GOVERNMENT COLLEGE FOR WOMEN

PARADE GROUND JAMMU

(An Autonomous College with CPE status by UGC)

FOUR YEARS UNDER GRADUATE PROGRAMME

WITH

MATHEMATICS AS MAJOR/MINOR SUBJECT

SEMESTER I

SYLLABUS

(For examinations to be held in 2022, 2023 and 2024)

Title: Differential Calculus **Course Code: UMAMJT-101/ UMAMNT-101**

Course Type: Major/Minor (Theory) **Credits: 04**

Internal Assessment: 20 Marks **End Semester Examination: 80 Marks**

Objectives: The primary purpose of Calculus is the study of motion and change. It is an indispensable tool in use in almost every branch of pure and applied science and some of the social sciences besides in other branches of Mathematics. So to make the students acquainted with notions and ideas of Calculus with applications to other disciplines is the main objective of this course.

Structure of the Course: This course is divided into five units of 12 class lectures (=12 hours) each, wherein one lecture is of one hour duration.

Learning Outcomes: Upon the successful completion of this course the students will be able to do the following:

- Problems of limits and continuity using ε-δ definition.
- Problems on types of discontinuities.
- Differentiability of functions and problems on linearization.
- Evaluation of limits using L'Hospital's Rule.
- Problems on partial differentiation and applications of Euler's theorem.
- Concavity and points of inflection.
- Asymptotes and double points of curves.
- Tracing of curves in Cartesian coordinates.
- Concept of polar coordinates, problems on angle between radius vector and tangent and angle of intersection of two curves.

- Tracing of curves in polar coordinates.
- Proof of Rolle's Theorem and Lagrange's mean value theorem and their geometrical interpretations.
- Taylor's and Maclaurin's series expansions of functions.

SYLLABUS

UNIT-I

Epsilon-delta definitions of limit and continuity of real- valued functions of a real variable with illustrations. Discontinuity and types of discontinuities. Differentiability of real -valued functions of a real variable, relation between continuity and differentiability. Idea of linearization with examples. Exercises based on these topics.

UNIT-II

Unit 2: Indeterminate forms, L'Hospital's Rule. Partial differentiation, Homogenous functions, Euler's theorem on homogeneous functions of two variables. Examples and exercises based on these topics.

UNIT-III

Unit 3: Concavity and points of inflection, Asymptotes, Double points, curve tracing in Cartesian coordinates. Examples and exercises based on these topics.

UNIT-IV

Unit 4: Polar Coordinates, Relation between Cartesian coordinates and Polar coordinates, angle between radius vector and tangent, angle of intersection of two curves. Graphic Techniques in Polar coordinates for the curves $r = a \pm b \sin\theta, r = a \pm b \cos\theta,\ r = a \cos n\theta,\ r = a \sin n\theta$ for $n = 1, 2, 3$ only. Examples and exercises based on these topics.

UNIT-V

Unit 5: Rolle's theorem and Langrage's mean value theorem with geometrical interpretations, Taylor's theorem with Lagrange's and Cauchy's form of remainder, Maclaurin's theorem. Examples and exercises based on these topics.

Textbook: Calculus and Analytic Geometry, by George B. Thomas, Jr. and Ross L. Finney, 9th Edition, Addison-Wesley Publishing Company, 1998/Pearson, India.

Reference Books:

1. Calculus and Analytic Geometry, by George B. Thomas, Jr. and Ross L. Finney, 9th Edition, Addison-Wesley Publishing Company, 1998/Pearson, India.

1. Calculus by Tom M. Apostol, Vol. 1, by Jhon-Wiley and sonsInc.

2. Differential Calculus, by Shanti Narayan and P. K. Mittal, S Chand and Co.

3. A first Course in Calculus, by S. Lang, Springer-Verlag

4. Calculus, by H. Anton, I Birens and S. Davis, John Wiley and Sons, Inc 2002

NOTE FOR PAPER SETTERS.

Internal Assessment

- **Internal assessment Test (Maximum Marks: 15; Time Duration: 1 hour)**
  Pattern for setting internal assessment test paper

The paper shall comprise of three sections

- Short answer questions – Attempt two questions of 2 marks each out of three questions.
- Medium answer question - Attempt two questions of 3 marks each out of 3 questions
- Long answer question - Attempt one question out of two questions 5 marks

The internal assessment test shall be from 40% (Units I and II) of the prescribed syllabus.

- **Attendance: 5 marks**

End Semester Examination

Maximum Marks: 80 Time Duration: 3 hours

The question paper for end semester examination will consist of three sections:

Section- A (15 marks)
Five short answer type questions of 3 marks each, one from each unit. All questions will be compulsory.

Section- B (35 marks)
Five medium answer type questions of 7 marks each, one from each unit. All questions will be compulsory.

Section- C 30 marks)

Five long answer type questions of 15 marks each, one from each unit. The candidate will have to attempt any two questions.

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SEMESTER I

SYLLABUS

(For examinations to be held in 2022, 2023 and 2024)

Title: Differential Calculus **Course Code: UMAMJP-101/ UMAMNP-101**

Course Type: Major/Minor (Projects/Seminars) **Credits: 02**

Internal Assessment: 25 Marks **End Semester Examination: 25 Marks**

Objectives: The main objective of this course it make students familiar with the preparation of projects and seminars on the topics allotted from the following topics of Differential Calculus and its applications.

1. History of Differential Calculus.

2. Optimization.

3. Intermediate theorem and Newton's Law.

4. Algebra of limits.

5. Limitations of L' Hospital' Rule.

6. Limits of functions of two variables.

7. Continuity of functions of two variables.

8. Directional Derivatives.

9. Linearization in two variables.

10. Maxima and minima of functions of two variables.

11. Learning about functions from derivatives.

12. Higher order derivatives and Leibnitz theorem.

13. Area in polar Coordinates.

14. Cauchy Mean Value theorem and its geometrical interpretation.

15. Maclaurin's series expansion of different functions.

Scheme of Evaluation

Maximum Marks: 50

I. Internal Assessment: 25 marks

Procedure for internal assessment shall be the same as is followed in other practical courses. 5 marks have been earmarked for attendance.

II. External End Semester Examination: 25 marks.

Procedure for external examination shall be the same as is followed in other practical Examinations.

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SEMESTER II

SYLLABUS

(For examinations to be held in 2022, 2023 and 2024)

Title: Integral Calculus and Differential Equations **Course No: UMAMJT-201/ UMAMNT-201**

Course Type: Major/Minor (Theory) **Credits: 04**

Internal Assessment: 20 Marks **End Semester Examination: 80 Marks**

Objectives: The objective of this course is to acquaint the students with applications of Differential Calculus and Integral Calculus to study the construction and solution of mathematical models in the form of differential equation.

Structure of the Course: This course is divided into five units of 12 class lectures (=12 hours) each, wherein one lecture is of one hour duration.

Learning Outcomes: Upon the successful completion of this course the students will be able to do the following:

- Integration of functions using reduction formulae.
- Problems on volumes of solids of revolutions, length of curves and areas of surfaces of revolutions.
- Solutions of linear and Bernoulli's differential equations.
- Differentiate between exact and non-exact differential equations and solution of such equations.
- Solution of first order and first degree differential equations solvable for x, y and z.
- Solution of Claiuraut's differential equations.
- Basic concepts of linear differential equations.
- Particular integrals of non-homogeneous linear differential equations with constant coefficients.
- Method of undetermined coefficients.
- Solution of linear differential equations with variable coefficients by method of reduction of order and method of variations of parameters.

- Solution of Cauchy-Euler differential equation.

Syllabus

Unit-I

Reduction formulae: $\int sin^n x\ dx$, $\int cos^n x\ dx$, $\int tan^n x\ dx$, $\int sec^n x\ dx$, $\int cosec^n x\ dx$, $\int cot^n x\ dx$, $\int sin^n x\ cos^m x\ dx$, $\int (log x)^n\ dx$. Volumes of solids of revolution along x-axis and y-axis, length of plane curves, areas of surfaces of revolution.

Unit-II

Review of differential equations, linear differential equations and Bernoulli equations, exact and non-exact differential equations, rules to find the integrating factors of non-exact differential equations. Examples and exercises based on these topics.

Unit-III

First order and higher degree differential equations solvable for p, x, and y, Clairaut's equations.

Basic theory of linear differential equations: Linearly dependent and linearly independent functions, Wronskian and its properties. Examples and exercises based on these topics.

UNIT-IV

Linear differential equations of second and third order with constant coefficients of the type F(D)y = Q(x), where Q(x) = 0, e^{ax}, $cosax$, $sinax$, x^n their sum and product in pairs. Solving a non-homogeneous linear differential equation with constant coefficients by the method of undetermined coefficients. Examples and exercises based on these topics.

Unit-V

Solution of homogeneous linear differential equations with variable coefficients and non-homogeneous linear differential equations with constant coefficients by reduction of order method. Non-homogeneous linear differential equations with variable coefficients: the method of variation of parameters, the Cauchy-Euler equation. Examples, problems and exercises based on these topics.

Textbooks:

For Unit-I: Calculus and Analytic Geometry, by George B. Thomas, Jr. and Ross L. Finney, 9th Edition, Addison-Wesley Publishing Company, 1998/Pearson, India.

For Units-II, III, IV and V: Differential Equations, by Shepley L. Ross, 3rd Edition, John Willy and Sons, 1984.

Reference Books:

1. Integral Calculus, by Shanti Narayan and P. K. Mittal, S. Chand.
2. Schaum's Outline of Theory and Problems of Differential Equations, by Frank Ayres Jr, McGraw-Hill Book Company, Singapore.
3. Elements of Partial Differential Equations, by I. Sneddon, McGraw-Hill International Edition, 1967.
4. An Introduction to Ordinary Differential Equations, by Earl A. Coddington, PHI Learning Private Limited, New Delhi, 2009.
5. Differential Equations with Applications and Historical Notes, by George F. Simmons, McGraw Hill Education; 2nd edition, 2017.
6. Ordinary and Partial Differential Equations, by M. D. Raisinghania, S. Chand and Co., New Delhi, 2005.

NOTE FOR PAPER SETTERS.

Internal Assessment

- **Internal assessment Test (Maximum Marks: 15; Time Duration: 1 hour)**
  Pattern for setting internal assessment test paper

The paper shall comprise of three sections

- Short answer questions – Attempt two questions of 2 marks each out of three questions.
- Medium answer question - Attempt two questions of 3 marks each out of 3 questions
- Long answer question - Attempt one question out of two questions 5 marks

The internal assessment test shall be from 40% (Units I and II) of the prescribed syllabus.

- **Attendance: 5 marks**

End Semester Examination

Maximum Marks: 80 Time Duration: 3 hours

The question paper for end semester examination will consist of three sections:

Section- A (15 marks)
Five short answer type questions of 3 marks each, one from each unit. All questions will be compulsory.

Section- B (35 marks)
Five medium answer type questions of 7 marks each, one from each unit. All questions will be compulsory.

Section- C 30 marks)

Five long answer type questions of 15 marks each, one from each unit. The candidate will have to attempt any two questions.

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MATHEMATICS AS MAJOR/MINOR SUBJECT

SEMESTER II

SYLLABUS

(For examinations to be held in 2022, 2023 and 2024)

Title: Integral Calculus and Differential Equations Course No: UMAMJP-201/ UMAMNP-201
Course Type: Major/Minor (Projects/Seminars) Credits: 02

Internal Assessment: 25 Marks End Semester Examination: 25 Marks

Objectives: The main objective of this course it make students familiar with the preparation of projects and seminars on the topics allotted from the following topics of Integral Calculus and Differential Equations.

1. History of Integral Calculus.

2. Integration of Irrational functions.

3. Area between two curves.

4. Length of curves in polar coordinates.

5. History of Differential Equations.

6. Modelling with Differential Equations:

   (i) Initial Value Problems

   (ii) Growth and Decay

   (iii) Newton's law of cooling.

   (iv) Pharmacology.

   (v) Spread of disease.

7. Applications of differential equations in Coordinate Geometry.

8. Differential equations reducible to Clairaut's form.

9. Linearly independence and linearly dependence.

10. Existence and uniqueness theorems on solutions of second order linear differential equations.

11. Legendre's linear differential equation.

Scheme of Evaluation

I. Internal Assessment: 25 marks

Procedure for internal assessment shall be the same as is followed in other practical courses. 5 marks have been earmarked for attendance.

II. External End Semester Examination: 25 marks.

Procedure for external examination shall be the same as is followed in other practical Examinations.

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MULTI-DISCIPLINARY COURSE

IN

MATHEMATICS

SYLLABUS

(For examinations to be held in 2022, 2023 and 2024)

Title: Elementary Mathematics **Course Code: UMAMDT-101/201/301**

Course Type: Multi-disciplinary (Theory) **Credits: 03**

Internal Assessment: 15 Marks **End Semester Examination: 60 Marks**

Objectives: The objective of the course is to introduce the students to the language of mathematics- the language to know the nature and to evolve the critical thinking.

Structure of the Course: This course is divided into four units of 12 class lectures (=12 hours) each, wherein one lecture is of one hour duration.

Learning Outcomes: Upon the successful completion of this course the students will be able to do the following:

- Construction of truth tables of negation, conjunction, disjunction, implications and bi-conditional statements.
- Negation, converse, contrapositive and inverse of statements
- Concepts of logical equivalences, tautology and contradiction.
- Representation of sets and types of sets.
- Problems on set operations and properties of set operations.
- Problems on counting principle.
- Formulae and exercises on general term, sum to n-terms of A. P. and G. P.
- Concept of A. M. and G. M. and relation between them.
- Solution of system of linear inequalities in two variables graphically.
- Formation and graphical solution of linear programming problems.

Syllabus

Unit-I

Propositions, truth values and truth tables, negation, conjunction and disjunction, implications, bi-conditional propositions, converse, contrapositive and inverse propositions, propositional equivalence: logical equivalences, predicates and quantifiers, tautology and contradiction. Examples and exercises based on these topics.

Unit-II

Sets, representation of a set, empty set, finite sets, infinite sets, equal sets, equivalent sets, subsets, power set, universal set, Venn diagrams. Set operations: Union and intersection of sets, difference and symmetric difference of two sets, complement of a set. Properties of operations on sets: Commutative laws, associative laws, distributive laws, DeMorgan's laws, complement laws, involution law and their proofs using Venn diagrams. Counting principle and its applications. Examples and exercises based on these topics.

Unit-III

Sequences and Series. Arithmetic Progression (A. P.), general term of an A. P., sum to n-terms of an A. P, Arithmetic Mean (A. M). Geometric Progression (G. P), general term of a G. P, sum to n-terms of a G. P., infinite G. P. and its sum. Geometric Mean (G. M.), relation between A. M. and G. M. Examples and exercises based on these topics.

Unit-IV

Graphical solution of system of linear inequalities in two variables. Linear Programming: Introduction, related terminology such as constraints, objective function, optimization, different types of linear programming problems, mathematical formulation of linear programming problems, graphical method of solution for problems in two variables, feasible and infeasible regions, feasible and infeasible solutions, optimal feasible solutions (up to three non-trivial constraints).

Textbook: Pure Mathematics for Beginners, by Steve Warner, Get 800 LLC, 2018.

Reference Books:

1. Elementary Number Theory, by David M. Burton, McGraw Hill Education, 2017.
2. Naïve Set Theory, by Paul R. Halmos, Springer, 1998.
3. Mathematics NCERT Textbook for Class XI, 2019.
4. Mathematics NCERT Textbook for Class XII, 2019.
5. The Joy of Sets: Fundamentals of Contemporary Set Theory. Undergraduate Texts in Mathematics, by K. Devlin, 2nd Edition, New York: Springer, 1993

NOTE FOR PAPER SETTERS.

Internal Assessment

- **Internal assessment Test (Maximum Marks: 10; Time Duration: 45 minutes)**

Pattern for setting internal assessment test paper

The paper shall comprise of three sections

a) Short answer questions – Attempt two questions of 1 mark each out of three questions.
b) Medium answer question - Attempt two questions of 2 marks each out of 3 questions.
c) Long answer question - Attempt one question out of two questions each of 4 marks

The internal assessment test shall be from 50% (Units I and II) of the prescribed syllabus.

- **Attendance: 5 marks**

End Semester Examination

Maximum Marks: 60 Time Duration: 2.5 hours

The question paper for end semester examination will consist of three sections:

Section- A (12 marks)
Four short answer type questions of 3 marks each, one from each unit. All questions will be compulsory.

Section- B (24 marks)
Four medium answer type questions of 6 marks each, one from each unit. All questions will be compulsory.

Section- C (24 marks)

Four long answer type questions of 12 marks each, one from each unit. The candidate will have to attempt any two questions.