HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY
PATAN- 384 265

Modified Detailed Syllabus of CBCS PROGRAMME Pattern for B Sc Mathematics Semester System

With Effect from June : 2015

FACULTY **: SCIENCE**

SUBJECT **: MATHEMATICS**

CLASS: Bachelor of Science.

SEMESTER : I to VI

TOTAL PAGE 01 TO 27 (WITH COURSE STRUCTURE)

DATE : October 18, 2014.

B Sc in Mathematics : PROGRAMME Structure Under CBCS

With Effect from June : 2015

M. B. Prajapati, *Department of Mathematics,*
Hemchandracharya North Gujarat University, Patan-384265.

Mission: Our mission is to provide opportunities for developing basic-quality mathematical skills and achievement for their betterment of life through scientific and technological development.

Learning outcomes: Four major focusing areas: Logical Reasoning & Motivation; Analysis & Problem solving; Information & Technology Proficiency.

Vision: To Motivate Individuals to excel in the mathematical basic knowledge-driven environment of the 21st century through curriculum and train integrally human resources through teaching.We **Focus** on quality education.

(1) EDUCATIONAL AIMS :

Mathematics is one of the fundamental disciplines in science. It is the basic for all the disciplines. To make education more effective and learner centric, restructurisation of curriculum becomes essential. As a positive step in this direction and in order to respond to the emerging trends in the global scenario, it is decided to introduce the Choice Based Credit System (CBCS) from the academic year 2011-12 and modified it after three years. Under this system, the academic programme becomes student-oriented, relevant, interdisciplinary and flexible.

(2) CONDITIONS FOR ADMISSION :

A candidate who has passed the H Sec-Science Degree examination of the state or any other examinations accepted by the Syndicate as equivalent thereto shall be eligible for admission to this B Sc Programme in Mathematics on full-time basis of study.

INTAKE rules for admission are as per University notification from time to time.

Students are allowed to take admissions to successive semesters under carry over benefit facility as per the norm decided by the university .

(3) LEARNING OUTCOMES :The programme leading to this degree provides the opportunities to develop and demonstrate knowledge and understanding in the following areas:

- **Knowledge and understanding :**When one has completed this degree he/she will have knowledge and understanding of the fundamental concepts, principles and techniques from a range of topic areas.
- **Cognitive skills :**When one has completed this degree he/she will be able to understand how to solve some problems using the methods taught and develop abstract mathematical thinking .
- **Practical skills:** When one has completed this degree, he/she will be able to demonstrate the Communicate clearly knowledge, ideas and conclusions about mathematics and improve his/her own learning and performance.

(4)   DURATION OF THE COURSE:

The CBCS pattern B. Sc. programme with multidisciplinary approach in Mathematics is offered on a full-time basis. The duration of the course is of three academic years consisting of six semesters each of 15 weeks duration.

(5) TEACHING, LEARNING METHODS :

All relevant material is provided and taught in the course texts and through the study of set books. 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 exercises at the end of each unit in form of practical using computer in computer laboratory.

(6) COURSE OF STUDY :

The curriculum has five major components:

1. *Principle/Core Courses (CC MAT)*
2. *Practical courses (PC MAT)*
3. *Elective Opt. Disciplinary courses (ES MAT)*
4. *Elective Generic course*
5. *Foundation Course*

There are at least 144 Credit COURSEs prescribed in the above classification as per the university norms to be studied to acquire B.Sc. Degree in Mathematics.

⇛ **COURSE STRUCTURE** ☒

SEMESTER-I	Courses	Credit /course	Teaching Hrs Total	Total Credits	Examination			Total Marks
Course	es	/course	Hrs Total	Credits	Internal	Hours	External	Marks
Principle/Core Courses: CC MAT-111	1	4	4	4	30	3	70	100
Practical/ PC MAT-111	1	2	4	2	-	-	50	50
Elective Opt. Disciplinary: ES MAT –11 Set Theory & Functions	1	2	2	2	-	-	50	50
Elective Generic	1	2	2	2	-	-	50	50
Foundation Course	1	2	2	2	15	1.5	35	50
SEMESTER-II								
Principle/Core Courses: CC MAT-122	1	4	4	4	30	3	70	100
Practical/ PC MAT-122	1	2	4	2	-	-	50	50
Elective Opt. Disciplinary: ESMAT –12 Industrial Mathematics	1	2	2	2	-	-	50	50
Elective generic	1	2	2	2	-	-	50	50
Foundation course	1	2	2	2	15	1.5	35	50
SEMESTER-III								
Principle/Core Courses: CC MAT-301	1	3	3	3	30	3	70	100
Principle/Core Courses: CC MAT-302	1	3	3	3	30	3	70	100
Practical/ PC MAT-301	1	1.5	3	1.5	-	-	50	50
Practical/ PC MAT-302	1	1.5	3	1.5	-	-	50	50
Elective Opt. Disciplinary: ESMAT –21 Business Mathematics-1	1	2	2	2	-	-	50	50
Elective generic	1	2	2	2	-	-	50	50
Foundation course	1	2	2	2	15	1.5	35	50
SEMESTER-IV								
Principle/Core Courses: CC MAT-401	1	3	3	3	30	3	70	100
Principle/Core Courses: CC MAT-402	1	3	3	3	30	3	70	100
Practical/ PC MAT-401	1	1.5	3	1.5	-	-	50	50

Course								
Practical/ PC MAT-402	1	1.5	3	1.5	-	-	50	50
Elective Opt. Disciplinary: ESMAT –22 Business Mathematics-II	1	2	2	2	-	-	50	50
Elective generic	1	2	2	2	-	-	50	50
Foundation course	1	2	2	2	15	1.5	35	50
SEMESTER-V								
Principle/Core Courses: CC MAT-501	1	3	3	3	30	3	70	100
Principle/Core Courses: CC MAT-502	1	3	3	3	30	3	70	100
Principle/Core Courses: CC MAT-503	1	3	3	3	30	3	70	100
Principle/Core Courses: CC MAT-504	1	3	3	3	30	3	70	100
Practical/PC MAT-501	1	1.5	3	1.5	-	-	50	50
Practical/PC MAT-502	1	1.5	3	1.5	-	-	50	50
Practical/PC MAT-503	1	1.5	3	1.5	-	-	50	50
Practical/PC MAT-504	1	1.5	3	1.5	-	-	50	50
Elective Opt. Disciplinary: ESMAT –31 Business Mathematics-III	1	2	2	2	-	-	50	50
Elective generic	1	2	2	2	-	-	50	50
Foundation course	1	2	2	2	15	1.5	35	50
SEMESTER-VI								
Principle/Core Courses: CC MAT-601	1	3	3	3	30	3	70	100
Principle/Core Courses: CC MAT-602	1	3	3	3	30	3	70	100
Principle/Core Courses: CC MAT-603	1	3	3	3	30	3	70	100
Principle/Core Courses: CC MAT-604	1	3	3	3	30	3	70	100
Practical/PC MAT-601	1	1.5	3	1.5	-	-	50	50
Practical/PC MAT-602	1	1.5	3	1.5	-	-	50	50
Practical/PC MAT-603	1	1.5	3	1.5	-	-	50	50
Practical/PC MAT-604	1	1.5	3	1.5	-	-	50	50
Elective Opt. Disciplinary: ESMAT –32 Business Mathematics-IV	1	2	2	2	-	-	50	50
Elective generic	1	2	2	2	-	-	50	50
Foundation course	1	2	2	2	15	1.5	35	50

N.B. :1. *Work-load depends on the number of students and the number of Batches/Groups , for practical and Cognitive-skill based Course.*

 2. As the *CBCS has a high probability to be operationalised efficiently and effectively for the elevating learners* , the **Essential Requirements** for all Mathematical Practical including MATLAB Practicals of Mathematical subjects are as under:

1. **Mathematical Laboratory inbuilt with sufficient number of Computers (as per the students enrollments and the number of practical batches) and MATLAB SOFTWARE with basic requirements for the MATLAB Practicals.**
2. **Mathematical Laboratory inbuilt with Graphs, Charts, Printer, Physical Models (two dimensional as well as three dimensional) & Virtual Models (Higher Dimensional – Computerized) and basic requirements for the same.**
3. Use also "PYTHON" Software instead of MATLAB Software.
4. *Essential Requirement for Mathematical Computer Laboratory:*
 (i) Atleast One full time Computer Operator having mathematical ability to run Matlab Software and related Computerized Mathematical Practical.

(ii) One Peon for computer laboratory.

Mathematics : Semester-1
Course : CC MAT-111

UNIT 1: Successive differentiation:

   Successive Derivatives, Some standard results for n^{th} derivatives, Leibnitz's Theorem and its examples. Cauchy's Mean Value Theorem. Taylor's Therom (without proof), power series of $sinx, cosx, e^x$. Maclaurians series and its examples. Expansion of

UNIT 2: Integration:
Reduction formula $\int_0^{\pi/2} \sin^n \theta d\theta$ $\int_0^{\pi/2} \cos^n \theta d\theta$ $\int_0^{\pi/2} \sin^m \theta \cos^n \theta d\theta$, m,n N.

   Application of definite integrals to (a) Summation of the series (b) Rectification
   (c) Surface and volume revolution.

UNIT 3:

(a) Vector analysis : scalar and vector product of three vectors, product of four vectors, reciprocal vectors, vector differentiation, gradient, divergent and curl.
(b) Polar co-ordinates, spherical and cylinder coordinates and their relations.

UNIT 4: Sphere, Cone and Cylinder and introduction to Conicoids:

(a) **Sphere:** plane section of sphere, intersection of two sphere, intersection of sphere and line, power at a point, tangent plane and normal. Plane of contact, angle of intersection of two spheres, condition of orthogonality.
(b) **Cone and cylinder:**
   Definition of cone, vertex, guiding curve, generators, equation of a cone with a given vertex and a guiding curve, right circular cone with given vertex, axis and semi vertical angle. Definition of a cylinder, equation of a cylinder whose generators intersect a given cone and are parallel to a given line, equation of a right circular cylinder.
(c) Concoid: Standard equation of ellipsoid, hyperboloid of one and two sheets, Elliptic paraboloid and hyperbolic paraboloid.

Reference Books:
(1) Differential Calculus, by Shantinarayan.
(2) Integral Calculus, by Shantinarayan.
(3) Vector Analysis, by Murry R. Spiegel.
(4) Vector Analysis, by Dr.K.S.Rawat, SARUP &SONS, DELHI
(5) Introduction to Vector Analysis, Fifth Edition, by Herry F. Davis, Arther David Saider

Course : PC MAT-111

UNIT 1   Introduction to Excel using Computer in a computer laboratory.
(i) Simple calculation through Excel ,(iii) Graphical Presentation of Trigonometric functions, Inverse Trigonometric functions and hyperbolic Trigonometric functions, logarithmic functions, polynomial functions through Excel

UNIT 2:   Practical based on successive differentiation, Cauchy Mean value theorem, Taylor's & Meclurian's theorem,

UNIT 3 : Practical based on integral and reduction formula, Summation of the series, Rectification , surface & volume.

UNIT 4 : Practical based on Sphere, Cone, Cylinder, Application of gradient, divergent and curl.

List of Practicals :

Unit:1 (1) Draw the graph of sin x, cos x, tan x, cot x, secx, cosecx .

   (2) Draw the graph of $\sin^{-1}x$, $\cos^{-1}x$, $\tan^{-1}x$, $\cot^{-1}x$, $\sec^{-1}x$, $\csc^{-1}x$.

   (3) Draw the graph of sinh x, cos hx, tan hx, cot hx.

   (4) Draw the graph of $\log_a x$ & a^x, a R^+-{1}.

   (5) Draw the graph of cardioids, asteroid.

Unit:2 (1)Find the nth derivative of the given function at given point.

(2)Application of Leibnitsz theorem.

(3) Application of Cauchy Mean value theorem.

(4) Application of Taylor's theorem.

(5) Application of Maclurain theorem.

Unit:3(1)Appication of Riduction formula for integration.

(2)Summetion of series using integration.

(3) Appication of rectification by using integration.

(4) Appication of surface revolution using integration.

(5) Appication of volume revolution.

Unit:4(1) Application of gradient & divergent.

(2) Application of curl. (3)Appication

on Sphere.

(4) Appication on Cone.

(5) Appication onCylinder.

Reference Book:
Excel Guide for Finite Mathematics and Applied Calculus by Revathi Narasimhan
Publisher: Houghton Mifflin Company; 7 edition

Course :PC MAT-111

Instructions: Strictly follow the instructions given by examiner(s)

Draw the graphs any two out of three from
1. unit-I   (10 Marks)
2. Attempt any two out of three from unit-II   (10 Marks)
3. Attempt any two out of three from unit-III   (10 Marks)
4. Attempt any two out of three from unit-VI   (10 Marks)
5. (a) Viva   (5 Marks)
   (b) Journal   (5 Marks)

<u>Subject Elective Course</u> : Code ESMAT-11 [Set Theory & Functions]

Unit-I : Set Theory   Sets and subsets , Basic set operations , Sets of numbers ,Product sets , Indexed sets , Union and intersection of indexed collections , Principle of duality , Bounded and unbounded sets.

Unit-II : Functions   Definitions, Operators , transformations , Range , one-one fu^{ns} , onto fu^{ns} , identity fu^{n} , constant fu^{n} , composition of fu^{ns} (product of fu^{ns}) , Inverse of fu^{n} , Set fu^{ns} , Real valued fu^{ns} , algebra of real valued fu^{ns} , characteristic fu^{n} .

References :

1. Set Theory & Related Topics.   By. Seymour Lipschutz   McGraw-Hill book Company , Singapur
2. Business Mathematics By. D.C.Sancheti & V.K.Kapoor,Publication : S Chand & sons, New Delhi.

Mathematics : Semester-2
Course : CC MAT-122

UNIT-1. De'Morve's theorem and its applications, (a) Roots of a complex number

(b) Application of Expansion of $\sin^n\theta, \cos^n\theta$, n N in terms of sine and cosine of multiples of θ.

(C) Expansion of $\sin n\theta$, $\cos n\theta$ and $\tan n\theta$ in terms of sine, cosine and tangent resply.

UNIT -2. (a) Exponential, Circular and hyperbolic function, Logarithmic and inverse functions.
(b) Sequence and series: Definition of sequence, series. Definition of convergence of sequence and series, partial sum, comparison test, ratio test, root test and its examples.

UNIT -3. (a) Linear differential equation $dy/dx + Py = Q$, P and Q are functions of x, Bernoulli's differential equation. (b)Differential equation of first order and higher degree solvable for s, solvable for y, solvable for $P= dy/dx$.(c)Solution of Clairaut's and Lagrange's differential equation. (d) Linear differential equation with constant coefficients.

UNIT -4. Matrices:Introduction of matrices, different types of matrices, operations on matrices, theorems on matrices, Symmetric and skew -symmetric matrices, Hermitian and skew-Hermitian matrices, linear dependence and independence of row and column matrices. Row rank, Column rank and rank of matrix, Row reduced Echelon form of a matrix and matrix inversion using it.
Reference Books:

(1) Complex Variables and Appiication, by Ruel V. Churchill & James Ward Brown, McGraw-Hill Publishing Company, New Delhi.
(2) Complex Analysis, by J.V.DESHPANDE, Tata McGRAW-Hill Publishing Co. Ltd. New Delhi.
(3) Theory of Matrices, by B.S.Vatssa, 2nd Edition, Wiley Easterns Ltd.
(4) Matrix Operations, by Schaum's Series McGRAW-HILL Book Co.

Course : PC MAT-122
List of Practicals:

Unit:1(1) Application of De'Morve's theorem.

(2) Application of roots of complex number.

(3) Application of $\sin^n\theta$ and $\cos^n\theta$ in terms of series of sine and cosine respectively.

(4) Application of $\sin n\theta$ and $\cos n\theta$ in terms of series of sine and cosine.

(5) Application of $\tan n\theta$ in terms of series of tangent.

Unit:2(1) Application of Exponential, Circular and hyperbolic function

(2) Application of inverse hyperbolic function and logarithm function of a complex number.

(3) Application of comparison test for a given sequence.

(4)Application of root test for a given sequence.

(5) Application of ratio test for a given sequence.

Unit:3(1) Application of linear differential equation $dy/dx + Py = Q$, where P and Q are function of x.

(2) Application of Bernoully's differential equation.

(3) Application of differential equation in first order and higher degree solvable for x, y and p, where p= dy/dx.

(4) Application of clairant's differential equation

(5) Application of linear differential equation with constant coefficients.

Unit:4 (1) Solution of simultaneous linear equations using matrices.

(2) Application of the inverse matrix by row reduction method.

(3) Application of the rank of a matrix.

(4) Application of the rank of a matrix by transforming into echelon form.
(5) Application of Hermitian and skew-Hermitian matrices.
(6) Matrix operation through Excel.(Addition, Multiplication, Inverse, Determinant, etc…..)

Course :PC MAT-122

Instructions: Strictly follow the instructions given by examiner(s)

1. Attempt any two out of three from unit-I (10 Marks)
2. Attempt any two out of three from unit-II (10 Marks)
3. Attempt any two out of three from unit-III (10 Marks)
4. Attempt any two out of three from unit-VI (10 Marks)
5. (a) Viva (5 Marks)
   (b) Journal (5 Marks)

Subject Elective Course :ESMAT-12 -Industrial Mathematics- 1

Unit : I
- Introduction to game theory
- Two-person zero sum theory
- Pure strategies' (Minmax and maxmin principles)
- Mix strategies
- Game with saddle point
- Rules to determine saddle point
- Game without saddle point
- Dominance principles solution of n á 2 and 2 á n game graphically

Unit : II
- Introduction to replacement problem
- Type of failure
- Replacement of items whose efficiency deteriorates with time
- Replacement of items that completely fail

Reference Books:
1. Operations Research,Theory & ApplicationJ.K.Sharma,4th Ed Macmillan Pub.
2. Kanti swarup, Gupta P.K. , Manmohan Sultan Chand & Sons,New Delhi
3. Operations Research ;PHI , Shah,Gor,Soni

Mathematics : Semester : III

CC –MATH- 301 Calculus and Linear Algebra

Unit : I : LIMIT , CONTINUITY AND PARTIAL DERIVATIVES
Function of severable variables, their limits and continuity, partial derivatives, Differentiability and differential, Conditions for commutativity of d independent variables in higher ordered derivatives, Derivatives of implicit functions

Unit : II : APPLICATION OF PARTIAL DERIVATIVES
Euler's theorem on homogeneous function, Extrema of function of severable variables, Application of Lagranges method of undetermined multiplies, Tailor and Maclorin's expansion for function of two variables, Tangent line and normal plane to twisted curves, Tangent plane and normal to surfaces.

Unit : III : VECTOR SPACE and LINEAR TRANSFORMATION
Vector spaces, Subspaces, Span of a set, More about subspaces, Linear dependence and Independence, Dimension and Basis. Definition and examples, Range and kernel of a linear map, Rank and Nullity, Inverse of a linear transformation, Consequences of a Rank-nullity theorem.

The main book for the course (Unit I and II) is ' **Differential Calculus' by Shantinarayan, S. Chand , New Delhi**

The main book for the course (Unit III and IV) is ' **An Introduction to Linear Algebra, by V. Krishnamurthy, V P Mainra, J L Arora, Affiliated East-west Press Pvt Ltd., New Delhi**
Unit : III – Chapter 3 : Topics 3.1 to 3.6 Unit : IV – Chapter 4 : Topics 4.1 to 4.8
Reference Books :
Calculus :
    (a) Advanced Calculus, D V Widder , Prentice Hall , New Delhi
    (b) Advanced Calculus Vol : I & II, T M Apostol, Blaisdoll
    (c) Advanced Calculus, R C Buck, MacMillan
    (d) Kalan Shashtra Part I , D H Pandya and N D Suthar, University Granth Nirman Board (Gujarati)
    (e) Kalan Shashtra Part II, A M Vaudya and V H Pandya, University Granth Nirman Board (Gujarati)

Linear Algebra :
    (f) Linear Algebra , Ramchandra Rao, P. Bhimasankar, Tata MacGrawHill
    (g) Topics in Algebra, I N Herstein, Wiley Eastern Ltd
    (h) Linear Algebra, S K Berberion, Oxford University Press
    (i) Linear Algebra Problem Book, P R Holmos, Cambridge University Press
    (j) Linera Algebra, Sharma and Vashishtha, Krishna Prakashan, Meerut
    (k) Linear Algebra, Gupta K P, Pragati Prakashan, Meerut
    (l) Linear Algebra, G Paria, New Central book agency Ltd, Calcutta
    (m) Surekh Bij Ganit, I H Sheth, University Granth Nirman Board (Gujarati)

Course: CC – MATH – 302 NUMERICAL ANALYSIS

Unit-1: <u>Finite Differences table and theory of interpolation</u>:
Ascending and Descending differences , Symbolic operators, Difference of polynomial, Factorial polynomials, Gregory-Newton's forward and backward interpolation formula.

Unit-2: <u>Divided Differences</u>:
Newton's divide difference interpolation formula, Lagrange's interpolation formula for equal and unequal intervals. <u>**Central Differences Interpolation Formula:**</u>
Gauss forward and backward interpolation formula, Sterling interpolation formula, Bessel's

interpolation formula.

Unit-3: **Numerical Differentiation and Integration:**
Taylor's method, Picard's method, Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule,
Euler's Method

Reference books:
1. **Numerical Analysis** by Kunz, McGraw Hill
2.**Numerical Analysis** by R. Gupta, Anmol Pub.Pvt.Ltd, New Delhi.
3.Numerical Analysis P.N.Chatterji Rajson's Prakashanmandir, Meerut.
4. Methods in Numerical Analysis K.W.NelsonMac-Millan
5.Numerical Methods Dr.V.N.Vedomurthy, Vikas Publishing House Pvt. Ltd .
6.**Numerical Methods in Engineering and Science,** Dr.B.S.Grewal,Khanna Pub.
7.**Numerical Analysis and Computational Procedures,** S.A.Mollah, New Central Book Agency,
Calcutta.

PC –301 : Practicals on Caculus and Linear Algebra
1. Application of Limit and Continuity (Two Practicals)
2. Application of Partial Derivatives (Two Practicals)
3. Application of Lagranges' method of undermined multiplies
4. Application of Euler's theorem
5. Application of Tailor's and Maclaurin theorems.
6. Applications of Vector Space
7. Applications of Subspaces
8. Geometrical meaning of Basis
9. To Expand linearly independent set upto a basis of a vector space
10. Verification on Dimension theorem
11. Verifications on Linear transformation
12. Verifications on Rank-Nullity theorem
13. To find the inverse of a Linear transformations
14. To find composition of linear maps

PC – 302 : Practicals on Numerical Analysis
Unit-1:
1 Application of Gregory-Newton forward formula.
2   Application of Gregory-Newton backward formula.
3   Application of Factorial polynomials.

Unit-2:
(1)Applications of Newton's divided difference formula.
(2) Application of Lagrange's interpolation formula for equal intervals.
(3) Application of Lagrange's interpolation formula for unequal intervals.
 (4**)** Application of Gauss forward interpolation formula.
(5) Application of Gauss backward interpolation formula.
(6) Application of Sterling interpolation formula.

Unit-3:
 (1) Application of Taylor's method.
 (2)Application of Picard's method.
 (3)Application of Trapezoidal rule.
 (4)Application of Simpson's 1/3 rule.
 (5)Application of Simpson 3/8 rule.

Subject Elective Course :ESMAT-21 Business Mathematics-1

Unit:1 Logic: [only examples] Logical Statements, Truth table, Negation, Compound statements,
Tautologies and Contrdiction, Negation of Compound statements, Propositions, Conditional and
Biconditional statements. **Set Theory:** [only examples]   Definition and methods of sets, types of sets,
Venn diagrams, Operation s on sets, De-Morgan's law, Finite and infinite sets.

<u>Unit:2</u>   <u>Permutations and Combinations</u>: [only examples] Fundamental rules of counting, Definition of Permutations and Permutation of n different things, Permutation of repeated things, Circular Permutation, Definition of Combination standard results and examples.

Referance books:

(1)Business Mathematics. BY. D.C.Sancheti & V.K.Kapoor,S Chad & Sons Publication, New Delhi.

(2)   Business Mathematics.   by. B.S.Shah Prakashsan, Ahmedabad.

Mathematics Semester : IV

Course: CC – MATH – 401   Advanced Calculus

UNIT-1 CURVATURE & RADIUS OF CURVATURE : Curvature of Plane curve, Radius of curvature of plane curve, **IMPROPER INTEGRAL:** Beta function and Gamma function, Convergence of Beta function and Gamma function Relation between them, Its Simple properties and applications, Several forms of Beta function

UNIT-2 MULTIPLE INTEGRAL: Double Integral, Integral on non rectangle regions, transformation to polar co-ordinate   Change order of integration, Triple integration, transformation to polar and cylindrical co-ordinate

UNIT-3 VECTOR ANALYSIS AND LINE & SURFACE INTEGRAL : Gradient of scalar function, Divergence and Curl of a vector function, Line integral, Surface Integral , Green's ,Stoke's and Gauss's Theorem

> **The Main Book for the course :**
> 1. **Integral Calculus Shantinarayan S. Chand, New Delhi (Course Book)**

Reference Books :
1. Advanced Calculus, D V Widder , Prentice Hall , New Delhi
2. Advanced Calculus Vol : I & II, T M Apostol, Blaisdoll
3. Advanced Calculus, R C Buck, MacMillan
4. Kalan Shashtra Part I , D H Pandya and N D Suthar, University Granth Nirman Board (Gujarati)
5. Kalan Shashtra Part II, A M Vaudya and V H Pandya, University Granth Nirman Board (Gujarati)

Course: CC – MATH – 402 Advanced Linear Algebra

Unit : I : MATRICES OF A LINEAR TRANSFORMATION
Definition of a Matrx of a linear transformation, Linear Transformation associated with a matrix, the dimension of L(U,V), and its determination, Rank and Nullity of a Matrix, invertibility of system of linear equations.

UNIT : II : INNER PRODUCT SPACE LINEAR FUNCTIONAL AND DUALITY
Definition of inner product space, Norm, Orthogonality, Schwarz's & Triangular inequality, Parallelogram law, Orthonornal basis, Gram-Schmidt Orthogonalization Process (Without proof) and its examples.
LINEAR FUNCTIONAL AND DUALITY
Definition of linear functional and its examples, Definition of Dual space and Dual asis and its examples, Adjoint of a linear operator, its properties and examples

UNIT : III : EIGEN VALUES AND EIGEN VECTORS
Eigen values and eigen vectors of a linear transformation, Characteristic polynomial, Cayley – Hamilton theorem, Using C – H theorem find inverse of a matrix, minimal polynomial deductions.The main book for the course is ' **An Introduction to Linear Algebra' by V. Krishnamurthy, V P Mainra, J L Arora, Affiliated East-west Press Pvt Ltd., New Delhi**

Reference Books :

1. Linear Algebra , Ramchandra Rao, P. Bhimasankar, Tata MacGrawHill
2. Topics in Algebra, I N Herstein, Wiley Eastern Ltd
3. Linear Algebra, S K Berberion, Oxford University Press
4. Linear Algebra Problem Book, P R Holmos, Cambridge University Press
5. Linera Algebra, Sharma and Vashishtha, Krishna Prakashan, Meerut
6. Linear Algebra, Gupta K P, Pragati Prakashan, Meerut
7. Linear Algebra, G Paria, New Central book agency Ltd, Calcutta
8. Surekh Bij Ganit, I H Sheth, University Granth Nirman Board (Gujarati) kem tame

Course:PC – MATH- 401 Practicals on Advanced Caculus and Linear Algebra

1. Application of double Integration (Two Practicals)
2. Application of Beta and Gamma functions (Two Practicals)
3. Application of Green's Theorem
4. Application of Stokes' theorem
5. Application of divergence theorems.
6. Applications of a linear transformation associated with given matrix.
7. Applications of a matrix associated with linear transformation
8. Verifications on Rank-Nullity theorem in matrices
9. Application of solution of system of linear systems
10. Application of a Dual Space
11. Application on Gram-Schmidt orthogonalization process
12. Application of Cayley-Hemilton theorem
13. Application of Eigen value and Eigen vectors of a linear transformation
14. Application of minimal polynomial deduction
15. Application to verify inner product space.

Course:PC – MATH- 402 PRACTICALS ON ADVANCED NUMERICAL ANALYSIS

→Application of solution of an equation by,
1. Graphical method.
2. Method of False Position.
3. Method of Bisection.
4. Method of Iteration.
5. Newton Raphson method.
6. Application of Synthetic division method.
7. Birge-Vieta method.
8. Application of Laplace Everett's interpolation formula.
9. Application of Bessel's interpolation formula.
10. Application on divided difference formula.
11. Application on Numerical differentiation.
12. Application on Numerical Integration.
13. Application on Euler's method.
14. Application on solving a system of equations using Gauss- Elimination method.
15. Application on solving a system of equations using Gauss-Jordan method.

Subject Elective Course: ESMAT-22 Business Mathematics-2
Unit-1   : Probability
Classical- Statistical (or Empirical)- Axiomatic (Modern) definition of probability, Definitions of event, equally likely, mutually exclusive and exhaustive events, Probability theorems, Statement's of Baye's theorem and its examples, Conditional probability and its examples.

Unit-2 : Probability Distribution
 Definitions of a Random variable, Probability Distribution of a random variable, Binomial distribution, Poission distribution, Normal distribution, Exponential distribution and its examples.

Reference Books :
(1) Business Statistics, by Bharat Jhunjhunwala, S. Chand Prakashan.
(2) Business Statistics, by R.S. Bhardwaj
(3) Statistics (Chapter – 18 & 19) by, R.S.N.Pillai & V. Bagavathi,S. Chand & Company, New- Delhi

Mathematics : Semester - V

CCourse: CC MATH-501 (Group Theory)

UNIT : 1 Definition of a Group and illustrations, Elementary property of a Group, Equivalent definitions of a Group, Generalized form of Associative Law, Finite Groups and their tables, Definition of a Subgroup and illustrations, Lagranges theorem and its applications.

UNIT : 2 Definition of a Permutation and illustrations, Transpositions and cycle, definition of a Normal subgroup and illustrations, Quotient group, Definition of an isomorphism of a group and its illustrations.

UNIT : 3 Properties of a cycle groups, Isomorphism of cyclic groups, Subgroup of a cycle group, Generator of a cycle group, Definition of a Homomorphism and its illustrations, Kernel of Homomorphism, Cayley's Theorem, Isomorphism of group, Groups of order four and six.

The course is covered by the Book : **I H Sheth,** *Abstarct Algebra,* **Prentice Hall of India (PHI) Publication.** Chapter 6(6.1 to 6.7), Chapter 7(7.1 to 7.3), Chapter 8(8.1 to 8.3), Chapter 9(9.1 to 9.3), Chapter 10(10.1 to 10.2), Chapter 11(11.1 to 11.5), Chapter 12(12.1 to 12.6)

Reference books :

1. I N Herstein, **Topics in Algebra**, Wiley Eastern Ltd.
2. N. Jacobson, **Basic Algebra Vol I & II**, Hindustan Publishing company
3. Shanti Narayan, **A text book of Modern Algebra,** S. Chand & Co.
4. P.B.Bhattacharya, S.K.Jain, S R Nagpal, **Basics Abstract Algebra, (second Edition),** Cambridge University Press.
5. N.S. Gopalkrishna, **University Algebra,** Wiley Eastern, New Delhi
6. Maclane Saunders and Birkhoff Garrett, **Algebra,** MacMillan, New York.
7. G.F.Simmons, **Introduction to Topology and Modern Analysis,** MacGrawHill Inc., U.S.A.

Course: CC MATH-502 Mathematical Analysis-I

Unit-1   **Number System:** The real field to be developed by ordered set approach, Equivalence of this approach and Dedikind's approach, Extended real number system, The complex number system, Euclidean spaces.

Unit-2   **Basic Topology:** Finite, Countable and Uncountable sets, Metric space, Neighborhoods in metric spaces, Limit point of a set, Open, Closed, Bounded, Compact, Perfect, Connected and Convex subsets of metric spaces.

Unit-3   **Sequences and Series:** Convergence sequence, Sub sequences, Cauchy sequences, Upper and lower limits, Special sequences and Series, Series of non negative terms, Roots and Ratio Test. Power Series with Real (Complex) terms, Interval (circle) of convergence and radius of convergence of a power series, Summation by parts, absolute convergence, addition and multiplication of series. The course is roughly covered by Chapters 1,2,3 (Omit 3.52 to 3.55) of The book entitled "Principles of Mathematical Analysis" by Walter Rudin, McGraw Hill (International Student Edition), 3rd Edition.

Reference books:

(1) "A First Course in Mathematical Analysis" by D. Somasundaram & B. Choudhary, Narosa Publishing House
(2) "Fundamentals of Mathematical Analysis" by G. Das & S. Pattnayak Tata Mcgraw Hill Pub.Co
(3) "Fundamental of Real Analysis" by S. L. Gupta & Nisha Rani – Vikas Pub. House Pvt. Ltd. New Delhi-1974.
(4) "Principle of Real Analysis "by S.C.Malik , Wiley Eastern Limited New Delhi 1982.
(5) "bhucl iv6ey" . Aem.DI.su4ar .yuin.g/>4 inmaR` bORd.Amdavad
(6) "Principle of Mathematical Analysis" by T.M.Apostol

Course : CC MATH-503 [DIFFERENTIAL EQUATIONS]

Unit:1 Formation of Differential Equations, Symbolic Operator, Method of finding C.F., Sybolic Operator $1/f(D)$, Method of finding P.I., Shorter method of finding P.I., To find P.I. when $X=e^{ax}$, where a is constant, To finding P.I. when $X=Cosax$ or $Sinax$, To find the value of $1/f(D).x^m$, where m is positive integer, To find the value of $1/f(D).(e^{ax}V)$, where a is constant and V is a function of x. To evaluate $1/f(D).(XV)$, where V is a function of x. (Chapter:4)

Unit:2 Condition of Exactness of the linear differential equations, Solution of non-linear equations which are Exact, Equations of the form $y^{(n)}=f(x)$, Equations of the form $y^{(2)}=f(y)$, Equation do not contain y directly, Equation that do not contain x directly, Equation in which y appears in only two derivatives whose orders differ by two, Equation in which y appears in only two derivatives whose order differ by unity.(Chapter:6)

Unit:3 Method of solving $y^{(2)}+Py^{(1)}+Qy=R$ when an integral included in the C.F. is known, Method of solving $y^{(2)}+Py^{(1)}+Qy=R$ by changing the dependent variable, $y^{(2)}+Py^{(1)}+Qy=R$ by changing the independent variable, Solution by factorization of the Operator, Method of variation of Parameters, Method of Undetermined Co-efficient.(Chapter:7)

The course is covered by "A text book of Differential Equations", by N.M.Kapoor, Pitamber publication, New Delhi.

REFERENCE BOOKS:

1. Erwin Kreyszing, Advanced Engineering mathematics, By. John Wiley & Sons Inc. New York, 1999.
2. D.A.Murray, Introductory course on Differential Equations, By. Orient Longman,(India), 1967.
3. A.R.Forsyth, A Terastise on Differential Equations, Macmillan and Co.Ltd., London.
4.Ian N. Sneddon, Elements of partial Differential Equations, McGraw-Hill Book Compony, 1998.
5. Fracis B. Hilderbrand, Advanced Calculus for Application, Prentice Hall of India Pvt. Ltd., New Delhi, 1977.
6. Jane Cronin, Differential Equations, Marcel Dekkar, 1994.
7. Frank Ayres, Theory and Problems of Differential Equations, McGraw-Hill Book Compony, 1972.

Mathematics : CC MATH-504 A BOOLEAN ALGEBRA

UNIT:1   Relations ,Equivalence Relation,Equivalance classes or sets,Partial order Relations,Hasse   Diagram,Upper and Lower Bounds,Minimal and Maximal elements ,Binary operations,closure operations,Partially Ordered Set,Totally Ordered Set,Lattices as Posets,Dual Lattice,Meet and Join,Lattice as an algebraic

structure,Direct Product Of two Lattices,Lattice Homomorphism,Lattice Isomorphism.

UNIT:2   Sub-Lattice,Completed Lattice,Bounded Lattice,Distributive

Lattice,Square Free Lattice,Complemented Lattice,Modular Lattice,De Morgan's Law,BooleanAlgebra,Boolean Algebra of Switching Circuits,Sub Boolean Algebra,Homomorphism and Isomorphism of Boolean Algebras,Atoms,Unique representation Theorem,Properties Of Set of Atoms,Stone's representation Theorem.

UNIT:3   Boolean Variables,Boolean Expression,Min term,Maxterm,Representation of Boolean Expression as a sum of Product Cannonical Form and as aProduct of Sum Cannonical Fofm,Boolean Function Associated With Boolean Expression,Symmetric Boolean Expression,Represantation of Boolean Functions And Minimization of Boolean Expression:Using Truth Table,Cube array Method,Karnaugh's Method,Circuit Diagrams.

REFERENCE BOOKS:
1.An Introduction To Discrete Mathematics -Udayan M.Prajapati, Dr.Ajay S. Gor, Nirav Prakashan
2.Discrete Mathematical Structures With Applications to Computer Science by Trembley I.P.AndMahonar R.
3.Discrete Mathematical Structures With applications to Computer Science by R.Hamming and E.A.Feigenbaum
4.Discrete Mathematical Structures for Computer Science by B.Kolman and R.C.Busy
5.The Essence of Discrete Mathematics by Neville Dean

Course : CC MATH-504 B Mechanics-I

UNIT-1 Method of Plane Statics:Fundamental for Newtonian Mechanics, Scalar field, Gradient Vector, Equilibrium of a particle and system of particles.

UNIT- 2 Necessary and Sufficient conditions for Equilibrium, Equipollent system of forces. Reduction of general force system. Principles of virtual work and potential energy.

UNIT-3 Mass centre of system of particles, Potential energy, Friction, Flexible Cables.

REFERENCE BOOKS :

1. Synge and Griffith: Principal of Mechanics
2. S.L.Loney : Statics,Macmillan and company, London.
3. R.S.Verma : A Text book on Statics,Pothishala Pvt. Ltd., Allahabad.
4. S.L.Loney : An elementary treatise on the Dynamics of a particle and rigid bodies.,Cambridge University press 1956.
5 Mechanics : Dr. L.K.Patel.

Mathematics : CC MATH-504 C OPERATIONS RESEARCH - I

Unit-1. Introduction: Nature and scope of Operations Research.
    Linear programming: (a) LP Model and method of solution- Graphical method, Slack-Surplus and unrestricted variables, Simplex Algorithm, Simplex Method.
Unit-2 . Artificial Slack variables, Two phase method, Big-M / Penalty method, Variation in simplex method solution- unbounded, infeasible solutions and concept of degeneracy.
Unit-3. (a) **Duality Theory**-
        The essence of duality theory, primal-dual relationships, Duality theorems, Dual simplex method.
    (b) Integer Programming- The need of integer solutions, The concept of the

Cutting – Plane, Gomory's Cutting Plane Algorithm.

REFERENCES BOOKS:
(1) Operations Research , by. J.K.Sharma. Macmillan Publishers India Ltd.
(2) Operations Research by Nita Shah, Ravi Gor and Hardik Soni, Prentice Hall of India.

(3) Operations Research(Principles and Practice) by Pradeep Prabhakar Pai, Oxford University Press.

Course: PC MATH-501-504

Objectives:

• Understand the MATLAB Desktop, Command window and the Graph Window
• Be able to do simple and complex calculation using MATLAB
• Understand the graphics capabilities of MATLAB
• Be able to carry out mathematical computations using MATLAB Symbolic Toolbox

PCMAT-501 Introduction to MATLAB

Starting and ending MATLAB session, MATLAB environment, MATLAB help, types of files, search path, some useful MATLAB commands, data types, constant and variables, operators, built-in functions, assignment statement, illustrative programs.

Vectors and Matrices Scalars and vectors, entering data in matrices, line continuation, matrix subscripts/indices, multi-dimensional matrices and arrays, matrix manipulations, generation of special matrices, useful commands, matrix and array operations, function with array inputs.

PCMAT-502 Polynomials

Entering a polynomial, polynomial evaluation, roots of a polynomial, polynomial operations - addition and subtraction, multiplication, division, formulation of polynomial equation, characteristic polynomial of a matrix, polynomial differentiation, integration, and curve fitting, evaluation of polynomial with matrix arguments.

PCMAT-503 MATLAB Graphics:

Two-dimensional plots, multiple plots, style options, legend command, subplots, specialized two-dimensional plots, three-dimensional plots.

PCMAT-504 Symbolic Processing With MATLAB

Symbolic Expressions and Algebra, Algebraic and Transcendental Equations, Calculus, Symbolic Linear Algebra, ordinary and partial differential equation, Symbolic Tutors.

Text Book:

1. "MATLAB and its Applications in Engineering" Raj Kumar Bansal, Ashok Kumar Goel, Manoj Kumar Sharma, Pearson.

coverage from the Text Book:
PCMAT-501 Chapter 1: 1.8, Chapter 2: 2.9 Chapter 3: 3.11
PCMAT-502 Chapter 4: 4.13
PCMAT-503 Chapter 6: 6.8
PCMAT-504 Chapter 9: 9.3 only. Additional commands for symbolic toolbox are to be covered from the list given below.

Symbolic Math Toolbox

Functions for Creating and Evaluating Symbolic Expressions	
Class	Returns the class of an expression.
Digits	Sets the number of decimal digits used to do variable precision arithmetic.
Double	Converts an expression to numeric form.
Ezplot	Generates a plot of a symbolic expression.
ezplot3	3-D parametric plot
Ezpolar	plot a 2-D curve in polar coordinates
Findsym	Finds the symbolic variables in a symbolic expression.
numden	Returns the numerator and denominator of an expression.
Sym	Creates a symbolic variable.
Syms	Creates one or more symbolic variables.
Vpa	Sets the number of digits used to evaluate expressions.

Functions for Manipulating Symbolic Expressions	
Collect	Collects coefficients of like powers in an expression.
Expand	Expands an expression by carrying out jpowers.
Factor	Factors an expression.
poly2sym	Converts a polynomial coefficient vector to a symbolic polynomial.
Pretty	Displays an expression in a form that resembles typeset mathematics.
Simple	Searches for the shortest form of an expression.
Simplify	Simplifies an expression using Maple's simplification rules.
Subs	Substitutes variables or expressions.
sym2poly	Converts an expression to a polynomial coefficient vector.

Symbolic Calculus Functions	
Diff	Returns the derivative of an expression.
jacobian	Compute the Jacobian matrix.
Dirac	Dirac delta function (unit impulse).
Heaviside	Heaviside function (unit step).
Int	Returns the integral of an expression.
Limit	Returns the limit of an expression.
symsum	Returns the symbolic summation of an expression.
Taylor	Returns the Taylor series of a function.

Symbolic Linear Algebra Functions	
Det	Returns the determinant of a matrix.
Eig	Returns the eigenvalues (characteristic roots) of a matrix.
Inv	Returns the inverse of a matrix.
Poly	Returns the characteristic polynomial of a matrix.

Symbolic Tutors	
Arclen	Find the arclength of the curve.
composefun	compose two functions
dirdifftool	plot or animate directional derivatives
Eigtool	interactive matrix eigenvalues
gradtool	plot or animate gradient(s)
Linsys	plot a system of 2-D or 3-D linear equations
Ratfun	demonstrate the graphing of rational functions
Rsums	Riemann sum approximate integration tutor
taylortool	taylor approximation tutor

Assignment: The student should submit the electronic copy of diary file showing the execution/output of Matlab session(s).

N.B.: As the *CBCS has a high probability to be operationalised efficiently and effectively for the elevating learners* , the <u>Essential Requirements</u> for all Mathematical Practical including MATLAB Practicals of Mathematical subjects are as under:

5. **Mathematical Laboratory inbuilt with sufficient number of Computers (as per the students enrollments and the number of practical batches) and MATLAB SOFTWARE with basic requirements for the MATLAB Practicals.**
6. **Mathematical Laboratory inbuilt with Graphs, Charts, Printer, Physical Models (two dimensional as well as three dimensional) & Virtual Models (Higher Dimensional – Computerized) and basic requirements for the same.**
7. Use also "PYTHON" Software instead of MATLAB Software.
8. ***<u>Essential Requirement for Mathematical Computer Laboratory:</u>***

(i) Atleast One full time <u>Computer Operator</u> having mathematical ability to run Matlab Software and related Computerized Mathematical Practical.
(ii) One Peon for computer laboratory.

<u>Subject Elective Course</u> :ESMAT-31 Business Mathematics-III

<u>Unit:1</u> [<u>Differential Calculus</u>] [only examples] Definition of differentiation in one variable, Working rules of differentiation, Derivative of x^n, logx, e^x, a^x, trigonometric functions and inverse trigo. Functions, Differentiation of method of substation and implicit function, parametric equations, Diff. of $f(x)^{g(x)}$.

<u>Unit:2</u> [<u>Integral Calculus</u>]   [only examples] Indefinite integral: Definition, Working rules of integration, integration of x^n, a^x, e^x, integration of $\dfrac{1}{x^2 \pm a^2} ; \dfrac{1}{\sqrt{x^2 \pm a^2}} ; \dfrac{1}{\sqrt{a^2 - x^2}} ; \dfrac{1}{|x|\sqrt{x^2 - a^2}}$ integration of

trigonometric functions , integration by method of substitution, **Some standard**

results: $\int f(x)dx = F(x) + c \Rightarrow \int f(ax+b)dx = \dfrac{1}{a} F(ax+b) + c$, $\int [f(x)]^n . f'(x)dx$,

$\int \dfrac{f'(x)}{f(x)} dx$, $\int \dfrac{1}{ax^2 + bx + c} dx$, $\int \dfrac{1}{\sqrt{ax^2 + bx + c}} dx$.

<u>Referance books</u>:
(1) Business Mathematics by D.C.Sancheti & V.K.Kapoor, S Chad & Sons Publication, New Delhi.
(2) Business Mathematics by. B.S.Shah Prakashsan, Ahmedabad.
(3) Any Advance Calculusbooks used in Science Streme .

Semester-VI Mathematics

Course: CC MATH-601   (Abstract Algebra)

UNIT : 1 Definition of a Ring and illustrations, Propertis of a Ring, Zero divisors and Integral domain, Characteristic of an Integral Ring, Solution of the equation $ax = b$ in a ring R, Subrings, Ideals,

UNIT : 2 Introduction of Polynomials, Integral Domain D[x], Familiar form of Integral domain D[x], Unique factorization of Polynomials, Division Algorithm for Polynomials, Solutions of a Polynomial Equation, Eisenstein Criterion for irreducibility.

UNIT : 3 Quotient ring, Homomorphism of rings, Maximal Ideal, Prime Ideal,

The course is covered by the Book : **I H Sheth, *Abstarct Algebra*, Prentice Hall of India (PHI) Publication.** Chapter 13(13.1 to 13.4), Chapter 14(14.1 to 14.4), Chapter 15(15.1 to 15.4), Chapter 16(16.1 to 16.3), Chapter 18(18.1 to 18.7), Chapter 19(19.1 to 19.4),

Reference books :

1. I N Herstein, **Topics in Algebra,** Wiley Eastern Ltd.
2. N. Jacobson, **Basic Algebra Vol I & II,** Hindustan Publishing company
3. Shanti Narayan, **A text book of Modern Algebra,** S.Chand & Co.
4. P.B.Bhattacharya, S.K.Jain, S R Nagpal, **Basics Abstract Algebra, (second Edition),** Cambridge University Press.
5. N.S. Gopalkrishna, **University Algebra,** Wiley Eastern, New Delhi
6. Maclane Saunders and Birkhoff Garrett, **Algebra,** MacMillan, New York.
7. G.F.Simmons, **Introduction to Topology and Modern Analysis,** MacGrawHill Inc., U.S.A.

Course : CC MATH-602 Mathematical Analysis-II

Unit-1   **Limits and Continuity:** Limits and Continuity for a functions from a metric space into another metric space, continuity of a composite function, Structural properties of continuous functions from a metric space in to R^k, Continuity and Compactness, Continuity and connectedness, Discontinuities, Monotonic function, Discontinuities of a monotonic function, Infinite limits and limits at infinity.

Differentiation: Derivatives of a real function, Continuity and differentiability, Structural properties of the class of differentiable functions, Mean value theorems, Continuity of derivatives, L'Hospital rule, Derivatives of higher order, Taylor's theorem.

Unit-2   **The Riemann – Stieltje's Integral:** Riemann integral and Stieltje's integral, properties of Riemann integral and Stieltje's integral, Integration and Differentiation, Integration of Vector Valued Functions, Rectifiable curves.

Unit-3 Sequences and Series of functions: Sequences of functions, Limit of a Sequence of functions, Uniform convergence, tests for uniform convergence and continuity, Uniform convergence and differentiation.
The course is roughly covered by Chapters - 4,5,6,7 (Omit 5.16 to 5.20 and 7.28 to 7.33) of The book entitled "Principles of Mathematical Analysis" by Walter Rudin, McGraw Hill (International Student Edition), 3rd Edition.

Reference books:

(1) "A First Course in Mathematical Analysis" by D. Somasundaram & B. Choudhary, Narosa Publishing House.

(2) "Fundamentals of Mathematical Analysis" by G. Das & S. Pattnayak Tata Mcgraw Hill Pub.Co

(3) "Fundamental of Real Analysis" by S. L. Gupta & Nisha Rani – Vikas Pub. House Pvt. Ltd. New Delhi-1974.

(4) "Principle of Real Analysis "by S.C.Malik , Wiley Eastern Limited New Delhi 1982.

(5) "બહુચલ વિધેય" . એમ.ડી.સુથાર .યુનિ.ગ્રંથ નિર્માણ બોર્ડ.અમદાવાદ

(6) "Principle of Mathematical Analysis" by T.M.Apostol

Course : CC MATH-603 A General TOPOLOGY

Unit-1. Toplology and topological spaces, Neighbourhoods, Hausdorff space, Closure of a subset of a topological space.

Unit-2. Interior of a subset of topological space , Boundary of a subset of a topological space, Continuity of a function from topological space to topological space, Hoeomomorphism between two topological spaces.

Unit-3. Subspace of a topological space, Connectedness of a topological spaces, Some applications of connectedness, Components of a point of connected topologicalspace.

Text-Book: An Introduction to topology, by. Bert Mendelson(third addition)

Ch.No.-3 : 2.1 to 2.4, 3.1, 3.3 , 3.7, 4.2 to 4.15 , 5.1to 5.7 , 5.9 , 6.1 to 6.3 , 6.5 to 6.8

Ch.No.-4 : 2.1 to 2.7 , 4.1 to 4.3 , 5.1 to 5.7

REFERENCE BOOKS:

(1) Introduction to Topology and Modern Analysis, by. "G F Symmons"., New York McGrawHill, 1963

(2) General Topology by Kelly J L , NewYork, Van Nostrand 1955

(3) Elementary Topology by Beackett D W., New York Academic press, 1967

Course : CC MATH-603 B :Number Theory

Unit I:

Some Preliminary Consideration: Well-Ordering Principle, Mathematical Induction,the Binomial Theorem & binomial coefficients.

Divisibility Theory: the division algorithm, divisor, remainder, prime, relatively prime, the greatest common divisor, the Euclidean algorithm (Without proof), the least common multiple, the linear Diophantine equation & its solution.

Unit II:

Prime Numbers: Prime and composite number, the Fundamental Theorem of Arithmetic (without proof), canonical form of a number, the Sieve of Eratosthenes.

Theory of Congruence: Definition and basic properties of congruence, Residue class &complete system of residues, special divisibility test, linear congruence, Chinese Remainder Theorem. (without proof)

Unit III:

Fermat's Theorem: Fermat's Factorization method, Fermat's little theorem, Wilson theorem, Euler's theorem: Euler's Phi-function $()n\varphi$ and formula for$()n\varphi$, Euler's theorem (without proof) and only problems on Euler's theorem.

Text Book:

Elementary Number Theory **-** David M. Burton, Sixth Edition, Universal Book stall, New Delhi.

[(Chapter 1): 1.1 and 1.2   **2)** 2.1 to 2.4   **3)** 3.1 and 3.2   **4)** 4.1 to 4.3   **5) 5.2 and 5.3**   **7)** 7.2 and 7.3 **]**

Reference Books:
1 An introduction to the Theory of numbers - Niven and Zuckerman, Wiley Eastern Ltd.
2 Number Theory - S. G. Telang, Tata Mc Graw-Hill Publishing Company Limited, New Delhi
3 Elementary Theory of Numbers - C. Y. Hsiung, Allied Publishers Ltd.-India, ISBN 81-7023-464-6.
4 Number Theory - George E. Andrews, Hindustan Publishing Corporation- Delhi.
5 Elementary Number Theory - Gareth A. Jones & J. Mary Jones, Springer Verlag, ISBN 81-8128-278-7.

6. Number Theory - J. Hunter, Oliver and Boyd-London.
7. Beginning Number Theory - Neville Robbins, Narosa Pub. House -New Delhi ISBN 978-81-7319-836
8 Introduction to the theory of Numbers - G. H. Hardy & E. M. Wright, Oxford Uni. Press
9 Higher Algebra - S. Barnard & J. M. Child, Macmillan India Ltd
10 Elements of Number Theory - I. M. Vinogradov , Dover Pub INC
11 Elementary Number Theory in Nine chapters - James J. Tattersall, Cambridge Uni Press
12 A first course in Theory of Numbers - K. C. Chowdhary, Asian Books Pvt Ltd New Delhi
13 1001 problems in Classical Number Theory - Jean Marie De Konick Armed Mercier, AMS

Course : CC MATH-604 A GRAPH THEORY

UNIT:1 Graphs,Basic Definitions,Undirected Graphs,Mixed Weighted Graphs,Incidence and Degree,Bipartite Graph and Bipartition,Regular and K-regular Graph,Graph Isomorphisms,Sub Graphs,Graph Operations,Walk,Trail,Paths ,Circuits,Connected Graph,Disconnected Graph,Eccentricity,Radius and Diameter,Adjacency Strong ,Weak and Unilateral Components,Eular Graphs,Hamilton Paths,Trees,Binary Trees And m-arrayTree,Spanning Trees.

UNIT:2 Cut set,Internaly Disjoint Paths, Connectivity and Separability,Planar Graphs and their different Representation,Detection Of Planarity,Geometric and Combinatorial duals,Vector Space Associated With a Graph.Circuit and Cut set Subspaces, Orthogonal Vectors And spaces.

UNIT:3 Incidence Matrix,Adjancy Matrix Of a Graph.Path matrix and their reletion ships. Colouring of a Graph,Chromatic Number,Chromatic Partitioning,Covering.Acyclic digraphs and dia cyclizations.

REFERENCE BOOKS :
1.An Introduction To Discrete Mathematics, Udayan M.Prajapati Dr.Ajay S. Gor, Nirav Prakashan
2.Graph Theory with Applications toEngineering and Computer Science by Narsing Deo
3.Discrete Mathematical Structures With Applications to Computer Science   by Trembley I.P.And Mahonar R.
4. Graph Theory by Harary F.
5. Graph Theory and its applications by B. Harris
5.Discrete Mathematical Structures With applications to Computer Science by R.Hamming and E.A.Feigenbaum
4.Discrete Mathematical Structures for Computer Science by B.Kolman and R.C.Busy
5.The Essence of Discrete Mathematics by Neville Dean

Course : CC MATH-604 B Mechanics-II

UNIT-1 Plane Kinematics, Tangential and Normal components of velocity and acceleration, Radial and tranverse components. Motion of a rigid body parallel to a plane. Linear momentum and conservation of energy for a particle and for a system of particles. Projectile without resistence.

UNIT-2 Harmonic Oscillators. General motion under central force and Central Orbits, Planetary Orbits. Kepler's laws of motion.

UNIT-3 Moment of inertia. Kinetic energy and angular momentum. Rotation of a rigid body about a fixed axis. General motion of a cylinder parallel to a fixed plane. Compound pendulum. Plane impulsive motion. Impulsive force. Principle of linear and angular momentum. Collision of sphere and coefficient of restitution. Examples.

REFERENCE BOOKS :

(1) Synge and Griffith: Principal of Mechanics
(2) S.L.Loney : Statics,Macmillan and company, London.
(3) R.S.Verma : A Text book on Statics,Pothishala Pvt. Ltd., Allahabad.
(4) S.L.Loney : An elementary treatise on the Dynamics of a particle and rigid
    bodies.,Cambridge   University press 1956.
(5) Mechanics : Dr. L.K.Patel

Course : CC MATH-604 C Operations Research II

Unit-1. Network Models- Concept of Networks.
   Transportation Problem- Introduction, general method of a T.P., unbounded T.P. NWCM, Least cost method, VAM methods to find the initial solution, Dual of a T.P. and MODI method, degeneracy in a T.P., variatons in T.P.- Maximization T.P. and prohibited routes.
   Assignment Problem- General model of A.P.(A.P. as a special case of a T.P.) Hungarian   Method of solving a A.P., variations in a A.P.- maximization, prohibited assignments.
Unit-2. Sequencing Problem :
   Methods of sequencing, Johnson's Algorithm for a two machine problem, three machine problem and M-machine problem, Processing Two jobs through M-machines
Unit-3. **Game Theory**: Introduction, Two-person zero games, Minimax and Maximax principles, saddle point theorems, mixed strategies, method for solution of 2×2 game, dominance principles, solution of games without sadddle points by using dominance and then mixed strategies, graphical method of solving $2\times m$ and $m\times2$ game, L.P. solution of games.

REFERENCES BOOKS:
(1) Operations Research , by. J.K.Sharma. Macmillan Publishers India Ltd.
(2) Operations Research by Nita Shah, Ravi Gor and Hardik Soni, Prentice Hall of India.
(3) Operatlons Research(Principles and Practice) by Pradeep Prabhakar Pai, Oxford University Press.

Objectives:
- Ensure the student can competently use the MATLAB programming environment
- Understand the capabilities of MATLAB for solving complex mathematical problems
- Understand the tools that are essential in solving real-world problems applying appropriate Mathematical concept.

PCMAT-601 Input-Output Statements in MATLAB Data input, interactive inputs, reading/storing file data, output commands, formatted input-output functions.

PCMAT-602 Programming Techniques Loops, Branches control structures, MATLAB programming, function subprograms, types of functions, function handles, errors and warnings, MATLAB debugger.

PCMAT-603 MATLAB Applications: The content of this unit is to be covered from the list given in Appendix A.

PCMAT-604 Practical using MATLAB programming List of practical is given in Appendix B.

Text Book:

"MATLAB and its Applications in Engineering" Raj Kumar Bansal, Ashok Kumar Goel, Manoj Kumar Sharma, Pearson.

coverage from the Text Book:

PCMAT-601 Chapter 5: 5.6
PCMAT-602 Chapter 7: 7.3, Chapter 8: 8.9
PCMAT-603 Appendix A: Table A.1:A.8
PCMAT-604 Appendix B
Appendix A:Table A.1

Discrete Math\Number theoretic functions	
factor	Returns Prime factors
factorial	Factorial function
nchoosek	All combinations of N elements taken K at a time
perms	All possible permutations
gcd	Returns the greatest common divisor.
lcm	Returns the least common multiple.
primes	Generate list of prime numbers
isprime	Returns a logical array that is prime numbers.
rat, rats	Returns a rational fraction approximation.
mod	The mod function is useful for congruence relationships. Returns modulus
rem	Returns remainder after division.

Table A.2

Coordinate System Conversion	
cart2sph	Transform Cartesian to spherical coordinates
cart2pol	Transform Cartesian to polar coordinates
pol2cart	Transform polar to Cartesian coordinates
sph2cart	Transform spherical to Cartesian coordinates

Table A.3

Interpolation Functions	
interp1	Linear and cubic-spline interpolations of a function of one variable.
interp2	Linear interpolation of a function of two variables.
spline	Cubic-spline interpolation.

unmkpp	Computes the coefficients of cubic-spine polynomials.

Table A.4

Numerical Integration Functions	
quad	Numerical integration with adaptive Simpson's rule.
quadl	Numerical integration with adaptive Lobatto quadrature.
trapz	Numerical integration with the trapezoidal rule.
quadv	Vectorized quadrature
dblquad	Numerically evaluate double integral
triplequad	Numerically evaluate triple integral

Table A.5

Numerical Differentiation Functions	
diff(x)	Computes the difference between adjacent elements in the vector x.
polyder	Differentiates a polynomial, a polynomial product, or a polynomial

Table A.6

ODE Solvers	
ode23	Nonstiff, low-order solver.
ode45	Nonstiff, medium-order solver.
ode113	Nonstiff, variable-order solver.
ode23s	Stiff, low-order.
ode23t	Moderately stiff, trapezoidal rule solver.
ode23b	Stiff, low-order solver.
ode15s	Stiff, variable-order solver.
odeset	Creates integrator options structure for ODE solvers.
deval	Evaluate solution of differential equation problem
bvp4c	Solve boundary value problems for ODEs

Table A.7

Optimization	
fminbnd	Finds minimum of single-variable function.
fzero	Finds zero of single-variable function.
fminsearch	Multidimensional unconstrained nonlinear minimization
lsqnonneg	Linear least squares with nonnegativity constraints
fminunc	Find minimum of unconstrained multivariable function
fmincon	Find minimum of constrained nonlinear multivariable function
linprog	Solve linear programming problems

Table A.8

Statistical Functions	
erf(x)	Computes the error function *erf* (x).
mean	Calculates the average.
median	Calculates the median.
std	Calculates the standard deviation.
var	Calculates the variance.
corrcoef	Correlation coefficients
cov	Covariance matrix

Appendix B:

1. Numerical Methods Practical (Lab) using MATLAB programming
2. Linear Algebra
3. Graph Theory
4. Calculus

5. Optimization
6. Problems related to programming given in text book.

Assignment: The work should involve programming using MATLAB. The student should submit the electronic copy of .m files or/and diary file showing the execution/output of Matlab session(s).

N.B.: As the *CBCS has a high probability to be operationalised efficiently and effectively for the elevating learners* , the <u>Essential Requirements</u> for all Mathematical Practical including MATLAB Practicals of Mathematical subjects are as under:

1. **Mathematical Laboratory inbuilt with sufficient number of Computers (as per the students enrollments and the number of practical batches) and MATLAB SOFTWARE with basic requirements for the MATLAB Practicals.**
2. **Mathematical Laboratory inbuilt with Graphs, Charts, Printer, Physical Models (two dimensional as well as three dimensional) & Virtual Models (Higher Dimensional – Computerized) and basic requirements for the same.**
3. Use also "PYTHON" Software instead of MATLAB Software.
4. *<u>Essential Requirement for Mathematical Computer Laboratory:</u>*

(i) Atleast One full time <u>Computer Operator</u> having mathematical ability to run Matlab Software and related Computerized Mathematical Practical.
(ii) One Peon for computer laboratory.

<u>Subject Elective Course : Business Mathematics-4</u>

Unit-1 : LPP Formulation & Graphical Method : Introduction, Structure of linear programming, problems, Important terms used in L P Problems, Objective function, constraints, Solution, feasible solution, Basic solution, BFS, Non-degenerate B.F.S, Degenerate solution, Infeasible, Unbounded & Multiple optimal solution, Slack & Surplus variables, Artificial variable, Formulation of LPP & a solution by Graphical metod.

Unit-2 : Correlation & Regression analysis : Definition of correlation, positive & negative correlation, Scatter diagram, Carl- Pearson's coefficient of linear correlation, Properties of correlation coefficients and its examples, regression coefficient, properties of regression coefficient and its examples.

References :
(1) Operation Research, by J.K.Sharma.
(2) Business Statistics , by R.S.Bhadyaj
(3) Business Statistics , by Bharat Jhnujhunwala
(4) Advanced Practical Statistics, by S.P.Gupta , D.Chand & Co. Ltd, New Delhi.

<u>Paper Style : Semester V & VI For Paper - 501 , 502 , 601 , 602 , 603(A)</u>

Q:1 (Unit-1)
   (a)Theory (6 Marks)
   (b) Theory (6 Marks)
   (c) Example(6 Marks)

<div align="center">OR</div>

Q:1 (Unit-1)
   (a)Theory (6 Marks)
   (b) Theory (6 Marks)
   (c) Example(6 Marks)

Q:2 (Unit-2)
    (a)Theory (6 Marks)
    (b) Theory (6 Marks)
    (c) Example

                             OR

Q:2 (Unit-2)
    (a)Theory (6 Marks)
    (b) Theory (6 Marks)
    (c) Example(6 Marks)
Q:3 (Unit-3)
    (a)Theory (6 Marks)
    (b) Theory (6 Marks)
    (c) Example(6 Marks)

                             OR

Q:3 (Unit-3)
    (a)Theory (6 Marks)
    (b) Theory (6 Marks)
    (c) Example(6 Marks)
Q:4 Attempt any two : (8 Marks)
    (a)Theory (Unit-1)
    (b) Theory (Unit-2)
    (c) Theory (Unit-3)
Q:5 Attempt any two : (8 Marks)
    (a) Example (Unit-1)
    (b) Example (Unit-2)
    (c) Example (Unit-3)

Semester : V Differential Equation   CMAT-503

Q:1 (Unit-1) (a) 6 marks (b) 6 marks (c) 6 marks
                             OR
Q:1 (Unit-1) (a) 6 marks (b) 6 marks (c) 6 marks
Q:2 (Unit-2) (a) 6 marks (b) 6 marks (c) 6 marks
                             OR
Q:2 (Unit-2) (a) 6 marks (b) 6 marks (c) 6 marks
Q:3 (Unit-3) (a) 6 marks (b) 6 marks (c) 6 marks
                             OR
Q:3 (Unit-3) (a) 6 marks (b) 6 marks (c) 6 marks
Q:4 Attempt any four Out of Six.(Two question from each unit) (16 marks)
(Each question quarry FOUR marks.)

Semester : V & VI Operational Research
Paper No. – CCMAT – 504- C & 604-C

Q:1 (Unit-1) (a) 10 marks (b) 10 marks
                             OR
Q:1 (Unit-1) (a) 10 marks (b) 10 marks
Q:2 (Unit-2) (a) 10 marks (b) 10 marks
                             OR
Q:2 (Unit-2) (a) 10 marks (b) 10 marks
Q:3 (Unit-3) (a) 10 marks (b) 10 marks
                             OR
Q:3 (Unit-3) (a) 10 marks (b) 10 marks
Q:4 (Unit -1,2,3)Attempt any FIVE out of SEVEN .(10 marks)