SHIVAJI UNIVERSITY, KOLHAPUR

CBCS SYLLABUS WITH EFFECT FROM JUNE 2018

B. Sc. Part – I Semester – I

SUBJECT: MATHEMATICS

DSC – 5A (DIFFERENTIAL CALCULUS)

Theory: 32 hrs. (40 lectures of 48 minutes)

Marks-50 (**Credits: 02)**

Unit – 1:- Hyperbolic Functions (15 hrs.)

1.1 De- Moivre's Theorem. Examples.

1.2 Applications of De- Moivre's Theorem , n^{th} roots of unity

1.3 Hyperbolic functions. Properties of hyperbolic functions.

1.4 Differentiation of hyperbolic functions

1.5 Inverse hyperbolic functions and their derivatives. Examples

1.6 Relations between hyperbolic and circular functions.

1.7 Representation of curves in Parametric and Polar co-ordinates.

Unit – 2: - Higher Order Derivatives (15 hrs.)

2.1 Successive Differentiation

n^{th} order derivative of standard functions: $(ax+b)^m$, e^{ax}, a^{mx}, $1/(ax+b)$, $\sin(ax+b)$, $\cos(ax+b)$, $e^{ax}\sin(ax+b)$, $e^{ax}\cos(ax+b)$.

2.2 Leibnitz's Theorem (with proof).

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

2.4 Euler's theorem on homogenous functions.

2.5 Maxima and Minima for functions of two variables.

2.6 Lagrange's Method of undetermined multipliers.

Recommended Books:

(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 – 6A (CALCULUS)

Theory: 32 hrs. (40 lectures of 48 minutes)

Marks- 50 (**Credits: 02)**

Unit – 1: - Mean Value Theorems and Indeterminate Forms (16 hrs.)

1.1 Rolle's Theorem

1.2 Geometrical interpretation of Rolle's Theorem.

1.3 Examples on Rolle's Theorem

1.4 Lagrange's Mean Value Theorem (LMVT)

1.5 Geometrical interpretation of LMVT.

1.6 Examples on LMVT

1.7 Cauchy's Mean Value Theorem (CMVT)

1.8 Examples on CMVT

1.9 Taylor’s Theorem with Lagrange’s and Cauchy’s form of remainder (without proof)

1.10 Maclarin’s Theorem with Lagrange’s and Cauchy’s form of remainder (without proof)

1.11 Maclarin’s series for sin x, cos x, e^x, log (1+x), $(1+x)^m$.

1.12 Examples on Maclarin’s series

1.13 Indeterminate Forms

1.14 L’Hospital Rule, the form $\frac{0}{0}$, $\frac{\infty}{\infty}$, and Examples.

1.15 L’Hospital Rule, the form $0 \times \infty$, $\infty - \infty$. and Examples.

1.16 L’Hospital Rule, the form 0^0 , ∞^0 , 1^∞ . and Examples.

Unit 2: - Limits and Continuity of Real Valued Functions (16 hrs.)

2.1 $\in$ - δ definition of limit of function of one variable, Left hand side limits and Right hand side limits .

2.2 Theorems on Limits (Statements Only)

2.3 Continuous Functions and Their Properties

2.3.1 If f and g are two real valued functions of a real variable 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.

2.3.2 Composite function of two continuous functions is continuous.

2.4 Classification of discontinuities (First and second kind).

2.4.1Types of Discontinuities :(i) Removable discontinuity(ii) Jump discontinuity of first kind (iii) Jump discontinuity of second kind

2.5 Differentiability at a point, Left hand derivative, Right hand derivative, Differentiability in the interval [a,b].

2.6 Theorem: Continuity is necessary but not a sufficient condition for the existence of a derivative.

2.7.1. If a function f is continuous in a closed interval [a, b] then it is bounded in [a, b].

2.7.2. If a function f is continuous in a closed interval [a, b] then it attains its bounds at least once in [a, b].

2.7.3. 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 $f(c) = 0$. (Statement Only)

2.7.4. 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). (Statement Only)

Recommended Books:

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

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

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

Reference Books:

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

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

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CBCS SYLLABUS WITH EFFECT FROM JUNE 2018

B. Sc. Part – I Semester – II

SUBJECT: MATHEMATICS

DSC – 5B (DIFFERENTIAL EQUATIONS)

Theory: 32 hrs. (40 lectures of 48 minutes)

Marks -50 (**Credits: 02)**

Unit 1: Differential Equations of First Order (16 hrs.)

1.1: Differential Equations of First Order and First Degree.

1.1.1: Exact Differential Equations.

1.1.2: Necessary and Sufficient condition for exactness.

1.1.3: Working Rule for solving an Exact Differential Equation.

1.1.4: Integrating Factor.

1.1.5: Integrating Factor by Inspection and examples.

1.1.6: Integrating Factor by using Rules (Without Proof) and Examples.

1.1.7: Linear Differential Equations: Definition, Method of Solution and examples.
1.1.8: Bernoulli’s Equation: Definition, Method of Solution and Examples.

1.2: Differential Equations of First Order but Not of First Degree:

1.2.1: Introduction.

1.2.2: Equations solvable for p: Method and Problems.

1.2.3: Equations solvable for x: Method and Problems.

1.2.4: Equations solvable for y: Method and Problems.

1.2.5: Clairaut’s Form: Method and Problems.

1.2.6: Equations Reducible to Clairaut’s Form.

Unit 2: Linear Differential Equations (16 hrs.)

2.1: Linear Differential Equations with Constant Cofficients

2.1.1: Introduction and General Solution.

2.1.2: Determination of Complementary Function

2.1.3: The Symbolic Function 1/f(D):Definition.

2.1.4: Determination of Particular Integral.

2.1.5: General Method of Particular Integral.

2.1.6: Theorem: $\frac{1}{(D-a)^n} e^{ax} = \frac{x^n}{n!} e^{ax}$, where n is a positive integer.

2.1.7: 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.

2.1.8: Examples.

2.2: Homogeneous Linear Differential Equations (The Cauchy-Euler Equations)

2.2.1: Introduction and Method of Solution.

2.2.2: Legendre’s Linear Equations.

2.2.3: Method of Solution of Legendre’s Linear Equations.

2.2.4: Examples.

Recommended Books:

(1) M. D. Raisinghania, Ordinary and Partial Differential Equations, Eighteenth Revised Eition 2016; S. Chand and Company Pvt. Ltd. New Delhi

(2) Shepley L. Ross, Differential Equations, Third Edition 1984; John Wiley and Sons, New York

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.

Mathematics - DSC – 6B (HIGHER ORDER ORDINARY DIFFERENTIAL EQUATIONS AND PARTIAL DIFFERENTIAL EQUATIONS)

Theory: 32 hrs. (40 lectures of 48 minutes)

Marks -50 (**Credits: 02)**

Unit 1: Second Order Linear Differential Equations and Simultaneous Differential Equations (16 hrs.)

1.1: Second Order Linear Differential Equations

1.1.1: The General Form.

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

1.1.3: Transformation of the Equation by changing the dependent variable

(Removal of First order Derivative).

1.1.4: Transformation of the Equation by changing the independent variable.

1.1.5: Method of Variation of Parameters.

1.1.6: Examples.

1.2 Ordinary Simultaneous Differential Equations and Total Differential Equations

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

1.2.2: Methods of Solving Simultaneous Linear Differential Equations.

1.2.3: Total differential equations Pdx + Qdy + Rdz = 0

1.2.4: Neccessary condition for Integrability of total differential equation

1.2.5: The condition for exactness.

1.2.6: Methods of solving total differential equations:

a) Method of Inspection

b) One variable regarding as a constant

1.2.7: Geometrical Interpretation of Ordinary Simultaneous Differential Equations

1.2.8: Geometrical Interpretation of Total Differential Equations

1.2.9: Geometrical Relation between Total Differential equations and Simultaneous differential Equations.

Unit 2 : Partial Differential Equations (16 hrs.)

2.1: Partial Differential Equations

2.1.1: Introduction

2.1.2: Order and Degree of Partial Differential Equations

2.1.3: Linear and non-linear Partial Differential Equations

2.1.4: Classification of first order Partial Differential Equations

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

2.1.6: 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.

2.1.7: Examples.

2.2: First Order Partial Differential Equations

2.2.1: First Order Linear Partial Differential Equations

2.2.2: Lagrange's equations $Pp + Qq = R$

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

2.2.4: Examples

2.3: Charpit's method

2.3.1: Special methods of solutions applicable to certain standard forms

2.3.2: Only p and q present

2.3.3: Clairaut's equations

2.3.4: Only p, q and z present

2.3.5: $f(x,p) = g(y,q)$

2.3.6: Examples

Recommended Books:

(1) M. D. Raisinghania, Ordinary and Partial Differential Equations, Eighteenth Revised Eition 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; Mc-Graw-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.

Core Course Practical in Mathematics I (CCPM - I)

Marks 50 (Credit 4)

1) Examples on Leibnitz's theorem
2) Examples on Euler's theorem
3) Applications of De Moivre's Theorem
4) Maxima and Minima of functions of two variables
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: $\frac{0}{0}$, $\frac{\infty}{\infty}$, 0^{∞}, 1^{∞}, ∞^{∞} .

11) Examples on differentiability

12) Orthogonal trajectories (Cartesian, 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.(Using software)

20) Plotting of Curves. .(Using software)