"Education for Knowledge, Science and Culture"

-Shikshanmaharshi Dr. Bapuji Salunkhe

Shri Swami Vivekanand Shikshan Sanstha's

VIVEKANAND COLLEGE (AUTONOMOUS), KOLHAPUR.

B. Sc. Part – I CBCS Syllabus with effect from June, 2018

MATHEMATICS-DSC -1003 A

Semester: I Mathematics-Paper- I

DIFFERENTIAL CALCULUS-I

Theory: 60 Hours -Credits -04

Section-I

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SECTION-I DIFFERENTIAL CALCULUS-I

UNIT –1: Higher order Derivatives **15 lectures**

1.1 Successive Differentiation

1.1.1 n^{th} order derivative of standard functions:

$y=(ax+b)^m$, $y=e^{ax}$, $y=a^{mx}$, $y=1/(ax+b)$, $y=\log(ax+b)$

1.1.2 $y=\sin(ax+b)$, $y=\cos(ax+b)$, $y=e^{ax}\sin(bx+c)$, $y=e^{ax}\cos(bx+c)$

1.1.3 Examples on n^{th} order derivatives

1.2 Leibnitz’s theorem

1.3 Partial differentiation, Chain rule (without proof) and its examples.

1.4 Euler’s theorem on homogenous functions.

1.5 Maxima and Minima for functions of two variables.

1.6 Lagrange’s method of undetermined multipliers.

UNIT 2 : Tracing of Curves and Its Rectification **15 lectures**

2.1 Introduction.

2.2.Definition of Terms: Tangents, Normals, Curvature, Asymptotes, Singular Points.

2.3 Procedure for tracing of curve given in Cartesian form.

2.4 Comman Curves

2.5 Some well known curves

2.6 Parametric representation of curves and tracing of parametric curves

2.7 Polar representation of curves and tracing of polar curves

2.8. Rectification of the curves

2.8.1 Length of the arc of a curve given by $y=f(x)$

2.8.2 Length of the arc of the curve given by $r=f(\theta)$

SECTION-II DIFFERENTIAL CALCULUS-II

UNIT 1 : Mean Value Theorem and Indeterminate Forms **15 Lectures**

3.1 Rolle's Theorem
3.2 Geometrical interpretation of Rolle's Theorem.
3.3 Examples on Rolle's Theorem
3.4 Lagrange's Mean Value Theorem (L.M.V.T.)
3.5 Geometrical interpretation of L.M.V.T.
3.6 Examples on L.M.V.T.
3.7 Cauchy's Mean Value Theorem (C.M.V.T.)
3.8 Examples on C.M.V.T.
3.9 Taylor's Theorem with Lagrange's and Cauchy's form of remainder
3.10 Maclaurin's Theorem with Lagrange's and Cauchy's form of remainder
3.11 Maclaurin's series for sin x, cos x, e^x, log (1+x), $(1+x)^m$.
3.12 Examples on Maclaurin's series
3.13 Examples on maxima and minima of function
3.14 Indeterminate Forms
    3.14.1 L'Hospital Rule,
    3.14.2 Indeterminate Forms $\frac{0}{0}, \frac{\infty}{\infty}$ and Examples.
    3.13.3 Indeterminate Forms $0 \times \infty$, $\infty - \infty$ and Examples.
    3.13.4 Indeterminate Forms 0^∞ , ∞^∞ , 1^∞ and Examples.

UNIT 2: - Limits and Continuity of real valued functions **15 Lectures**

4.1 $\in$ - δ definition of the limit of a function of one variable,
    Left hand side limits and Right hand side limits .
4.2 Theorems on Limits (Statements only)
4.3 Continuous Functions and their properties
4.3.1 If f and g are two real valued functions of a real variables which are continuous at x = c then
    (i) f + g (ii) f – g (iii) f.g are continuous at x = c. and
    (iv) f/g is continuous at x = c , $g(c) \neq 0$.
4.3.2 Composite function of two continuous functions is continuous.
4.4 Classification of discontinuities (First and second kind).
4.4.1 simple discontinuities
    (i) Removable discontinuity
    (ii) Jump discontinuity of first kind
    (iii) Jump discontinuity of second kind
4.5 Differentiability at a point, Left hand derivative, Right hand derivative, Differentiability in the interval [a,b].
4.6 Theorem: Continuity is a necessary but not a sufficient condition for the existence of a derivative.
4.7 1. If a function f is continuous in a closed interval [a, b] then it is bounded in [a, b].

2. If a function f is continuous in a closed interval [a, b] then it attains its bounds at least once in [a, b].
3. If a function f is continuous in a closed interval [a, b] and if f(a), f(b) are of opposite signs then there exists $c \in [a, b]$ such that $f(c) = 0$.
4. If a function f is continuous in a closed interval [a, b] and if $f(a) \neq f(b)$ then f assumes every value between f(a) and f(b).

Recommended Book:

(1) H. Anton, I. Birens and Davis, Calculus, John Wiley and Sons, Inc.2002.

(2) G. B. Thomas and R. L. Finney, Calculus and Analytical Geometry, Pearson Education, 2007.

(3) Maity and Ghosh, Differential Calculus, New Central Book Agency (P) limited, Kolkata,India. 2007.

Reference Books:

(1) Shanti Narayana and P. K. Mittal, **A Course of mathematical Analysis**, S. Chand and Company, New Delhi. 2004.

(2) S. C . Malik and Savita arora, **Mathematical Analysis (second Edition)**, New Age International Pvt. Ltd., New Delhi, Pune, Chennai.

MATHEMATICS-DSC -1003 B
Semester: II Mathematics Paper- II
DIFFERENTIAL EQUATIONS
Theory: 60 Hours-(75 Lectures) -Credits -04

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SECTION-I : DIFFERENTIAL EQUATIONS-I

Unit 01: Differential Equations of First Order and First Degree: 8 Lectures

1.1: Exact Differential Equations:

1.1.1: Necessary and Sufficient condition for exactness.

1.1.2: Working Rule for solving an Exact Differential Equation.

1.1.3: Integrating Factors:

1.1.4: Integrating Factor by Inspection and examples.

1.1.5: Integrating Factor by using Rules (Without Proof) and examples.

1.2: Linear Differential Equations: Definition, Method of Solution and Examples.

1.3: Bernoulli's Equation: Definition, Method of Solution and Examples.

Unit 02: Differential Equations of First Order But Not of First Degree: 7 Lectures

2.1: Introduction.

2.2: Equations solvable for p: Method and Problems.

2.3: Equations solvable for x: Method and Problems.

2.4: Equations solvable for y: Method and Problems.

2.5: Clairaut's Form: Method and Problems.

2.6: Equations Reducible to Clairaut's Form.

Unit 03: Linear Differential Equations With Constant Coefficients: f(D)y =X 8 Lectures

3.1: Introduction.

3.2: General Solution.

3.3: Determination of Complementary Function.

3.4: The Symbolic Function 1/f(D):Definition., Theorems about 'D'

3.5: Determination of Particular Integral.

3.5.1: General Method of Getting P.I.

3.5.2: Short Methods of Finding P.I. when X is in the form e^{ax}, sin ax , cos ax , x^m(m being a Positive Integer), e^{ax}V , x V where V is a function of x.

3.6: Examples.

Unit 04: Homogeneous Linear Differential Equations (The Cauchy-Euler Equations): 7L

4.1: Introduction.

4.2: Method of Solution.

4.3: Legendre's Linear Equations.

4.4: Method of Solution of Legendre's Linear Equations.

4.5: Examples

Section II-Differential Equations-II

Unit 05: Second Order Linear Differential Equations: 8 Lectures

5.1: The General Form.

5.2: Complete Solution when one Integral is known: Method and Examples.

5. 3 : Transformation of the Equation by changing the dependent variable(Removal of First order Derivative).

5. 4: Transformation of the Equation by changing the independent variable.

5.5: Method of Variation of Parameters.

5.6 Examples.

Unit 06: Ordinary Simultaneous Differential Equations and Total Differential Equations: 8 Lectures

6.1: Simultaneous Linear Differential Equations of the Form $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$.

6.2: Methods of Solving simultaneous Linear Differential Equations.

6.3: Total (or Pfaffian) differential equations Pdx + Qdy + Rdz = 0

6.4: Neccessary condition for Integrability of total differential equation

6.5: The condition for exactness.

6.6: Methods of solving total differential equations :

a) Method of Inspection

b) One variable regarding as a constant

6.7: Geometrical Interpretation of Ordinary Simultaneous Differential Equations

6.8: Geometrical Interpretation of Total Differential Equations

6.9: Geometrical Relation between Total Differential equations and Simultaneous differential equations

Unit 7: Partial Differential Equations 6 Lectures

7.1: Introduction

7.2: Order and Degree of Partial Differential Equations

7.3 Linear and non-linear Partial Differential Equations

7.4: Classification of first order Partial Differential Equations

7.5: Formation of Partial Differential Equations by the elimination of arbitrary constants

7.6: Formation of Partial Differential Equations by the elimination of arbitrary functions Ø from the equation Ø(u,v) = 0 where u and v are functions of x, y and z.

7.7: Examples :

Unit 8. First order Partial Differential Equations

8.1: First Order Linear Partial Differential Equations

8.1.1: Lagrange's equations Pp + Qq = R

8.1.2: Lagrange's methods of solving Pp + Qq = R

8.1.3: Examples

8.2: First Order Non-linear Partial Differential Equations 8 Lectures

8.2.1: Complete integral, particular integral, singular integral and General integral

8.2.2: Method of getting singular integral directly from the partial differential equation of first order

8.2.3: Charpit's method

8.2.4: Examples

8.3: Special methods f solutions applicable to certain standard forms

8.3.1: Only p and q present
8.3.2: Clairaut’s equations
8.3.3: Only p, q and z present
8.3.4: $f(x,p) = g(y,q)$
8.3.5: Examples

Recommended Book:

(1) M. D. Raisinghania, Ordinary and Partial Differential Equations, Eighteenth Revised edition 2016; S. Chand and Company Pvt. Ltd. New Delhi
(2) Shepley L. Ross, Differential Equations, Third Edition 1984; John Wiley and Sons, New York
(3) Ian Sneddon, Elements of Partial Differential Equations, Seventeenth Edition, 1982; Mcgraw-Hill International Book Company, Auckland

Reference Books:

(1) R. K. Ghosh and K. C, Maity, An Introduction to Differential Equations, Seventh Edition, 2000; Book and Allied (P) Ltd
(2) D. A. Murray, Introductory course in Differential Equations, Khosala Publishing House, Delhi.

COMPUTATIONAL MATHEMATICS LAB (I)DSC-1003A(PR)
DSC 3A: DIFFERENTIAL CALCULUS
60 Hours (75 Lectures) credits 2

1) Examples on Leibnitz's theorem
2) Examples on Euler's theorem
3) Applications of De Moivre's Theorem
4) Tracing of curves in Cartesian form
5) Polar coordinates and tracing of curves in polar form
6) Radius of curvature for Cartesian curve i.e. For $y = f(x)$ or $x = f(y)$.
7) Radius of curvature for Parametric curve (i. e. $x = f(t)$, $y = g(t)$) and radius of curvature for polar curve (i.e. $r = f(\theta)$)
8) Examples on Lagrange's Mean Value theorem
9) Examples on Cauchy's Mean Value theorem
10) L'Hospital Rule: $\frac{0}{0}, \frac{\infty}{\infty}, \infty-\infty, 0^{\infty}, 1^{\infty}, \infty^{\infty}$.

COMPUTATIONAL MATHEMATICS LAB (II)
DSC 3B: DIFFERENTIAL EQUATIONS
60 Hours (75 Lectures) credits 2

11) Orthogonal trajectories (Cartesian)
12) Orthogonal trajectories (Polar)
13) Simultaneous Differential Equations
14) Total differential Equations
15) Examples on Linear Differential Equations with Constant Coefficients
16) Examples on Exact Differential Equations
17) Examples on Charpit's method.
18) Examples on Clairaut' s Forms.
19) Plotting family of solutions of second order differential equations
20) Plotting of Curves.

Structure of B. Sc. I (Semester I&II) (Mathematics)

B. Sc. I	Subject (Core Course)	No. of Lect.	Hours	Credit
Semester-I	MATHEMATICS-DSC 1003A : DIFFERENTIAL CALCULUS	5	4	4
	MATHEMATICS LAB(I): DSC 1003(PR) : DIFFERENTIAL CALCULUS	4	3.2	2
Semester-II	MATHEMATICS -DSC 1003B: DIFFERENTIAL EQUATIONS	5	4	4
	MATHEMATICS LAB(II)- DSC 1003B(PR): DIFFERENTIAL EQUATIONS	4	3.2	2

Nature of Question Paper

Instructions: *1) All the questions are **compulsory**.*

*2) Answers to the two sections should be written in **same** answer book.*

*3) Figures to the right indicate **full** marks.*

*4) Draw neat labeled diagrams **wherever** necessary.*

5) Use of log table/calculator is allowed.

Time : 3 hours **Total Marks: 80**

SECTION-I

Q.1. Choose correct alternative. **8**

i)

A) B) C) D)

ii)

A) B) C) D)

iii)

A) B) C) D)

iv)

A) B) C) D)

v)

A) B) C) D)

vi)

A) B) C) D)

vii)

A) B) C) D)

viii)

A) B) C) D)

Q.2. Attempt any two. **16** A)

B)

C)

Q.3. Attempt any four. **16**

a)

b)

c)

d)

e)

f)

SECTION-II

Q.4. Choose correct alternative. **8**

i)

A) B) C) D)

ii)

A) B) C) D)

iii)

A) B) C) D)

iv)

A) B) C) D)

v)

A) B) C) D)

vi)

A) B) C) D)

vii)

A) B) C) D)

viii)

A) B) C) D)

Q.5. Attempt any two. **16** A)

B)

C)

Q.6. Attempt any four. **16**

a)

b)

c)

d)

e)

f)

SCHEME OF MARKING (THEROY)

Sem.	DSC	Marks	Evaluation	Sections	Answer	Standard

					Books	of passing
I	DSC1003 A	80	Semester wise	Two sections each of 40 marks	As per Instruction	35% (28 marks)
II	DSC1003 B	80	Semester wise	Two sections each of 40 marks	As per Instruction	35% (28marks)

SCHEME OF MARKING (CIE) Continuous Internal Evaluation

Sem.	DSC	Marks	Evaluation	Sections	Answer Books	Standard of passing
I	DSC1003 A	20	Concurrent	-	As per Instruction	35% (7 marks)
II	DSC1003 B	20	Concurrent	-	As per Instruction	35% (7 marks)

SCHEME OF MARKING (PRACTICAL)

Sem.	DSC	Marks	Evaluation	Sections	Standard of passing
I AND II	DSC1003 A (pr) DSC1003 A (pr)	50	Annual	As per Instruction	35% (18 marks)

*A separate passing is mandatory