calculate confidence interval for a population parameter for single sample and two sample cases. Understand the concept of p-values.
- Learn non-parametric test such as the Chi-Square test for Independence as well as Goodness of Fit.
- Compute and interpret the results of Bivariate and Multivariate Regression and Correlation Analysis, for forecasting and also perform ANOVA and F-test..

Course Content

Unit - 1

Descriptive Statistics and Correlation: Introduction to Statistics, Applications in Business & Economics, Data Summarizing Qualitative & Quantitative Data, Exploratory Data Analysis, The Stem and leaf Display, Cross tabulation & Scatter Diagrams, Measures of location, Mean, Median, Mode, Percentiles, Quartiles, Measures of variability, Range, Inter quartile range, Variance, Standard deviation, Coefficient variation, Measures of distribution shape, Relative location and detecting outliers, Measures of association between two variables, Covariance, Correlation.

Unit - 2

Probability & Probability Distribution: Basic probability concepts, Experiment, Sample space, Events, Exclusive events, Exhaustive events, Independent events, Dependent events, Methods for assigning probability: Classical method, Relative frequency method, Subjective method, Events and their Probability, Addition rule (not to be proved or derived), Conditional probability, Multiplication rule (not to be proved or derived), Baye's theorem (statement only not to be proved or derived), Random variable, Discrete and continuous random variable, Expected value and variance of random variable, Probability distribution: Binomial distribution, Poisson distribution, Hyper geometric distribution, Uniform distribution, Normal distribution, Normal approximation of Binomial exponential distribution, Relationship between Poisson and Exponential distribution, Discuss pmf/ pdf, properties and applications of all distribution.

Unit - 3

Statistical Inference: Sampling methods, Sampling distribution, Central limit theorem (statement only), Point and interval estimation, Sampling distribution of sample mean, Sampling distribution of sample proportion, Hypothesis tests: Null and alternative hypothesis, Type I & II errors, One and two tails test, Rejection rule using p- value and critical value approach, Test of hypothesis about population mean (known), Test of hypothesis about population and proportion, Sampling distribution and test of hypothesis about difference between two population means(known and unknown), Sampling distribution and test of hypothesis about difference between two population and proportions analysis of variance (I way, two way).

Unit - 4

Regression: Introduction to Regression, Simple linear Regression Model, Least Square Method, Coefficient of Determination, Correlation Coefficient, Model Assumptions, Residual Analysis, Validating Model Assumptions, Outliers and Influential Observations, Using the Estimated Regression Equation for Estimation and Prediction.

Reference Books:

(1) Anderson, Sweeney, Williams, " Statistics for business and economics ", 9th edition, Cengage Publication.

(2) S.P. Gupta, "Statistical Method" Sultan Chand and Sons 37th edition (2008).

Name of the Course: Advanced Linear Algebra

Subject Code	Title of the Course	Course Credits	No. of Hrs. Per Week	Weightage For MSE+CIA	Weightage For UE	Total Marks	Duration Of Semester end Exam in hrs.
MTEG-1	Advanced linear Algebra	3	3	25	50	75	2

Course Objectives

- To provide students with a good understanding of the concepts and methods of linear algebra, described in detail in the syllabus.
- To connect linear algebra to other fields both within and without mathematics.
- To develop abstract and critical reasoning by studying logical proofs and the axiomatic method as applied to linear algebra.

Learning Outcomes

- Students will be able to apply the concepts and methods described in the syllabus, they will be able to solve problems using linear algebra, they will know a number of applications of linear algebra, and they will be able to follow complex logical arguments and develop modest logical arguments.

Course Content:

Revision

Vector spaces, Subspaces, Bases and dimensions, Dual spaces, Linear transformations.

Unit - 1

The Algebra of Linear Transformation, Characteristic roots, Matrices.

Unit - 2

Triangular canonical forms, Nilpotent linear transformations.

Unit - 3

Trace and transpose, Decomposition theorem, Jordan canonical forms.

Unit - 4

Rational canonical forms, Determinants.

Text Book: Topics in Algebra", 2nd edition, by I N Heestein John Wiley and sons, Student Edition, New York (2004).

Reference Books:

(1) Lenneth Hoffman, Ray Kunze, Linear Algebra, 2nd edition Prentice Hall of IndiaNew Delhi (1971).

(2) P B Bhattacharya, Phani Bhusan Bhattacharya, S K Jain, S R Nagpaul, First course in Steven Roman, Advanced linear algebra, New Age International Ltd Publishers, New Dlhi (2008).

(3) Steven Roman, Advanced linear algebra, 3rd edition, Springer (2008).

Name of Course: INTRODUCTION TO MATLAB

Subject Code	Title of the Course	Course Credits	No. of Hrs. Per Week	Weightage For MSE+CIA	Weightage For UE	Total Marks	Duration Of Semester end Exam in hrs.
SSG-1	Introduction to MATLAB	2	2	-	50	50	2

Course Objectives

- To develop the knowledge of Import/export data , Create and manipulate variables , Program and run simple scripts (M-files)
- Use graphics tools to display data and Use of built-in help features
- To learn the basics of MATLAB as a method of solving problems and to see a few solution techniques you will implement to solve these problems.

Learning Outcomes

- After finished course the student should be able to use an advanced mathematical tool. The student should be able to adopt an applied problem and solve it with Matlab.

Course Content:

Unit - 1

Introduction- Matlab interface, Menus and the toolbar, Computing with matlab, Script files & editor debugger, Help system.

Unit - 2

Arrays & Matrices- Arrays and multidimensional arrays, Polynomial operation using arrays, Cell arrays, Structure arrays, Matrices &sub matrices, Matrix operations.

Unit - 3

Programming Techniques- Program Design & Development, Logical operators & functions, Relational operators & logical variables, Conditional Statements, Loops,

Unit - 4

Plotting & Polynomials- XY- plotting functions, Sub plots and overlay plots, Special plots, Interactive plotting, 3 D plots, Rational polynomials, Curve fitting, Integration and Differentiation.

Reference Books:

(1) Introduction to MATLAB 7 for Engineers , by William J Palm, Mc Graw Hill 2005.

(2) Learning MATLAB -7 Oxford, 2008

(3) Mastering MATLAB -7 by D. Hanselman, B.Littlefield, Pearson Education2005.

Name of Course: PROGRAMMING IN MATLAB (PRACTICAL)

Subject Code	Title of the Course	Course Credits	No. of Hrs. Per Week	Weightage For MSE+CIA	Weightage For UE	Total Marks	Duration Of Semester end Exam in hrs.
SSG-2	Programming in MATLAB(Practical)	3	3	25	50	75	2

Course Content:

Practical related to the followings

1. MATLAB Environment: MATLAB interface, commands & Variables.
2. Built in MATLAB Functions
3. Vector & Matrix data
4. Plotting
5. User Defined Functions
6. Mathematical or Engineering case studies.

Reference Books:

(1) Introduction to MATLAB 7 for Engineers , by William J Palm, Mc Graw Hill 2005.

(2) Learning MATLAB -7 Oxford, 2008

(3) Mastering MATLAB -7 by D. Hanselman, B.Littlefield, Pearson Education2005.

SEMESTER 2

Name of the Course: Topology

Subject Code	Title of the Course	Course Credits	No. of Hrs. Per Week	Weightage For MSE+CIA	Weightage For UE	Total Marks	Duration Of Semester end Exam in hrs.
MTCG–4	Topology	4	4	30	70	100	3

Course Objectives

- This course aims to teach the fundamentals of point set topology and constitute an awareness of need for the topology in Mathematics.

Learning Outcomes

- Student will be able to use axioms of set algebra
- Student will be able to define topology and its construction
- Student will be able to distinguish open and closed subset.
- Student will be able to construct closure, interior and boundary of a set

Course Content:

Unit - 1

Topological Spaces: Topological spaces, Basis and sub basis for a topology (Definitions and examples only), The order topology, The product space (For finitely many topological spaces), Subspace topology, Closed sets, Limit points.

Unit – 2

Continuous Functions: Continuous functions, Homeomorphisms, The pasting lemma, Map into products, The metric topology, The sequence lemma, Uniform limit theorem, The quotient topology.

Unit - 3

Connectedness: connected spaces, Path connected spaces, Connected sets in the real line, Components and path components, Locally connected spaces and path connected spaces.

Unit - 4

Compactness: Compact spaces, Compact sets in the real line, Limit point compactness, Locally compact spaces, One point compactification. Note: All results and examples are to be excluded which use the concept of the product topology of a collection of infinitely many topological spaces.

Text Book: "Topology – A first course"- by J. R. Munkres, Prentice – Hall of India, 1992.

Reference Books :

(1) "General Topology " – by S. Willard, Addision Wesley, 1970.

(2) "Topology "-by J. Dugundji, Prentice- Hall of India, 1975.

(3) "Aspects of Topology" by C. O Christonson and W. I Voxman, Marcel-Dekker Inc 1977.

(4) "General Topolog"- by J. L. Kelley, D. Van Nostraml. 1950.

Name of the Course: COMBINATORICS & GRAPH THEORY

Subject Code	Title of the Course	Course Credits	No. of Hrs. Per Week	Weightage For MSE+CIA	Weightage For UE	Total Marks	Duration Of Semester end Exam in hrs.
MTCG-5	Combinatorics & Graph Theory	4	4	30	70	100	3

Course Objective

- To learn basic logic and set theory.
- To learn core ideas in combinatorial mathematics
- To learn core ideas in graph theory

Learning Outcomes

- At the end of the course student will understand Boolean algebra and truth tables and get the ideas of permutations and combinations.
- Students will understand how to apply combinatorial ideas to practical problems and understand the language of graphs and trees.

Course Content:

Unit-1

Revision: Permutations and combinations, Basic counting techniques, The pigeonhole principle, The Inclusion-Exclusion principle and applications.

Unit-2

Generating functions, Recurrence relations, Binomial & Multinomial coefficients, Polya's theory of counting.

Unit-3

Fundamental concepts, Graph, Walk, Path, Cycle, Tree, Sub graph, Isomorphic graphs, Cutest, Matching set, Distance in graph, Degree of vertex, Graph and Matrices, Independent set, Dominating set, Hamiltonian path & cycle, Euclidian graph, Connectivity of a graph, Complementary graph, Complete graph, Bipartite Graph.

Unit-4

Coloring of a graph, Map, Vertex & edge, Four color problem, Graph algorithms: Shortest Path and Minimum spanning tree.

Text Book: "Introductory Combinatorics (4th Edition)"- by Richard A. Brualdi, P

"Introduction to graph theory" - by D B West Prentice Hall.

Reference Books:

(1) "Combinatorics and Graph theory" by Harris John, Hirst Jeffry L., Mossinghoff, Michael, 2nd ed.,(2008) Springer.

(2) "Graph Theory" by Bondy J A, Murthy U.S.,(2008) Springer

(3) "Discrete Mathematics & its Applications" by Rosen K.H.6^{th} ed , Tata McGraw Hill

(4) "Combinatorics –Topics, Techniques &Algorithms" by Peter J. Cameron Cambridge University Press, 1994

Name of the Course: MEASURE THEORY

Subject Code	Title of the Course	Course Credits	No. of Hrs. Per Week	Weightage For MSE+CIA	Weightage For UE	Total Marks	Duration Of Semester end Exam in hrs.
MTCG-6	Measure Theory	4	4	30	70	100	3

Course Objective

- To provide knowledge of the theory of measurable sets, integration and Martingales.

Learning Outcomes

- On successful completion of this module, students should be able to:
- Identify and formulate the basic concepts and theorems of sigma algebras, measures and abstract measure spaces
- Discuss the completion and construction of measures including the basics of Carathéodory's Extension Procedure.
- Synthesise techniques that have been developed in the course to solve particular problems and explain the basic concepts and main theorems of Lebesgue and Lesbesgue-Stieltjes integration including the main convergence theorems.
- Solve problems involving Lebesgue and Lesbesgue-Stieltjes integration.

Course Content:

Revision

Standard topology on R, Structure of open sets, Cantor set, Lim sup, Lim inf.

Unit- 1

Algebra and o- algebra of sets, O- algebra of Borel sets, Lebesgue outer measure on R, Measurable sets, Lebesgue measure.

Unit- 2

Measurable function, Littelwood's three principles, Egoroff's theorem, Integral of a simple function, Lebesgue integral of bounded functions, Bounded convergence theorem.

Unit- 3

Integral of nonnegative functions, General lebesgue (integral), Fatou's lemma, Monotone convergence theorem, Lebesgue's convergence theorem, Convergence in measure.

Unit -4

Differentiation of monotone functions, Functioned of bounded variation, Differentiation of an integral, Absolutely continuous functions and indefinite integrals.

Text Book: "Real Analysis" by H. L Ryoden, Macmillan Pub. Co 3rd Ed.

Reference Books:

(1) "Theory of Functions of a Real Variable"- by I. N. Natansen, Fredrik Pub Co., 1964.

(2) "Measure Theory"- by P. R. Halmos, East and West Press.

(3) "Introduction to Real Variable Theory"- by S.C. saxena and S. N Shah Prentice Hall of India 1980.

(4) "Real and Complex Analysis", Rusin, W., 2nd Edition, Tata McGraw- Hil Publishing Co., Ltd 1974.

Name of the Course: SPECIAL FUNCTIONS

Subject Code	Title of the Course	Course Credits	No. of Hrs. Per Week	Weightage For MSE+CIA	Weightage For UE	Total Marks	Duration Of Semester end Exam in hrs.
MTEG-2	Special Functions	3	3	25	50	75	2

Course Objectives

- The objective of the course is to introduce some special functions that appear in different venues of Applied mathematics.

Learning Outcomes

- At the end student will be able to use special function for solving real-life problems
- Construct meaningful connections between mathematics and other disciplines
- Model some physical cases as PDE and obtain their solution

Course Content:

Unit 1

Power series solution, Gauss's Hypergeometric function.

Unit 2

Hermite polynomials, Chebyshev polynomials.

Unit 3

Legendre polynomials.

Unit 4

Bessel function.

Text Book: "Differential equations with application and historical notes" by George F Simmons Tata McGraw – Hill, Publishing Co. Ltd., New Delhi, 1974.

Reference Books:

(1) An introduction to Ordinary Differential Equations- E.A Coddington., Prentice-Hall of India Private Ltd., New Delhi, 2001.

(2) Elementary Differential Equations (3^{rd} Edition) – W. T Martain and E. Relssner,

(3) Addison Wesley Publishing Company, inc 1995.

(4) Theory of Ordinary Differential Equations – E. A Codington and N Levinson, Tata McGraw hill Publishing co Ltd., New Delhi, 1999.

Name of the Course: INTRODUCTION TO 'C' LANGUAGE

Subject Code	Title of the Course	Course Credits	No. of Hrs. Per Week	Weightage For MSE+CIA	Weightage For UE	Total Marks	Duration Of Semester end Exam in hrs.
SSG-3	Introduction to 'C' Language	2	2	-	50	50	2

Course Objectives

- To develop a programming logic and skills for writing programs using 'C'

Learning Outcomes

- Students logic and ability to solve the problems efficiently using C programming will be developed.

Course Content:

Unit 1

Constant, Variables and data types, Operators and expressions, Managing input and output operators.

Unit 2

Conditional statements, Decision making and branching, Decision making and looping.

Unit 3

Defining and manipulating arrays, Logical expression and more control statement, Handling of character strings.

Unit 4

User- defined functions, Some mathematical C programs.

Text Book: "Programming in ANSIC" by E. Balagurusamy, The Mcgraw- Hill Pub. Co. Ltd., 1992.

Reference Books :

(1) "Computer programming in C" by V Rajaraman, PHI- 2002

(2) "The C Programming Language" by B. W. Kernighan and B. M Ritchie. Prentice- Hall, 1977

(3) "The C Primer" by L. Hancock and M. Krieger, McGraw- Hill, 1987.

Name of the Course: PROGRAMMING IN 'C' AND APPLICATIONS (PRACTICAL)

Subject Code	Title of the Course	Course Credits	No. of Hrs. Per Week	Weightage For MSE+CIA	Weightage For UE	Total Marks	Duration Of Semester end Exam in hrs.
SSG-4	Programming in 'C' and Applications (Practical)	3	3	25	50	75	2

Course Content:

The following programs are to be practiced:

1. Largest among the numbers, Sum of individual digits of a given number.
2. Reverse order of a given number, evaluations of operators.
3. Determination of roots of quadratic equations, $Ax^2 + Bx + C = 0$,
4. Arranging given set of numbers in increasing/ decreasing order, calculation of Mean.
5. Evaluation of sum of power series eg. Ex, sin X, cos X, log (1 + x)
6. Calculation of GCD/LCM of two integers, sum of given numbers, Fibonacci numbers.
7. Evaluation of factorial of a positive integer and evaluation of binomial coefficients.
8. Evaluation of Prime and Armstrong number, Generation of twin primes, automorphic numbers.
9. Addition, subtraction and multiplication of matrices, Transpose, determinant ……..etc
10. Writing of a given number in words using function, Arranging a set of names in alphabetical order.
11. Operations with strings and sorting ……etc.

Text Book: "Programming in ANSIC" by E. Balagurusamy, The Mcgraw- Hill Pub. Co. Ltd., 1992.

Reference Books :

(1) "Computer programming in C" by V Rajaraman, PHI- 2002
(2) "The C Programming Language" by B. W. Kernighan & B. M Ritchie. Prentice-Hall,1977
(3) "The C Primer" by L. Hancock and M. Krieger, McGraw- Hill, 1987.

SECOND YEAR

SEMESTER 3

Name of the Course: DIFFERENTIAL EQUATIONS

Subject Code	Title of the Course	Course Credits	No. of Hrs. Per Week	Weightage For MSE+CIA	Weightage For UE	Total Marks	Duration Of Semester end Exam in hrs.
MTCG–7	Differential Equations	4	4	30	70	100	3

Course Objective

- To understand the concept of second order linear differential equations.
- Introductions to vector fields, matrices, phase spaces and linear systems.
- The Linearization Theorem and examples.

Learning Outcomes

- Recognize some standard types of differential equation: separable, first order linear, homogeneous, and know techniques to solve these equations.
- Integrate first order differential forms, understand the geometrical interpretation of the solutions as a collection of integral curves.
- Construct sketched direction fields for autonomous/non-autonomous first order ordinary differential equations.
- Know the techniques for solving second order linear differential equations.
- Calculate eigenvalues and eigenvectors of matrices, use matrix calculations to obtain solutions.

Course Content:

Unit - 1

Simultaneous ordinary differential equations of first order and first degree, pfaffian method, Total differential equations, partial differential equations of the first order.

Unit- 2

Cauchy's Problem (Only Statement), Geometrical interpretation, Linear equations, Nonlinear equations, Charpit's method, Jacobi's method.

Unit- 3

Equations of second order, Linear equations with constant and variable coefficients, The three canonical forms, Method of separation of variables, Monge's method for $Rr + Ss + Tt = V$.

Unit- 4

Laplace's Equations: Elementary solutions, Boundary value problems, Separation of variables, Solution with axial symmetry, Two dimensional equation. Wave Equations: One dimensional equation, Three dimensional problems, General solutions of Kirchoff, Diffusion equation, Boundary value problems, Elementary solution, Separation of variables.

Reference Books

(1) M.D Raisinghania, Ordinary and Partial Differential Equations, S Chand & Co.

(2) Gerald B Folland, Introduction to Partial Differential Equations, 2nd edition, Prentice – Hall of India (2001)

Name of the Course: NUMBER THEORY

Subject Code	Title of the Course	Course Credits	No. of Hrs. Per Week	Weightage For MSE+CIA	Weightage For UE	Total Marks	Duration Of Semester end Exam in hrs.
MTCG-8	Number Theory	4	4	30	70	100	3

Course Objectives

- The purpose of the course is to give a simple account of classical number theory, prepare students to graduate-level courses in number theory and algebra, and to demonstrate applications of number theory (such as public-key cryptography).

Learning Outcomes

- Upon completion of the course, students will have a working knowledge of the fundamental definitions and theorems of elementary number theory, be able to work with congruences, solve congruence equations and systems of equations with one and more variables, and be literate in the language and notation of number theory

Course Content:

Unit - 1

Divisibility, G.C.D, Primes, Fundamental theorem of arithmetic, Euclidean algorithm, Greatest integer function, Mobius function μ, Euler function Φ, Divisor functions σ_k for $k \geq 0$, Integer properties of these functions, multiplicative functions, Mobius inversion formula.

Unit – 2

Congruence, Complete residue system, Linear congruence, Reduced residue system, Euler-Fermat theorem, Chinese remainder theorem, Exponents of a number mod m, Primitive roots.

Unit – 3

Quadratic residues, Legendre symbol and its properties, Gauss lemma, Quadratic reciprocity law, Jacoby Symbol.

Unit 4

Diophantine Equations $ax + by = c$ and its positive solutions, Equation $x^2 + y^2 = z^2$, Equation $x^4 + y^4 = z^2$, and Equation $x^4 + y^4 = z^4$, Sum of squares, Fermat's Last theorem.

Text Book: "Elementary Number Theory" 2nd edition by David M Burton Wm. C. Brown Pub.

Reference Books:

(1) I Niven and H. Zukerman "An introduction to the theory of Numbers. " 3rd ed. Wiley Eastern University Edition, New Delhi , 1985.

(2) T. M. Apostol, "Introduction to Analytic Number Theorem", Springer student edition 1995.

(3) Baker Alan "A concise Introduction to the theory of Numbers" Cambridge University Press

(4) Rose H.E "A course in number theory," Oxford University Press 1988.

(5) Shapiro, Harold, "Introduction to the theory of Numbers. " John Wiley and Sons, 1983.

(6) Hardy G. H and E. M Wright "An Introduction to the theory of Numbers" 5th edition Oxford University Press 1975.

(7) T. Nagell " Introduction to Number Theory", 2nd edition, chelsea, 1984.

Name of the Course: CLASSICAL MECHANICS

Subject Code	Title of the Course	Course Credits	No. of Hrs. Per Week	Weightage For MSE+CIA	Weightage For UE	Total Marks	Duration Of Semester end Exam in hrs.
MTEG-4	Classical Mechanics	3	3	25	50	75	2

Course Objective

- How to use Newton's laws of motion to solve advanced problems involving the dynamic motion of classical mechanical systems.
- How to use differential equations and other advanced mathematics in the solution of the problems considered in item 1.
- How to use conservation of energy and linear and angular momentum to solve dynamics problems.
- How to represent the equations of motion for complicated mechanical systems using the Lagrangian and Hamiltonian formulations of classical mechanics.

Learning Outcome

- Explain the difference between Newtonian mechanics and Analytic mechanics solve the mechanics problems using Lagrangian formalism, a different method from Newtonian mechanics
- Discuss the connection between classical mechanics and quantum mechanics from Hamiltonian formalism
- Apply the Variational principle to real physical situations

Course Content:

Unit - 1

Generalized co- ordinates, Holonormic, Non holonormic, Rheonomous and scleronomous constraints, Derivation of Largrange's equations from D' Alembert's principle.

Unit - 2

Velocity dependent potentials (electromagnetic case), Rayeigh's dissipation function and application, Hamilton's principle and derivation of Largrange's equations from Hamilton's principle.

Unit - 3

Extensions of Hamilton's principle to non conservative and non holonomic dynamical systems.

Unit - 4

Cyclic coordinates and Routhian function, Applications of Lagrange's formalism to two body problem.

Text Book: "Classical Mechanics" by H. Goldstein(2nd Edition), Narosa Publishing House, 1985

Reference Books

(1) H. C.Corhen and P. Stechle: " Classical Mechanics", Wiley, New York, 1950.

(2) J. B. Griffith: " The theory of Classical Dynamics", Cambridge Uni. Press, 1985.

(3) L. D Landan and E. M. Lifshiftz: "Mechanics", Pergenion Press, 1969.

Name of the Course: RESEARCH METHODOLOGY

Subject Code	Title of the Course	Course Credits	No. of Hrs. Per Week	Weightage For MSE+CIA	Weightage For UE	Total Marks	Duration Of Semester end Exam in hrs.
MTEG -6	Research Methodology	3	3	25	50	75	2

Course Objective

- The purpose of this study was to describe the sample selection, describe the procedure used in designing the instrument and collecting the data, and provide an explanation of the statistical procedures used to analyze the data.

Learning Outcome

• understand some basic concepts of research and its methodologies

• identify appropriate research topics

• select and define appropriate research problem and parameters

• prepare a project proposal (to undertake a project)

• organize and conduct research (advanced project) in a more appropriate manner

• write a research report and thesis

• write a research proposal (grants)

Course Content:

Unit - 1

What is research/ Science and research, Basic and applied research, Essential steps in research, Characteristic of scientific research, Research and experimental design.

Unit - 2

Introduction to Statistics: Definition and scope, Data collection, Classification, Tabulation of data and its graphical and diagrammatic presentation, Measures of central tendency, Dispersion and standard error, Probability distributions, Binomial, Poisson and normal distribution.

Unit - 3

Statistical significance: Hypothesis testing, Types of error, Level of significance, Various test and Chi- square goodness of fit, Simple linear regression and Correlation analysis.

Unit - 4

Scientific writing, Research proposal, Research paper, Review paper, Thesis, Conference Report, Book review and project report (any two), Reference writing, Scientific abbreviations, Preparation and delivery of scientific presentations, Research report/ Thesis formatting and

typing (computing), Title page, Certificate, Declaration, Acknowledgement, List of table, Figures, Abbreviations and symbols, Chapters quotations, Table, Figures, Summary, Appendices, References etc.

Reference Books:

(1) How to write and publish a scientific paper by Day, R. A
(2) Guide to write scientific papers by Garson, G. D.
(3) Developing Bioinformatics computer skill by Gibas.
(4) Instrumental methods of analysis by D. A Skoog.

Name of the Course: INTRODUCTION TO LATEX

Subject Code	Title of the Course	Course Credits	No. of Hrs. Per Week	Weightage For MSE+CIA	Weightage For UE	Total Marks	Duration Of Semester end Exam in hrs.
SSG-5	Introduction to LATEX	2	2	-	50	50	2

Course Objective

- To understand a document preparation system.
- To understand a sophisticated program design system to produce high-quality typesetting especially for mathematical text.

Learning Outcome

- At the end of course student are able to use a typesetting system which is very popular with computer scientists and engineers. It actually consists of a set of macros written in the TeX typesetting language (from this fact you can infer that LaTeX is more convenient but TeX is more powerful).

Course Content:

Unit - 1

Introduction to LATEX, LATEX – what it is? Typical LATEX Input File, Characters and control sequences, Required components of a LATEX, Document Typing, LATEX Commands.

Unit - 2

Basic elements of a LATEX, Font-size and other required formatting commands, Margins, Line-spacing, Sections, Sub-sections, Paragraphs and new-lines, Italics, Bold-face, Underlining and centering, Examples of mathematical expressions, Lists, Tabbing.

Unit - 3

Text Formatting: Centering text, Special headers, Extended quotation, Bulleted lists, Numbered lists, Filling a line, Bibliographies, Line breaks, Bibliography and compound expressions.

Unit - 4

Slides, Graphics & Functions, Slide class, How to use the slides class, The picture environment, Basic commands, Line segments, Arrows, Circles, Text and formulas, Functions-sums, Integrals and limits, Roots, Text in math displays, Operators, Relations, Negated Symbols.

Reference Books:

(1) LATEX: A Document Preparation System (2nd Edition) Leslie Lamport.

(2) A Guide to LATEX: Document Preparation for Beginners and Advanced Users (3rd Edition) Helmut Kopka Patric W. Daly B001IYZNGS

Name of the Course: PROGRAMMING IN LATEX (PRACTICAL)

Subject Code	Title of the Course	Course Credits	No. of Hrs. Per Week	Weightage For MSE+CIA	Weightage For UE	Total Marks	Duration Of Semester end Exam in hrs.
SSG-6	Programming in LATEX (Practical)	3	3	25	50	75	2

Course Content:

The following programs are to be practiced:

1. Producing Simple Documents using LATEX
2. Producing Mathematical Formulae using LATEX
3. Constructing various graphics using LATEX
4. Constructing various mathematical functions.
5. Finding errors in program syntax.

Reference Books:

(1) LATEX: A Document Preparation System (2nd Edition) Leslie Lamport.

(2) A Guide to LATEX: Document Preparation for Beginners and Advanced Users (3rd Edition) Helmut Kopka Patric W. Daly B001IYZNGS

SEMESTER 4

Name of the Course: MATHEMATICAL LOGIC

Subject Code	Title of the Course	Course Credits	No. of Hrs. Per Week	Weightage For MSE+CIA	Weightage For UE	Total Marks	Duration Of Semester end Exam in hrs.
MTEG–3	Mathematical Logic	3	3	25	50	75	2

Course Objectives

- To provide Knowledge of the principles and standard methods of analysis and evaluation in mathematical logic.

Learning Outcomes

- Identify different types of arguments as well as their premises and conclusions;
- Evaluate arguments and identify mistakes in reasoning; and
- Prove the validity or invalidity of arguments.

Course Content:

Unit – 1

Propositional logic syntax: Atomic formulae, Logical connectives, V formulae, Defined logical connectives A =>, <=, Semantics: Truth valuation as a map V from the set of all formulae, Truth table, Tautological consequences and Tautologies, Axioms and rules of inferences, Propositional axioms, Extension, Construction, Associative and cut rules, The notion of a proof and of a theorem of propositional logic, Tautological equivalence and conjunctive normal form of a Formula, Post's Tautology Theorem (Completeness of Propositional Logic).

Unit - 2

First order logic: Syntax, Variables, Propositional connectives and V Quantifier, Equality symbol =, Non logical constant, Function and predicate symbols, Defined connective for all terms, Atomic formulae, Sub formulae of a formula, Bound and free occurrence of a variable in a formula, Closed formula, Substitutability, Semantics, Structure of a first order language, The notion of truth of a formula in a structure (via name of each element of the universe), Axioms and Rules of Inferences, Logical axioms, Propositional identity, Equality and

Substitution axioms, Rules of inferences, Expansion, Contraction, Associative, Cut and introduction rules, Non logical axioms, Notion of a first order theory, Some examples of first order theories, Models, The notion of a proof and theorem of first order theory, Model of a first order theories, validity (or soundness) Theorem.

Unit – 3

Theorem in first order theories: Auto logy theorem for first order theories [and few simple application, Induction on theorem], Results on quantifiers $\forall$ distribution rule and closure theorem, Deduction Theorem and Theorem on constants, Equivalence and Equality Theorems: Equivalence theorem, Variant theorems, Symmetry and Equality theorems, Prenex normal Form including the algorithm to reduce a formula in a prenex normal form.

Unit - 4

The complements theorem: Reduction theorem of consistency, Consistent theories, Conservative extension, Equivalent theories, Statement of completeness theorem, Complete theories, Henkin theories, Henking model of a complete Henking theory.

Reference Books:

(1) Shoenfield- " Mathematical Logic "- Addison Wesley.

(2) Change, C. L and Lee, R.T.C – " Symbolic Logic and Mechanical Theorem Proving", Academic Press.

Name of the Course: INTEGRAL TRANSFORMS

Subject Code	Title of the Course	Course Credits	No. of Hrs. Per Week	Weightage For MSE+CIA	Weightage For UE	Total Marks	Duration Of Semester end Exam in hrs.
MTEG-5	Integral Transforms	3	3	25	50	75	2

Course Objectives

- The aim of the course is to describe the ideas of Fourier and Laplace Transforms and indicate their applications in fields such as digital signal processing and differential equations.

Learning Outcomes

- The idea of a principal value integral and the significance of absolute integrability.
- The definition of the Fourier transform and how to compute it for standard examples.
- The Inversion Theorem and its uses in computing transforms and inverse transforms.
- Band-limited signals and the Shannon sampling theorem.
- Applications of Fourier transforms to partial differential equations.
- The Laplace transform and how to compute it for standard examples.
- Applications of Laplace transforms to differential equations.

Course Content:

Unit - 1

Laplace transform: Definition and its properties, Rules of shifting, Laplace transforms of derivatives and integrals, Properties of inverse Laplace transform, Convolution theorem, Complex inversion formula.

Unit - 2

Fourier transform: Definition and properties of Fourier sine, cosine and complex transforms, Convolution theorem, Inversion theorems, Fourier transform of derivatives.

Unit - 3

Mellin transform: Definition and elementary properties, Mellin transforms of derivative and integrals, Inversion theorem, Convolution theorem.

Unit - 4

Henkel Transform: Definition and elementary properties, Henkel transforms of derivative and integrals, Inversion theorem, Convolution theorem.

Reference Books:

(1) Brian Davies "Integral Transforms and Their Applications", 3rd edition Springer Publication

(2) "Integral Transforms for Engineers" Larry c Andrews, Bhimsen KShivamoggi, published By SPIER – The international society for optical engineering.

(3) "Applied Integral Transforms" M. Ya. Antimirov, A. A. Kolyshkin, Remi Vaillancourt. Published by American mathematical Society.

Name of the Course: MATHEMATICAL MODELING

Subject Code	Title of the Course	Course Credits	No. of Hrs. Per Week	Weightage For MSE+CIA	Weightage For UE	Total Marks	Duration Of Semester end Exam in hrs.
MTEG-7	Mathematical Modeling	3	3	25	50	75	2

Course Objectives

- The overall objective of this course is to provide an introduction to the process of mathematical modeling while giving students an opportunity to develop and construct appropriate models for various problem situations.
- Analyze given models to uncover underlying assumptions.
- Investigate particular problems to find out what has already been done toward developing solutions.

Learning Outcomes

- Students learn to use the modeling process to translate problem situations to mathematical expressions,
- Use a variety of mathematical resources and tools to study problem situations.
- Use appropriate technology to assist in the problem-solving process.
- Take an analytical approach to problems in their future endeavors

Course Content:

Unit - 1

Introduction to the subject its scope and limitation, Classification of models, Dimensional homogeneity, Technique of dimensional analysis, An arithmetic model of gravity, Simple population growth model, Logistic population growth model, Geometric interpretation of logistic growth function.

Unit - 2

Two species population models: Prey predator modes for population dynamics, Geometric interpretation and stability of Prey predator model, Competition model, Epidemic models, Simple deterministic model, SIS model, Epidemic models with constant number of carriers, Epidemic model with removal.

Unit - 3

Diffusion and glucose in the blood stream, Model for diabetes mellitus, Genetics models: Hardy Weinberg law model for genetics, Genetics model for blood group.

Unit - 4

Traffic models: Macroscopic Highway traffic model, Continuum hypotheses and the fundamental diagram, Linear car following models.

Text Book:

(1) J. N. Kapur, Mathematical Modeling, Wiley Eastern Ltd., 1988.

(2) J. N. Kapur, Mathematical Models in Biology and Medicine, East West press Pvt Ltd., 1992

Reference Books:

(1) Braum, Colemem & Drew. Differential Equation Models, Springer Verlag, 1983.

(2) Martin Braun, Differential Equation and their application, Springer Verlag, 1977.

(3) Dym & Lvey, Principles of Mathematics Modeling, Academic Press- 1980.

(4) Lucas & Roberts, Discrete and system models, Spriger Verlag, 1983.

(5) Haberman, Mathematical Model, Prentice- Hall Inc., 1977.

Name of the Course: OPERATIONS RESEARCH

Subject Code	Title of the Course	Course Credits	No. of Hrs. Per Week	Weightage For MSE+CIA	Weightage For UE	Total Marks	Duration Of Semester end Exam in hrs.
MTEG-8	Operations Research	3	3	25	50	75	2

Course Objectives

- Ability to understand and analyze managerial problems in industry so that they are able to use resources (capitals, materials, staffing, and machines) more effectively.
- Knowledge of formulating mathematical models for quantitative analysis in industry.
- Mathematical models for analysis of real problems in Operations Research.

Learning Outcomes

- Recognize the importance and value of Operations Research and mathematical modeling in solving practical problems in industry
- Formulate a managerial decision problem into a mathematical model.
- Understand Operations Research models and apply them to real-life problems.

Course Content:

Unit - 1

Development, Definition, Characteristics and Phases Types of models, Operation research models, Applications, Linear programming problem formulation, Graphical solution, Simplex method, Artificial variables techniques Big M method Duality Principle.

Unit - 2

Transportation problems: Formulation, Optimal solution, Unbalanced transportation problem, Degeneracy, Maximization case, Assignment Problems: Formulation, Optimal solution, Variants of Assignment Problem.

Unit - 3

Theory of Games: Introduction, Minimax (maximin) Criterion and optimal strategy, Solution of games with saddle points, Rectangular games without saddle points, dominance principle, m x 2 & 2 x n games, graphical method.

Unit - 4

Project Management (CPM & PERT): Network concepts, components, rules for network construction, Critical path method (CPM), Project Evaluation and Review Techniques (PERT), Production Scheduling (Job Sequencing): Introduction, Johnson's algorithm for n jobs 2 machines, Johnson's algorithm for N jobs m machines, 2 jobs m machines using graphical method.

Reference Books:

(1) J. K. Sharma, "Operation Research- Theory and Application", 4th Edition, Macmillian Publishers India Ltd.

(2) N H Shah, Ravi Gor, Hardik Soni, " Operations Research ", PHI.

Kadi Sarva Vishwavidyalaya, Gandhinagar

M.Sc. (Mathematics), End Term Examination, Month-Year

Semester: **Total Marks: 70**

Subject: **Duration: 3hrs**

Subject Code: **Date:**

Instructions: (1) All questions are compulsory

(2) Figures to the right denote marks.

(3) Indicate clearly the options you attempt along with the respective question number.

Q1	**Answer the following questions (MCQ / Short questions)**		**14**
Q2	**Answer the following questions**		**14**
	(A)		
	(B)		
		Or	
	(B)		
Q3	**Attempt any two**		**14**
	(A) **(B)** **(C)**		
Q4	**(A)**		**14**
	(B)		
		Or	
	(B)		
Q5	**(A)**		**14**
	(B)		
		Or	
	(A)		
	(B)		

Kadi Sarva Vishwavidyalaya, Gandhinagar
M.Sc. (Mathematics), End Term Examination, Month-Year

Semester: **Total Marks: 50**
Subject: **Duration: 3hrs**
Subject Code: **Date:**

Instructions: (1) All questions are compulsory
(2) Figures to the right denotes marks.
(3) Indicate clearly the options you attempt along with the respective question number.

Q1	**Answer the following questions (MCQ / Short questions)**		**10**
Q2	**Answer the following questions**		**10**
	(A)		
	(B)		
		Or	
	(B)		
Q3	**Attempt any two**		**10**
	(A) **(B)** **(C)**		
Q4	**(A)**		**10**
	(B)		
		Or	
	(B)		
Q5	**(A)**		**10**
	(B)		
		Or	
	(A)		
	(B)		

Name of the Course: Project work

Subject Code	Title of the Course	Course Credits	No. of Hrs. Per Week	Weightage For MSE+CIA	Weightage For UE	Total Marks	Duration Of Semester end Exam in hrs.
MTPD	Project work	9	9	75	150	225	0.75

Course Content:

MTPD-1

Cognitive skill project to develop student's cognitive abilities to solve assignment or problem or etc. Problems in a longer time frame than in usual in other courses. Students will learn how to search for known results and techniques related the project work. On completion of project work each students is expected to submit a written document describing the results, mathematical developments, background material bibliographical search etc. Present orally in a seminar setting of the work done in the project work. The students will meet regularly with the project guide to work out problems that appear and adjust the goals and time frame accordingly. The project should be carried out individually/jointly are acceptable only with prior permission of the guide. Cognitive skill work based project carries 9 credits in at least 16 hours depending on the number of students and number of batches or groups per week teaching and two work project to be chosen from the list of following group.

1. Book review
2. Field work project
3. Problem solving work project
4. Foundation of mathematics
5. History of mathematics
6. Mathematics education

FORMATS FOR THE PREPARATION OF RECORD/PROJECT/COGNITIVE WORK

The Rough Sketch of the Structure/Pattern provided herewith and is to be modified, time to time if needed.

(1) Structure for computer laboratory/Practical Examination.

Duration: 3 Hours Examination, Maximum for Lab Course 50 Marks. There is no continuous Internal Assessment for any practical, University Exam Per practical: 50 Marks

(Practical Examination: 40 Marks + Journal 10 Marks)

(i) Record of Laboratory work for practical:

Title of the Course

Course Number-------- Year--------Category--------Semester--------Credits------Course Code

Total Instructional Hours per week-

(a) Aim (b) Flowchart and Algorithm

(c) Source Code (d) Input/ output specification

(e) Printout (S) (f) Remarks/Scope/Limitation of the Experiment.

(ii) Format for the cognitive project work certificate

This is to certify that the report entitled "TITLE OF THE PROJECT" being submitted to the Kadi Sarva Vishwavidhyalaya, Gandhinagar by Candidate's Name for the partial fulfillment for the award of the Degree of Master of Science in Mathematics in a bona fide record of worked carried out by him/her under my guidance and supervision.

Date: Signature and Address of the Guide Signature of the HOD

Place:

_____

Submitted for the viva –voce examination on _____ at _____Examiner- 1:

_____

(Signature and Name of the External Examiner)

Chairman of the examination: _____(Signature and Name of the External Examiner)

(a) Acknowledgement (b) Content (c) Introduction

(d) Chapters (e) References (f) Appendices, if any.