# GONDWANA UNIVERSITY
# GADCHIROLI

Proposed Syllabus For

**B.Sc. Mathematics**

**Semester-I & Semester-II**

**Under Choice Based Credit System**

**(C.B.C.S.)**

**with effect from**

**Academic Year :2017-18**

**(Considered and approved in B.O.S.)**

# Semester-I

# USMT-01

# Differential and Integral Calculus

Max Marks : 60+15

## Unit –I

Limit and continuity ($\varepsilon$ and $\delta$ definition). Types of discontinuities, theorems on limit and continuity. Differentiability of functions, successive differentiation, Leibnitz's theorem.

## Unit –II

Mean Value theorem, Roll's theorem, Cauchy's generalized mean value theorem, Lagrange's mean value theorem, Taylors theorem with Lagrange's &Cauchy's form of remainder, Maclaurins Series &Taylors Series of sin x , cos x ,

$e^x$ ,log $(1+ x)$, $(1+ x)^m$

## Unit –III

Improper integral Gamma function properties of Gamma function , Beta function , Properties of Beta function Indeterminate forms L' Hospitals rule.

## Unit –IV

Double integration, properties of double integration, Iterated integral, Change of order integration, Transformation of Double integral in polar form.

### Reference Books

1. H. Anton, I.birens and S.Davis, *Calculus* , John Wiley and Sons, Inc.,2002.

2. G.B. Thomas and R. L. Finney, *Calculus,* Pearson Education,2007.

3. Text Book of Differential Calculus –Gorakh Prasad .

4. Integration for degree student –Dr.P.K.Mittal, S. Chand & Co. New Delhi.

5. Text Book of Differential Calculus –Musheer Ahmad, Macmillan India Ltd. Delhi - 2006.

6. Wilfred Kaplan & D.J.Lewis,*Calculus & linear algebra combined edition.*

# USMT-02

## Differential Calculus and Trigonometry

Max Marks: 60+15

## Unit –I

Limit and continuity of functions of two variables, Partial Differentiation, Differential, and Chain rule.

## Unit –II

Homogeneous function, Euler's theorem, Jacobian , Maxima & minima, Lagrange's Multiplier method ,Taylor's theorem for function of two variables.

## Unit –III

Tangent & normal, curvature asymptotes singular points, tracing of curve parametric representation of curve, tracing of curve in Cartesian form.

## Unit –IV

De Moivre's theorem & its application , square root of complex number, inverse circular & hyperbolic functions , logarithm of complex quantity, summation of series. C+iS Method .

**Reference Books**

1. H.Anton , I. Birens and S. Davis, *Calculus* , John Wiley and Sons , Inc., 2002

2. G.B. Thomas and R.L. Finney, *Calculus* ,Pearson Education ,2007

3. Text book of Differential calculus – Gorakh Prasad Pothishala Pvt.Ltd. Allahabad

4. Calculus –H Antan I Birens & S Davis , John Velly & son 2002.

5. Wilfred Kaplan & D.J.Lewis,*Calculus & linear algebra combined edition.*

6. S. L. Loney, *Plane trigonometry part-II*, Macmillan & compaany,London.

## Semester-II

## USMT-03

## Ordinary Differential Equations and Difference Equations

Max Marks: 60+15

### Unit –I

First order exact differential equation, integrating factor, rules to find an integrating factors , Linear equation , Bernoulli's equation, First order higher degree equations solvable for x,y,p, Orthogonal Trajectory.

### Unit –II

Simultaneous differential equations, Linear equation with constant coefficients complementary function operator to find the Particular integral.

### Unit –III

Linear equation with Variable coefficient Cauchy's Euler's homogeneous Linear differential equation , Wronskian & its properties , method of variation of parameter .

### Unit –IV

Formation of Difference equation . Order of difference equation .Liner difference equation. Homogeneous linear equation with constant coefficient . Non homogeneous linear equation Particular integrals.

### Reference Books

1. *Differential equations* N.Ch.S.N.Iyengar , Anmol Publication Pvt.Ltd.

2. D.A.Murry, Introductory Course in Differntial Equations , orient Longman (India)  1967.

3.G.F.Simmons, Differential Equation Tata Mc Graw2 Hill 1972.

4.Shepley L.Ross, *Differential Equations*, 3rd Ed., John Wiley and Sons, 1984.

5. H.C.Saxena,*Calculus of Finite Differences & Numerical Analysis*,S.Chand & Co.Ltd,New Delhi,1976. Scope: chapter 8

# USMT-04

# Partial Differential Equation

Max Marks:60+15

## Unit –I

Linear partial differential equation of first order . Formation partial differential equation by eliminating the arbitrary constant and arbitrary function .Total differential equation Lagrange's linear partial differential equation.

## Unit –II

Compatible Differential Equations.  Condition of Compatibility . Non linear partial differential equations.

Type I        f(p,q)=0

Type II       Z=px+qy+f(p,q)

Type III      F(z,p,q) =0

Type IV       F(x,p)= G(y,q)

Charpit's method

## Unit –III

Homogeneous partial differential equation with constant coefficient solution of partial differential equation complementary function and particular integral, Jacobbi's method.

## Unit –IV

Non- Homogeneous linear partial differential equation, Equation reducible to linear . partial differential equation . with constant coefficient classification of second order partial differential equation.

**Reference Books**

1. *Differential equations* N.Ch.S.N.Iyengar , Anmol Publication Pvt.Ltd.

2. D.A.Murry , Introductory Course in Differential Equation , orient Longman (Indioa)11967.

3. G.F.Simmons , Differential Equations ,Tata Mc Graw Hill 1972.

4. Shepley L.Rss, *Differential Equations* ,3$^{rd}$ Ed., John Wiley and Sons, 1984.

5.  I. Sneddon *Elements Of partial Differential Equations*, Mc Graw-Hill, International Edition ,1967.

# B.Sc. (MATHEMATICS)

## SEMESTER WISE DISTRIBUTION OF MARKS AND CREDITS

| Sr. No. | Class | Semester | Theory Paper Marks | | Internal Assessment Marks | Total Marks |
|---------|-------|----------|---------|----------|------------|-------------|
| | | | Paper I | Paper II | | |
| 1 | B. Sc | I | 60 | 60 | 15+15 | 150 |
| 2 | B. Sc | II | 60 | 60 | 15+15 | 150 |
| | | | 100 | 100 | 100 | 300 |

| Semester | Papers | University Exam. | Internal Assessment | Total |
|----------|--------|------------------|---------------------|-------|
| | | Marks - Credits | Marks - Credits | Marks – Credits |
| I | 2(Core Course) | $2 \times 60$ - $2 \times 2$ | $2 \times 15$ - $2 \times 1 = 2$ | 150-6 |
| II | 2(Core Course) | $2 \times 60$ - $2 \times 2$ | $2 \times 15$ - $2 \times 1 = 2$ | 150-6 |

## DISTRIBUTION OF MARKS FOR INTERNAL ASSESSMENT

| Sr. No. | Activities | Max. Marks |
|---------|-----------|------------|
| 1 | Attendance | 05(Compulsory) |
| | **Any Two of the Following Activities** | |
| 1 | Seminar | 05 |
| 2 | Unit Tests | 05 |
| 3 | Home Assignments | 05 |

**Total Marks -15**

**Minimum Passing Marks -06**

# Gondwana University, Gadchiroli



# Faculty of Science & Technology

Proposed Syllabus For

# B.Sc. Mathematics

# Semester-III & Semester-IV

## (Choice Based Credit System)

## With effect from

## Academic Year: 2018-19

**(Considered and Approved in B.O.S. in Mathematics)**

# Gondwana University, Gadchiroli

## B.Sc. Mathematics

## Semester-III & IV

### (Choice Based Credit System)

# Semester-III

**Paper –V: USMT-05   Real Analysis**

**Paper- VI: USMT-06 Set Theory and Laplace Transform**

# Semester-IV

**Paper – VII: USMT-07 Algebra**

**Paper- VIII: USMT-08 Elementary Number Theory**

**B.Sc. Mathematics**
**Semester-III**
**(Choice Based Credit System)**

**Paper –V: USMT-05**
**Real Analysis**

**Max. Mark- 60 + 15**

### Unit-I
Real sequence, bounded sequence, Cauchy convergence criterion for sequences, Cauchy's theorem on limits, monotone sequences and their convergence, monotone convergence theorem.

### Unit – II
Infinite series, Cauchy convergence criterion for series, positive term series, geometric series, comparison test, convergence of p-series, Root test, Ratio test, alternating series, Leibnitz's test, test for convergence.

### Unit – III
Metric, Neighbourhood, closed sets, open sets, bounded sets, DeMorgan's law, definition of metric space, subspace of metric space, open sphere, closed sphere, Cauchy sequence, complete metric space.

### Unit-IV
Riemann integral, Darboux's upper and lower sums, lower and upper integrals, Riemann integral, criterion for Riemann integrability, properties of integrable functions, integrability of continuous and monotonic functions, The fundamental theorem of integral calculus, Mean value theorem of integral calculus.

**Reference Books**
1. I. M. Apostol – Calculus (Vol. I), John Wiley and Sons (Asia)P. Ltd., 2002
2. R. G. Bartle and D. R. Sherbert  - Introduction to Real Analysis, John Wiley and Sons (Asia)P. Ltd., 2000.
3. E. Fischer - Intermediate Real Analysis,  Springer Verlag, 1983
4. T. M. Karade , J.N. Salunke, K. S. Adhav and M. S. Bendre - Analysis , Sonu –Nilu Publ. Nagpur, 2004
5. T. M. Karade  - Mathematical Analysis , Sonu –Nilu Publ. Nagpur, 2014
6. Walter Rudin – Principle of Mathematical Analysis , 3$^{rd}$ Edition Mac Graw Hill, 1976

# B.Sc. Mathematics
## Semester-III
### (Choice Based Credit System)

## Paper- VI: USMT-06
## Set Theory and Laplace Transform

**Max. Mark- 60 + 15**

**Unit-I**

Sets, subsets, basic set operations, Venn diagrams, finite and infinite sets, classes of sets, power of a set, countable and uncountable sets, basic sets of numbers, set of real numbers R, real line, supremum and infimum, completeness property of R, Archimedean property of R, Cartesian products of two sets, relations, types of relations, equivalence relation.

**Unit-II**

Basic concepts of Fuzzy sets, examples of fuzzy sets, operations on fuzzy sets: intersection, union and complements of fuzzy sets, alpha cuts and convex fuzzy sets, normal fuzzy sets.

**Unit-III**

Laplace transform, existence theorem for Laplace transform, linearity of Laplace transform, shifting theorem, Laplace transform of derivatives and integrals.

**Unit-IV**

Inverse Laplace transform, convolution theorem, solution of differential equations and partial differential equations

**Reference Books**

1. R. P. Grimaldi - Discrete Mathematics and Combinatorial Mathematics, Pearson Education, 1998
2. P. R. Halmos -Naïve Set Theory, Springer, 1974
3. E. Kamke - Theory of Sets, Dover Publication, 1950
4. Erwin Kreyszig – Advanced Engineering Mathematics, John Willey and Sons Inc, 1999
5. T.M.Karade – Partial Differential Equations and Laplace Transform, Sonu-Nilu Publication, Nagpur, 2013
6. Seymour Lipschutz- Schaum's out lines- Set Theory and Related Topics , Tata MacGraw Hill Education Pvt. Ltd. 5th Edition -2005
7. G. J. Klir and Bo Yuan – Fuzzy Sets and Fyzzy Logic , PHI Publication
8. T. M. Karade, J. N. Salunke, M. S. Bendre – Elements of Calculus, Group and Fuzzy Sets, - Sonu Nilu Publication -2010, Nagpur.
9. Ross Timothy J. –Fuzzy Logic with Engineering Applications –Wiley India 2nd Edition 2007

# B.Sc. Mathematics
## Semester-IV
### (Choice Based Credit System)

## Paper –VII: USMT-07
## Algebra

**Max. Mark- 60 + 15**

### Unit-I
Group: definition of a group with examples, properties of a group, subgroups, cyclic groups, order of a generator of a cyclic group, permutation groups, even and odd permutations.

### Unit-II
Cosets and Normal Subgroups: cosets, Langrage's theorem, normal subgroups: their definition, examples, and characterizations, algebra of normal subgroups, quotient groups.

### Unit – III
Homomorphism and Isomorphism: homomorphism, homomorphic image, kernel of homomorphism, isomorphism of a group, fundamental theorem on homomorphism of a group, Natural homomorphism, second isomorphism theorem, third isomorphism theorem .

### Unit-IV
Ring, Integral domain and Field: definition, examples and properties of a ring (commutative ring, ring with unity, zero divisor, without zero divisor), subring, characterization of ring, integral domain, field.

### Reference Books
1. I. N. Herstein - Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975
2. John B. Fraleigh - A First Course in Abstract Algebra,7$^{th}$ Ed. Pearson , 2002
3. M. Artin-Abstract Algebra, 2$^{nd}$ Ed. Pearson , 2011
4. Joseph A. Gallian-Contemporary Abstract Algebra , Narosa, 1999
5. N. Jocobson- Basic Algebra ,Vol I and II W.H. Freeman ,1980, (Hindustan Publ. Co.)
6. K. B. Datta – Matrix and Linear Algebra , Prentice Hall of India  Pvt. Ltd. New Delhi , 2000
7. P. B. Bhattacharya , S.K.Jain, and S.R. Nagpal – Basic Abstract Algebra  , II nd Edition , Cambridge Uni. Press  Indian Edition , 1997
8. Shanti Narayan – A Text Book of Modern Abstract Algebra , S. Chand and Co. New Delhi
9. Vivek Sahai and Vikas Bisht – Algebra , Narosa Publishing House , 1997
10. T. M. Karade , J. N. Salunke , K. S. Adhav ,S. D. Katore, Rekha Rani – Modern Algebra (Groups- Rings) Sonu- Nilu Publ. (Ist Publication )Nagpur, 2014

# B.Sc. Mathematics
## Semester-IV
### (Choice Based Credit System)

## Paper- VIII: USMT-08
## Elementary Number Theory

**Max.  Mark- 60 + 15**

### Unit-I
Divisibility, division algorithm, the greatest common divisor, greatest common divisor of more than two integers, Euclidean algorithm, least common multiple.

### Unit- II
Prime numbers, the Fundamental theorem of arithmetic or unique factorization theorem, Fermat numbers, linear Diphantine equation.

### Unit-III
Congruence, properties of congruence, special divisibility test, linear congruence, Chinese reminder theorem, Goldbach conjuncture

### Unit-IV
Arithmetic function, Euler's theorem, Mobius $\mu$ function, the $\tau$ and $\sigma$ functions, Pythagorean triplets.

### Reference Books
1. David M. Burton - Elementary Number Theory, 6th Ed. Tata McGraw-Hill Edition, Indian Reprint, 2007
2. Richard E. Klima, Neil Sigmon , Ernest Stitzinger - Applications of Abstract Algebra with Maple, CRC Press, Boca Raton, 2000
3. Neville Robinns - Beginning Number Theory, 2nd Ed. Narosa Publishing House Pvt. Ltd., Delhi,2007
4. I. Niven , S.H. Zuckerman and I.H. Montgomery  - An Introduction to the Theory of Numbers , John Wiley, 1991
5. T. M. Karade, J. N. Salunke, K. D. Thengane , M. S. Bendre – Lectures on Elementary Number Theory,Sonu- Nilu Publ. , Nagpur , 2005
6. C.Y. Hsiung - Elementary Theory of Numbers, Allied Publishers Ltd. 1992
7. G.A.Jones and I. M. Jones - Elementary Number Theory, Springer, 1998
8. W. Slerpinski - Elementary Theory of Number, North- Holland, 1988, Ireland
9. K.H.Rosen - Elementary Number Theory and its Applications, Addison – Wesley, 1986

# Gondwana University, Gadchiroli

## Proposed B.Sc. (Mathematics) CBCS Syllabus

## Semester-V & VI

## 2019-2020

By

Board of Studies (Mathematics)

Faculty of Science & Technology

# B.SC. (MATHEMATICS)

## SEMESTER WISE DISTRIBUTION OF MARKS AND CREDITS

There are two Types of Courses for B.Sc. Sem V and Sem VI
(A)Skill Enhancement Course (SEC)
(B)Discipline Specific Elective (DSE)

### SKILL ENHANCEMENT COURSE (SEC)

| Sr. No. | Class | Semester | Theory paper Marks | Internal Assessment Marks | Total Marks | Marks for passing out of 50 |
|---------|-------|----------|--------------------|---------------------------|-------------|------------------------------|
| 1 | B.Sc. | V | 15 | 35 | 50 | 20(minimum 06 marks in theory examination) |
| 2 | B.Sc. | VI | 15 | 35 | 50 | 20(minimum 06 marks in theory examination) |
| | | | 30 | 70 | 100 | 40 |

| Semester | Papers | College Examination Paper-Marks | College Internal Assessment Paper-Marks | Total Marks-Credits |
|----------|--------|---------------------------------|-----------------------------------------|---------------------|
| Sem -V | 1 (SEC) | 1 - 15 | 1 - 35 | 50  - 2 |
| Sem -VI | 1 (SEC) | 1 - 15 | 1 - 35 | 50  - 2 |

## DISTRIBUTION OF MARKS FOR SEC INTERNAL ASSESSMENT

| Sr. No. | Activities | Max Marks |
|---------|------------|-----------|
| 1 | Attendance | 05 |
| 2 | Seminar on the respective paper | 15 |
| 3 | Project on any topics in Mathematics | 15 |

### Skill Enhancement Course (SEC)

Note:  i) For Skill Enhancement Course (SEC), College will conduct the examination.
ii) For each semester V & VI, SEC Examination is of 50 Marks with 2 credits.
iii) Theory examination is of 15 marks and internal assessment is of 35 marks.
iv) Minimum passing marks is 20 (Including minimum 06 marks in theory + internal
Assessment marks).
v) Examination Time period for SEC theory examination is of 01 hour.

### Discipline Specific Elective (DSE)

For Discipline Specific Elective (DSE), University will conduct the examination.

## B.Sc. (MATHEMATICS)
## SEMESTER WISE DISTRIBUTION OF MARKS AND CREDITS FOR
## DISCIPLINE SPECIFIC ELECTIVE (DSE)

| Sr. No. | Class | Semester | Theory Paper Marks | | Internal Assessment Marks | Total Marks |
|---|---|---|---|---|---|---|
| | | | Paper I | Paper II | | |
| 1 | B.Sc. | V | 60 | 60 | 15+15 | 150 |
| 2 | B.Sc. | VI | 60 | 60 | 15+15 | 150 |
| | | | 120 | 120 | 60 | 300 |

| Semester | Papers | University Examination | Internal Assessment | Total |
|---|---|---|---|---|
| | | Marks-Credits | Marks-Credits | Marks-Credits |
| Sem-V | 2 (DSE) | 2x60  - 2x2 | 2x15  - 2x1 = 2 | 150-6 |
| Sem-VI | 2 (DSE) | 2x60  - 2x2 | 2x15  - 2x1 = 2 | 150-6 |

## DISTRIBUTION OF MARKS FOR DSE INTERNAL ASSESSMENT

| Sr. No. | Activities | Max Marks |
|---|---|---|
| 1 | Attendance | 05 |
| Any Two of the following activities | | |
| 1 | Seminar | 05 |
| 2 | Unit test | 05 |
| 3 | Home Assignments | 05 |

**Total Marks: 15 + 15**

**Minimum Passing Marks: 06 + 06**

**Proposed Scheme for B. Sc Sem - V with Choice Based Credit System**

**B. Sc. Sem - V**

**Mathematics**

**2019-2020**

**Skill Enhancement Course (SEC)**

Maximum Marks - 15+35                                      Credits -2

College will conduct the Examination.

Choose any **one** of the following Papers

Paper: SEC - I - Probability

Paper: SEC -II - Mathematical Modeling

**Discipline Specific Elective (DSE)**

Time – Three Hours                                      Max. Marks – 60+15

University will conduct the Theory examination

Choose any **Two** of the following.

Paper: DSE –I- Linear Algebra

Paper: DSE –II- Mechanics

Paper: DSE –III- Matrices and Theory of Equations

Paper: DSE-IV-Special Relativity - I

**B.Sc. III SEM - V**

**Paper: SEC-I**

**Probability**

Time: 1 Hour                                             Max. Marks: 15+35

1.Introduction, Sample Space, Events , types of events, algebra of events concept of probability, axiomatic definition of probability, conditional probability, properties of conditional probability, statement of Bayes theorem and examples .

2. Addition theorem (using axiomatic definition and Venn diagram), multiplicative theorem

(Statement and examples), probability mass function-definition, probability distribution, cumulative distribution function of a discrete random variable (definition and examples)

3. Expected values, variance, standard variation of discrete random variables – definition with examples.

4. Probability density function and distribution function of a continuous random variable (definition with examples)

**Reference Books:**

1.Robert V. Hogg, Joseph W. McKean and Allen T. Craig –Introduction to Mathematical Statistics , Pearson Education,Asia,2007.

2.Irwin Miller and Marylees Miller , John E. Freund – Mathematical Statistic with Application , 7th Ed. Pearson Education , Asia, 2006

3.Sheldon Ross – Introduction to Probability Model , 9th Ed. Academic Press Indian Reprint, 2007

4.Mathematics Text Book for Class XII NCERT.

5.Mathematics and Statistics – Std. XII Maharashtra State Board of Secondary and Higher Secondary Education , Pune.

**B.Sc. III SEM - V**

**Paper: SEC-II**

**Mathematical Modeling**

Time: 1 Hour                                                    Max. Marks: 15+35

1. Introduction, Preliminaries, Definition of mathematical modeling formation: Identifying the relevant factors, mathematical description, examples of mathematical modeling

2. Need of mathematical modeling, Principles of mathematical modeling , (steps for mathematical modeling), examples of mathematical modeling, limitations of mathematical modeling.

3. Applications of Differential equations: Vibration of mass on a spring , resonance phenomenon, mechanics of simultaneous differential equations .

4. Application of traffic flow, vibrating string, gravitational potential, conservation laws.

**Reference Books:**

1. I. Snedon -Elements of Partial Differential Equations , McGraw Hill , International Ed. 1967
2. ShepleyL.Ross - Differential Equations ,3$^{rd}$ Ed. John Wiley and Sons.1984
3. Mathematics Text Book for Class XIandXII , NCERT.

**B.Sc. III SEM - V**

**Paper: DSE-I**

**Linear Algebra**

Time –Three Hours                                                                 Max. Marks- 60+15

Unit- I Vector Space: Definition and example of vector spaces, subspace, linear span, Quotient space, Linear dependence and Independence and their basic properties, Basis and dimension.

Unit- II Linear transformations: The algebra of linear transformation, Rank Nullity Theorem, Matrix and linear transformation, Rank Nullity of Matrix, Isomorphism.

Unit- III Dual Space: Dual Space, Bi dual space and natural isomorphism. Adjoint of a linear transform, Eigen values and Eigen vectors of a linear transform.

Unit- IV Inner product space: Inner product, Cauchy Schwartz inequality, orthogonalvectors,orthogonal compliment, Orthogonal set, Bessel's inequality for finite dimensional space, Gram –Schmidt Orthogonalisation process.

**Reference Books:**
1. I.N.Herstein – Topics in Algebra, Wiely Eastern Ltd. New Delhi, 1975
2. N. Jacobson – Basic Algebra, Vol I and II W.H.Freeman, 1980, Hindustan Publishing Co.
3. Shanti Narayan – A Text Book of Modern Abstract Algebra, S.Chand and Co., New Delhi
4. K.B.Datta – matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd, New Delhi, 2000
5. P.B.Bhattacharya, S.K. Jain and S.R.Nagpal – Basic Abstract Algebra, II$^{nd}$Edition, Cambridge University Press Indian Edition, 1997
6. K.Hoffman and R. Kunze - Linear Algebra, IInd Edition, Prentice Hall Englewood Cliffs, New Jersey, 1971
7. S.K.Jain, A.Gunwardhana and P.B.Bhattacharya – Basic Linear Algebrawith MATLAB, Key Collage Publishing –Springer Verlag, 2001
8. S.Kumarsen - Linear Algebra, A Geometric Approach , P. Prentice Hall of India Pvt. Ltd , New Delhi, 2000
9. VivekSahai and VikasBisht – Algebra, Narosa Publishing House, 1997
10. D.S. Malik, J.N. Mordeson and M.K.Sen – Fundamentals of Abstract Algebra, McGraw Hill International Edition 1997
11. T.M.Karade, J.N. Salunke, K.S. Adhav, M.S. Bendre –Lectures on Abstract Algebra, SonuNilu Publication, Nagpur, II$^{nd}$ Publication

# B.Sc. III SEM – V

## Paper: DSE-II

### Mechanics

Time –Three Hours                                                  Max. Marks- 60+15

**Unit – I Kinematics in two dimensions and simple harmonic motion**
Coordinate systems, radial and transverse components of velocity and acceleration, tangential and normal components of velocity and acceleration, differential equation of simple harmonic motion and its solution.

**Unit – II Mechanics of a system of particles**
Newton's three laws of motion, System of particles, centre of mass, conservative system of forces, conservation theorems : of linear momentum, angular momentum and of energy.

**Unit – III Lagrangian dynamics**
Generalized coordinates and velocities,constraints, relations between $r_i$ and generalized coordinates, D'Alembert principle, Lagrange's equations of motion, generalized potential, Rayleigh's dissipation function.

**Unit – IV Central force motion**
Equivalent one body problem, central force field, motion in one dimension, potential well, infinite motion, classification of central orbits, differential equation for the orbit, integrable power law force field, three laws of Kepler, viral theorem

Reference Books:
1] Goldstein H- Classical Mechanics , Addison Wesley, 1980
2] Karade T M and Bendre M S-  Lectures on Classical Mechanics
     Sonu Nilu, EFI, 2001
3] Karade T M, Bendre M S and Ladke L S -Elements of Mechanics and
     Statics ,Sonu Nilu, 2013
4] Karade T M, Salunke J N and Bendre M S- Elements of Classical
      Mechanics, Sonu Nilu, Fourteenth Edition 2017
5] Landau L D and Lifshitz E M -Mechanics ,Pergamon Press, 1976
6] Synge J L and Griffith B A-  Principles of Mechanics,    McGraw Hill, 1959

# B.Sc. III SEM- V

## Paper: DSE-III

### Matrices and Theory of Equations

Time –Three Hours                                                                                    Max. Marks- 60+15

Unit – I Symmetric, Skew symmetric, Hermition and skew Hermition matrices , elementary operations on matrices , reduction to normal form Adjoint  matrix , the inverse of a matrix , Linear independence of row and column matrix , Row rank, column rank and rank of a matrix.

Unit – II Linear equations – Homogeneous equations, Non – homogeneous equations, Methods of solving linear equations- solution by matrix inversion, solution by Cramer's rule, solution of Gauss – Jordan elimination method. Eigen values and Eigenvectors, some important theorems on Eigen values, Caley-Hamilton theorem.

Unit – III General Properties of polynomial equation in one variable, Descartes' rule of sips, some properties of polynomial equations, Relation between roots and coefficient, transformation of equations, Roots with signs changed, roots multiplied by given number, Reciprocal roots, to increase or diminish the roots by a given quantity, removal of terms.

Unit – IV Reciprocal equations, Cubic equation, Cordon's method, Transformation of a general cubic to the standard term, Bi-quadratic equations, Ferrari's method, and Descartes' method.

**Reference Books:**

1] H.S. Hall and S.R. Knight – Higher Algebra – H.M. Publications     1994

2] K.B. Datta – Matrix and linear algebra – Prentice Hall of India Pt. Ltd. New Delhi

3] C.C. Mac Duffee – Theory of equation – John Wiley and sons Inc 1954

4] Dr. T.M. Karade and Maya S. Bendre – Algebra and Trigonometry – Sonu- Nilu Publ. Nagpur 2009

## B.Sc. III SEM V

## Paper: DSE-IV

## Special Relativity – I

Time –Three Hours                                                     Max. Marks- 60+15

Unit –I Review of Newtonian mechanics, Inertial system , Galilean transformation, Newtonian relativity, Conservation laws in  Newtonian mechanics , Maxwell's electromagnetic theory , Michelson – Morley experiment, Lorentz Fitzgerald contraction hypothesis, relative character of space and time

Unit – II Einstein's special theory of relativity, postulates of special relativity theory, Lorentz transformation, Geometrical interpretation of Lorentz transformation , Group properties of Lorentz transformation , Length contraction, Time dilation.

Unit – III  Relativistic Kinematics- Composition of parallel velocities , transformation equations for componets of velocity, addition law for velocity, transformation of Lorentz contraction factor $(1-v^2/c^2)^{1/2}$, The transformation equation for components of acceleration of a particle.

Unit – IV Geometrical representation of space time , Four dimensional Minkowskian space time of special relativity,  Time like , Light like , and Space like inteervals , Lorentz transformation in index form , Proper time , world line of a particle ,  Four vectors and Four tensors in Minkowskin space time.

### Reference Books:

1.T.M.Karade , K.S.Adhav and Maya S. Bnedre – Lectures on Special Reklativity , Sonu Nilu Pbl.Nagpur

2. Moller C. – The Theory of Relativity , Oxford Clarendon Press , 1932

3.Bergmann P.G. – Introduction to the Theory o0f Relativity ,Prentice Hall of India Pvt. Ltd. 1969

4.Anderson I.I.- Principle of Relativity Physics , Academic Press 1967

5.M.R. Spiegel – Theory and Problems on vector Analysis SIJ Metrics and Introduction to Tensor Theory , Schaum's  out line Series McGraw Hill Book Co.

**Proposed Scheme for B. Sc. Sem VI with Choice Based Credit System**

**B.Sc. Sem VI**

**Mathematics**

**2019-2020**

**Skill Enhancement Course (SEC)**

Maximum Marks- 15+35.                                    Credits -2

College will conduct the examination

Choose any **one** of the following Papers

Paper: SEC - III - Graph Theory

Paper: SEC - IV - Boolean Algebra

**Discipline Specific Elective (DSE)**

Time: Three Hour                                    Max. Marks – 60+15

University will conduct the examination of **Discipline Specific Elective (DSE) Subjects.**

Choose any **Two** of the following.

Paper: DSE –V- Numerical Methods

Paper: DSE –VI - Complex Analysis and Vector Calculus

Paper: DSE –VII- Linear Programming and Transportation Problems.

Paper: DSE –VIII- Special Relativity - II

**B.Sc. III SEM -VI**

**Paper: SEC- III**

**Graph Theory**

Time: 1 *Hour*                                    Max. Marks- 15+35

Basic Concepts of Graph Theory, Undirected and Directed graphs , simple graphs, multi graphs, degree of vertex, in degree and out degree ,sub graphs and isomorphic graphs , weighted graphs, path and circuit, shortest path, Eulerian path and circuits, travelling salesman problems, planar graphs , Dijkstra's algorithm, Floyd – Warshall algorithm.

**Reference Books:**

1.Edgar G. Goodaire and Michael M. Parmenter – Discrete Mathematics with Graph Theory , 2$^{nd}$ Ed. Pearson Education (Singapore)Pvt. Ltd. Indian Reprint , 2003

2.RudolfLidl and Gunter Pitz- Applied Abstract Algebra 2$^{nd}$ Ed. Undergraduate Text in Mathematics , Springer (SIE)Indian Reprint 2004

3.J.P.Tremblay , R. Manohar- Discrete Mathematical Structure with Application to Computer Science, Tata McGraw Hill Ed.

**Paper: SEC-IV**

**Boolean Algebra**

Time: 1 *Hour*                                                          Max. Marks- 15+35

Lattices-Definition,examples and basic properties of ordered sets, maps between ordered sets, cover, Hasse Diagram, examples of lattices, principle of duality of lattices, sub lattices.

Properties of lattices–Isotonicity property, distributive inequalities, modular inequalities, Idempotent, commutative, associative and absorption property, some examples of lattices.

Boolean Algebra- Definition and properties of Boolean algebra, definition of sub algebras, definition of direct product, definition of Boolean Homomorphism , meaning of minterms and maxterms, Boolean expressions.

"Sum of products" canonical form with examples, minimization of Boolean functions Karnaugh diagram, switching circuits and application of switching circuits, Quinn- Mccluskey method.

**Reference Books:**

1.B.A.Davey and H.A. Priestley-Introduction to Lattices and Order, Cambridge University Press, Cambridge, 1990

2. Rudolf Lidl and Gunter Pitz- Applied Abstract Algebra 2$^{nd}$ Ed. Undergraduate Text in Mathematics, Springer (SIE)Indian Reprint 2004

# B.Sc. III SEM- VI

## Paper: DSE- V

## Numerical Methods

Time –Three Hours                                                    Max. Marks- 60+15

Unit – I Solution of nonlinear equations $f(x) = 0$

Bisection method, Regula falsi method, secant method, Newton- Raphson method Solution of linear algebraic equations $Ax = B$           Gauss elimination method, partial pivoting, Gauss- Jordon elimination method, LU decomposition method, Gauss- Jacobi method of iteration, Gauss- Seidel method of iteration

Unit – II Lagrange and Newton interpolation

Finite difference operators: forward, backward, shift, central average and differential operators, Newton- Gregory forward and backward difference interpolation formula, Lagrange interpolation formula for unequal intervals, Newton divided difference interpolation formula for unequal intervals

Unit – III Numerical differentiation

Newton's special formulae for derivatives at the end points of an interval, Newton's general formulae for derivatives, Newton divided difference formula for derivatives, maxima and minima of a tabulated function

Unit – IV Numerical integration

Newton- Cotes quadrature formula,

trapezoidal quadrature rule, Simpson's one-third rule, Simpson's three-eighth rule, Boole's rule, the degree of precision and truncation error of above quadrature rules

Reference Books:

1] Atkinson Kendall E - An Introduction to Numerical Analysis ,John Wiley and sons, 1978

2] Chapra Steven C and Canale Raymond P-Numerical Methods for

   Engineers,Tata McGraw Hill Education Private Limited,  Fifth Edition, 2006

3] Jain M K, Iyengar S R K and Jain R K ,Numerical Methods for Scientific and Engineering

    Computation,New Age International Publishers, Fifth Edition, 2007

4]Karade T. M.-Numerical Analysis , YashawantraoChavan Open University , Nashik 2019

5]Kreyszig Erwin –Advanced Engineering Mathematics ,John Wiley and Sons , 8th Edition , 2001

6]Mathews John H. – Numerical Methods for Mathematics , Science and Engineering –

  Prentice Hall of India 2nd Ed. 2005

7] SankarRao K.-Numerical Methods for Scientists and Engineers – PHI Learning Private Ltd. 3rd Ed. 2009

8]Sastry S.S. – Introductory Methods of Numerical Analysis – Prentice Hall of India Pvt. Ltd. 4th Ed. 2006

9]Scheid Francis - Numerical Analysis , Schaum's Outline Series, McGraw Hill Book Co., Singapore , 1998

**B.Sc. III SEM- VI**
**Paper: DSE-VI**

**Complex Analysis and Vector Calculus**

Time –Three Hours                                        Max. Marks- 60+15


Unit- IAnalytic function, Cauchy Riemann Equation, Polar form of Cauchy Riemann Equation, Harmonic functions, Mobius Transformation, Cross Ratio.

Unit- II ComplexIntegration, Cauchy's Integral Theorem, Cauchy's Integral   Formula, Singularity, Residue Theorem.

Unit- III   Vector Differentiation,Gradient,Divergence, Curle and Vector Integration.

Unit- IV Green, Gauss and Stokes Theorems and Problem based on these.

**Reference Books:**

1. J.W.Brown and R.V. Churchill- Complex Variables and Applications, 8th Ed. McGraw Hill International Edition, 2009

2. JosephBak and J. Newman- Complex Analysis 2nd Ed. Undergraduate Texts in Mathematics, Springer Verlag, New York, Inc.1997

3. T.M.Karade- Complex Analysis SonuNiluPublication, Nagpur

4. M.R.Spiegel – Theory and Problems of Advanced Calculus, Schaum Series Pub.

5. M.R.Spiegel – Vector Analysis, Schaum Series Pub.

6. N Saran and S.N. Nigam – Introduction to Vector Analysis, Pothishala Pub. Allahabad.

## B.Sc. III SEM - VI

## Paper: DSE - VII

## Linear Programming and Transportation Problem

Time –Three Hours                                        Max. Marks- 60+15

Unit- I   Standard Form of Linear Programming Problems: Methods of Generating Initial Feasible Solution and Standard Form of Linear Programming Problems, Linear Dependence and Independence, Graphical approach for solving some linear programs. Convex Combination, Convex sets and Extreme Points of a Convex set   , Basic Feasible Solutions of Linear Programming Problems, Supporting and separating hyper planes,

Unit- II LinearProgramming: The Simplex Method and Duality –Computation Procedure of the Simplex Method, Modified Simplex Method of Linear Programs with Artificial Variables: Two Phase and Big M Methods, Duality in Linear Programming Problems, Duality Theorems and Dual Solutions.

Unit- III Transportation Problems : Some Definitions and Observations ,Transportation Algorithm, Mathematical Formulation of Transportation Problem , Methods for  Finding an Initial Basic Feasible Solution :North West Corner  Rule, Least Cost Method and Vogel's Approximation .Test for Optimality.

Unit- IV  Non- Linear Programming : Single Variable Optimization, Local Maximum,  Local Minimum, Global  Maximum,  Global Minimum , Critical Points , Convex and Concave Functions, Sequential Search Techniques, Types of Sequential Search Techniques with examples , Assignment Problems and its Mathematical Formulation , Various examples of  Assignment Problems , Hungarian Method for solving  Assignment Problems .

**Reference Books:**

1.  KantiSwarup , P.K. Gupta and Man Mohan – Operation Research ,14th Thoroughly Revised Edition ,  S. Chand  and Sons Educational Publishers , New Delhi.

2.  R. K. Gupta – Operation Research,Krishana Prakashan Media Ltd.

3.  J. K. Sharma - Operation Research: Theory and Applications, 2nd Edition 2006, Macmillan India Ltd.

4.   R.R .Mahajan, K.D.Thengane, B.G. Ambatkar, S.D. Tade , L.S.Ladke, B. M. Roy- Linear Programming, Complex Numbers and Statics, Das Ganu Prakashan, Nagpur.

# B.Sc. III SEM VI

# Paper: DSE-VIII

# Special Relativity – II

**UNIT – I**
Tensor Analysis – Coordinate transformations, Summation Convention, The Kronecker delta, Covariant, Contravariant and mixed tensor, symmetric and skew symmetric tensors, Fundamental operations on tensors, metric tensor, conjugate metric tensor.

**UNIT – II**
Christoffels symbols, Transformation of christoffels symbols, covariant derivatives, Absolute derivative, Geodesics, Curvature tensor, Ricci tensor, Einstein tensor, The Bianchi identity.

**UNIT – III**
Relativistic Mechanics : Variation of mass with velocity Equivalence of mass and energy, Transformation $Eq_n$ for mass, momentum and energy, Energy momentum four vectors, Relativistic force and transformation equation for its components, Relativistic Lagrangian and Hamiltonian Relativistic $eq_n$ of motion of particle.

**UNIT – IV**
Electromagnetism : Maxwell's equation in vacuum, Transformation equations for density of electric charge and current, propagation of electric and magnetic field strength, Transformation equations for electromagnetic four potential vector, Lagrangian for a charged particle in an electromagnetic field. Lorentz force, The electromagnetic field tensor Maxwell's $eq_n$ in tensor form, Lorentz force on a charged particle.

## Reference Books :-

1. Prof. T. M. Karade, K. S. Adhav and Maya S. Bendre,-Lectures on Special Relativity Sonu Nilu.
2. C. Moller, The Theory of Relativity, Oxford Clarendon Press, 1952.

3. P. G. Bergmann, Introduction to the theory of relativity, Prentice Hall of India, Pvt. Ltd. 1969.

4. I. I. Anderson, Principle of relativity Physics, Academic Press, 1967.

5. Murray R. Spiegel, Theory and Problems on vector Analysis SIJ Metrics and Introduction to Tensor Theory, Shaum's outline Series, Mc. Gra. Hill Book Company.