

# The Partidar Gin Science College, Bardoli Co-Po

## Bachelor of Science (Mathematics)

Program Outcome	<p><b>PO1 : Fundamental Knowledge Enrichment</b></p> <p>Program trains students with the core Mathematics knowledge domains. It also makes students capable of using core concepts in the conceptualization of domain specific application.</p> <p><b>PO2 : Critical Thinking Development</b></p> <p>The program develops the skills of critical thinking, problem solving, evaluative learning of various techniques, and understanding the essence of the problem.</p> <p><b>PO3 : Develop arguments in a logical manner</b></p> <p>The program trains students to formulate and develop arguments in a logical manner and make them ready to prepare real world problem solution mathematically.</p> <p><b>PO4 : Develop decision making ability</b></p> <p>The program develop the skill in students to take decisions at intellectual, organizational and personal from different perspectives of life using analysis</p> <p><b>PO5 : Computational Skill Development</b></p> <p>The program develop basic computational skill in students for planning and managing process of complex real world.</p> <p><b>PO6 : Provides an effective Mathematical communication skill</b></p> <p>The program develop an effective Mathematical communication skill in the students.</p> <p><b>PO7 : Team Work and Leadership Development</b></p> <p>Trains students to work in a team and also to take leadership.</p>
Program Specific Outcomes	<p><b>PSO1 : Develop and strengthen the fundamental core concepts that are required to solve complex problems</b></p> <p><b>PSO2 : Develop the skills that needs independent logical and analytical thinking, teamwork and leadership</b></p> <p><b>PSO3 : Nurture the students to investigate and development of a workable solution for a real world problem</b></p> <p><b>PSO4 : Develop students for self-learning and practicing challenging</b></p>

	<p>problem solution</p> <p>PSO5 : Train students to apply mathematical skills for new investigation.</p> <p>PSO6 : Train students to expand their knowledge of fields related to their current areas of professional specialization.</p> <p>PSO7 : Train students to take-up the real world challenges to develop workable solution to a domain specific problem.</p> <p>PSO8 : Inculcate the passion for continuous learning and doing research for making a successful professional career.</p>								
Mapping between POs and PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	PO1								
	PO2								
	PO3								
	PO4								
	PO5								
	PO6								
	PO7								

### B.Sc. Mathematics 1<sup>st</sup> Semester

#### Course: MTH-101: [Mathematics-I](#)

Course Outcomes	<p>This course will enable the students to:</p> <p>CO1 : Explain the insight of the fundamental aspects of the Trigonometry .</p> <p>CO2 : Assimilate the De' Moivre's theorem and its applications, Trigonometric functions for multiple arguments.</p> <p>CO3 : Calculate the Indeterminate forms by using Euler's expressions, Hyperbolic functions..</p> <p>CO4 : Understand the Logarithm of complex quantities, Separations of Logarithmic, Inverse circular and Inverse hyperbolic functions into real and imaginary parts.</p> <p>CO5 : Sketch curves in Trigonometric and hyperbolic functions.</p> <p>CO6 : Apply Trigonometry in social sciences, physical sciences, life sciences and a host of other disciplines</p>								
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
	CO3								
	CO4								

	CO5								
	CO6								

B.Sc.Mathematics 1<sup>st</sup> Semester

Course: MTH-102: **Mathematics-II**

Course Code	MTH-102								
Course Title	Mathematics-2								
Credit	3								
Teaching per Week	3 Hrs								
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)								
Effective From	June 2020								
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts calculus of and learn its applications.								
Course Objective	To make students acquainted with concepts of calculus.								
Course <b>Outcomes</b>	<p>This course will enable the students to</p> <p>CO1 : Explain the insight of the historical and fundamental aspects the Calculus.</p> <p>CO2 : Assimilate the Successive differentiation, Leibnitz theorem and its applications</p> <p>CO3 : Understand the consequences of various mean value theorems for differentiable functions , Asymptotes, Concavity, Convexity and reduction function.</p> <p>CO4 : Calculate the Curvature and radius of curvature.</p> <p>CO5 : Apply concept of Increasing and Decreasing functions, Asymptotes, Concavity and Convexity</p> <p>CO6 : Apply calculus in social sciences, physical sciences, life sciences and a host of other disciplines</p>								
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
	CO3								
	CO4								
	CO5								
	CO6								

## B.Sc. Mathematics 2<sup>nd</sup> Semester

### Course: MTH-201: **Mathematics-III**

Course Code	MTH-201								
Course Title	Mathematics-III								
Credit	3								
Teaching per Week	3 Hrs								
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)								
Effective From	June 2020								
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the theory of matrices with its applications.								
Course Objective	To make students acquainted with concepts of Theory of matrices.								
Course Outcomes	<p>This course will enable the students to:</p> <p>CO1 : Explain the insight of fundamental aspects the theory of matrices.</p> <p>CO2 : Understand the genesis of theory of matrices..</p> <p>CO3 : Learn elementary row operations, rank theory and matrix properties.</p> <p>CO4 : Find eigen values and corresponding eigenvectors for a square matrix.</p> <p>CO5 : Calculate solution of linear system of equation.</p> <p>CO6 : Apply matrix theory in social sciences, physical sciences, life sciences and a host of other disciplines.</p>								
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
	CO3								
	CO4								
	CO5								
	CO6								

## B.Sc. Mathematics 2<sup>nd</sup> Semester

Course: MTH-202: [Mathematics-IV](#)

Course Outcomes	<p>The course will enable the students to:</p> <p>CO1 : Understand the genesis of Integral Calculus and ordinary differential equations.</p> <p>CO2: Sketch curves in Cartesian coordinate systems.</p> <p>CO3 :To solve first order first degree and first order higher degree differential equation.</p> <p>CO4 : Grasp the concept of a general solution of a higher order linear differential equation of an arbitrary order and also learn a few methods to obtain the general solution of such equations.</p> <p>CO5: To solve initial and boundary value problem.</p> <p>CO6 : Apply Integral Calculus and Differential Equations in social sciences, physical sciences, life sciences and a host of other disciplines</p>								
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
	CO3								
	CO4								
	CO5								
	CO6								

## B.Sc. Mathematics 3<sup>rd</sup> Semester

Course: MTH-301: [Advanced Calculus-I](#)

Course Outcomes	<p>The course will enable the students to:</p> <p>CO1 : Explain the insight of the function of two variable and their calculus.</p> <p>CO2 : Understand the Limits and Continuity of a function of two variables, Partial Differentiation.</p> <p>CO3 : Find surface integral of the surfaces.</p> <p>CO4 : Understand basics of vector calculus.</p>								
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## B.Sc. Mathematics 3<sup>rd</sup> Semester

### Course: MTH-303: Differential-Equations

Course Outcomes	<p>The course will enable the students to:</p> <p>CO1 : Explain the insight of the Linear Differential Equations with variable coefficients.</p> <p>CO2 : Understand Second order Differential Equations</p> <p>CO3 : Learn about Formation of Partial Differential Equation.</p>								
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
	CO3								
	CO4								
	CO5								
	CO6								

## B.Sc. Mathematics 3<sup>rd</sup> Semester

### Course: E.G.-3001: Mathematical Methods

Course Outcomes	<p>The course will enable the students to:</p> <p>CO1 : Explain the insight of the difference calculus.</p> <p>CO2 : Understand Finite difference and Method of unknown coefficients</p> <p>CO3 : Learn about Difference equation.</p> <p>CO4 : Solve problem of Difference equation.</p> <p>CO5 : Obtain solution of Homogeneous difference equations with constant coefficients.</p> <p>CO6 : Apply difference calculus in social sciences, physical sciences, life sciences and a host of other disciplines</p>								
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
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## B.Sc. Mathematics 3<sup>rd</sup> Semester

### Course: E.G.-3002: Group of Symmetries-I

Course Outcomes	<p>The course will enable the students to:</p> <p>CO1 : Explain the insight of the Group theory.</p> <p>CO2 : Understand Sub group and their properties</p> <p>CO3 : Learn about Symmetry planes and reflection symmetry.</p> <p>CO4 : Solve problem of Product of symmetry operations.</p> <p>CO5 : Analyze consequences of Rotation axes and rotation symmetry</p> <p>CO6 : Apply Group of Symmetries in social sciences, physical sciences, life sciences and a host of other disciplines</p>																																																															
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## B.Sc. Mathematics 4<sup>th</sup> Semester

### Course: MTH-401: [Advanced Calculus-II](#)

Course Outcomes	<p>The course will enable the students to:</p> <p>CO1 : Explain the insight of the beta gamma function and Maxima- Minima for Function softwovariables.</p> <p>CO2 : Understand Double and triple integrals</p> <p>CO3 : Learn about Laplace transform .</p> <p>CO4 : Realize importance of Laplace transform.</p> <p>CO5 : Determine various Inverse Laplace transform.</p> <p>CO6 : Apply the Special function, double Triple integral and Laplace transform in social sciences, physical sciences, life sciences and a host of other disciplines</p>																																																						
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B.Sc. Mathematics 4<sup>th</sup> Semester

Course: MTH-402: [Numerical Analysis-II](#)

Course Outcomes	<p>The course will enable the students to:</p> <p>CO1 : Explain the insight of the numerical analysis.</p> <p>CO2 : Understand the Lagrange’s Interpolation Formula, Divided Differences, Newton’s General Interpolation Formula</p> <p>CO3 : Obtain numerical Differentiation.</p> <p>CO4 : Learn about Numerical Integration.</p> <p>CO5 :Determine Solution of Ordinary Differential Equations by Taylor’s series method, Picard’s approximation method, Euler’s method.</p> <p>CO6 : Apply numerical analysis in social sciences, physical sciences, life sciences and a host of other disciplines</p>								
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
	CO3								
	CO4								
	CO5								
	CO6								

B.Sc. Mathematics 4<sup>th</sup> Semester

Course: MTH-403: [Introduction to Abstract Algebra](#)

Course Objective	<p>The course will enable the students to:</p> <p>CO1 : Explain the insight of the Divisors GCD and LCM.</p> <p>CO2 : Understand the basics of group and elementary properties of group</p> <p>CO3 : Recognize Subgroups, CyclicGroups, Orderofanelement.</p> <p>CO4 : Learn about basics of Ring theory.</p> <p>CO5 :Determine Least Common multiple, Prime numbers, Fundamental theorem of Arithmetic.</p>							
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	CO6 : Apply Basic of number theory in social sciences, physical sciences, life sciences and a host of other disciplines.								
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
	CO3								
	CO4								
	CO5								
	CO6								

### B.Sc. Mathematics 4<sup>th</sup> Semester

#### Course: E.G.-4001: Mathematical Modelling

Course Outcomes	<p>The course will enable the students to:</p> <p>CO1 : Explain the insight of the Mathematical Modelling.</p> <p>CO2 : explain the concept of mathematical modelling</p> <p>CO3 : formulate the real world problem into Mathematical form.</p> <p>CO4 :analyze the mathematical model.</p> <p>CO5 : Predict the future by using mathematical modelling.</p> <p>CO6 : Apply Mathematical modelling in social sciences, physical sciences, life sciences and a host of other disciplines</p>								
		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
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### B.Sc. Mathematics 4<sup>th</sup> Semester

#### Course: E.G.-4002: Group of Symmetries-II

Course Outcomes	<p>The course will enable the students to:</p> <p>CO1 : Explain the insight of the Formation of groups of symmetries.</p> <p>CO2 : Understand formation of groups of symmetries of the Chemical Molecules</p> <p>CO3 : Learn about Concept of isomorphism of groups.</p>								
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## B.Sc. Mathematics 5<sup>th</sup> Semester

### Course: MTH-504: Real Analysis - II

Course Outcomes	<p>The course will enable the students to:</p> <p>CO1 : Explain the insight of the real analysis.</p> <p>CO2 : Understand the Limit and Continuity of a function on the real line,                      Definition &amp; examples of Metric spaces</p> <p>CO3 : Recognize Open ball in <math>R_1</math>, open ball in metric space, functions continuous on metric spaces.</p> <p>CO4 : Learn about Limit, Convergence and Cauchy sequence in metric space,                      Equivalent metrics..</p> <p>CO5 :Analyze Open sets and their properties.</p> <p>CO6 : Apply real analysis .in social sciences, physical sciences, life sciences and a host of other disciplines</p>																																																															
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Reference Books	<ol style="list-style-type: none"> <li>1. R. R. Goldberg : Method of Real Analysis, Oxford &amp; IBH Pub. Co. Ltd. New Delhi.</li> <li>2. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.</li> <li>3. S. Lang : Undergraduate Analysis, Springer-Verlag, New York, 1983.</li> <li>4. D. SomSundaram&amp; B. Chaudhari : A first course in Mathematical Analysis, Narosa Publishing House, New Delhi, 1997.</li> <li>5. P. K. Jain &amp; S. K. Kaushik : An Introduction to Real Analysis, S. Chand &amp; Co. New Delhi, 2000.</li> <li>6. E. T. Copson : Metric Spaces, Cambridge University Press, 1968.</li> <li>7. P. K. Jain &amp; K. Ahmed : Metric Spaces, Narosa Pub. House, New Delhi, 1996.</li> </ol>																																																															

## B.Sc. Mathematics 5<sup>th</sup> Semester

### Course: MTH-505: Graph Theory

Course Outcomes	<p>The course will enable the students to:</p> <p>CO1 : Explain the insight of the graph theory.</p> <p>CO2 : Understand the graph theory and relevant term</p>
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	CO6								
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B.Sc. Mathematics 5<sup>th</sup> Semester

Course: E.G.-5001: Operations Research-I(ElectiveGeneric)

Course Outcomes	<p>The course will enable the students to:</p> <p>CO1 : Explain the insight of the Operations research.</p> <p>CO2 : Understand Linear programming problem and their Graphical solution.</p> <p>CO3 : Compute the solutions LPP by dual simplex method</p> <p>CO4 :Learn about Definition of the dual problem and their properties</p> <p>CO5 : Find the solution of LPP by Big-M method.</p> <p>CO6 : Apply Operations Research in social sciences, physical sciences, life Science and a host of other disciplines</p>								
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
	CO3								
	CO4								
	CO5								
	CO6								

B.Sc. Mathematics 5<sup>th</sup> Semester

Course: E.G.-5002: Computer Oriented Numerical Methods – I(ElectiveGeneric)

Course Outcomes	<p>The course will enable the students to:</p> <p>CO1 : Explain the insight of the Computer Oriented Numerical Methods.</p> <p>CO2 : Understand Flow charts and symbols, More flow charting examples and FORTRAN language</p> <p>CO3 : Compute the operations in expressions</p> <p>CO4 :Learn about Arithmetic statement, Mode of Arithmetic expression, Special</p>								
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	<p>function, examples of use of functions, Program preparation preliminaries.</p> <p>CO5 : Familiarize with Input-Output statement, STOP and END statement, FORTRAN coding form, Simple FORTRAN program.</p> <p>CO6 : Apply Computer Oriented Numerical Methods in social sciences, physical sciences, life Science and a host of other disciplines</p>								
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
	CO3								
	CO4								
	CO5								
	CO6								

### B.Sc. Mathematics 5<sup>th</sup> Semester

#### Course: E.G.-5003: Fourier Series (ElectiveGeneric)

Course Outcomes	<p>The course will enable the students to:</p> <p>CO1 : Explain the insight of the Fourier Series.</p> <p>CO2 : Understand the Definition of Fourier series, Euler’s formulae, Evaluation of definite integrals, Conditions for a Fourier expansion</p> <p>CO3 : Compute the Fourier series of functions</p> <p>CO4 :Learn about Functions having points of discontinuity, change in intervals, even and odd functions, Expansion of even or odd periodic functions.</p> <p>CO5 : Familiarize with Half range series, Typical waveforms, Parseval’s formula, Root mean square value, Complex form of Fourier series.</p> <p>CO6 : Apply Fourier series in social sciences, physical sciences, life Science and a host of other disciplines</p>								
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
	CO3								
	CO4								
	CO5								
	CO6								



## B.Sc. Mathematics 6<sup>th</sup> Semester

### Course: MTH-601: Ring Theory

Course Outcomes	<p>The course will enable the students to:</p> <p>CO1 : Explain the insight of the Formation of Ring theory.</p> <p>CO2 : Understand Ring Homomorphism and Isomorphism, Ideals &amp; Quotient rings, Maximal Ideal, Principal Ideal</p> <p>CO3 : Learn about different kinds of ring and their properties..</p> <p>CO4 : Recognize Prime element in a Euclidean Ring, Unique factorization theorem in a Euclidean ring.</p> <p>CO5 : Link the Particular Euclidean Ring, Polynomial Ring, Degree of a Polynomial, Division Algorithm, Irreducible polynomial.</p> <p>CO6 : Apply Ring theory in social sciences, physical sciences, life sciences and a host of other disciplines</p>																																																															
Mapping between COs with PSOs	<table border="1" style="width: 100%; border-collapse: collapse; margin: 0 auto;"> <thead> <tr> <th style="width: 10%;"></th> <th style="width: 10%;">PSO1</th> <th style="width: 10%;">PSO2</th> <th style="width: 10%;">PSO3</th> <th style="width: 10%;">PSO4</th> <th style="width: 10%;">PSO5</th> <th style="width: 10%;">PSO6</th> <th style="width: 10%;">PSO7</th> <th style="width: 10%;">PSO8</th> </tr> </thead> <tbody> <tr> <td>CO1</td> <td style="background-color: #cccccc;"></td> <td style="background-color: #cccccc;"></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>CO2</td> <td style="background-color: #cccccc;"></td> <td style="background-color: #cccccc;"></td> <td style="background-color: #cccccc;"></td> <td style="background-color: #cccccc;"></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>CO3</td> <td style="background-color: #cccccc;"></td> <td style="background-color: #cccccc;"></td> <td style="background-color: #cccccc;"></td> <td></td> <td style="background-color: #cccccc;"></td> <td></td> <td></td> <td></td> </tr> <tr> <td>CO4</td> <td></td> <td style="background-color: #cccccc;"></td> <td style="background-color: #cccccc;"></td> <td style="background-color: #cccccc;"></td> <td></td> <td style="background-color: #cccccc;"></td> <td style="background-color: #cccccc;"></td> <td style="background-color: #cccccc;"></td> </tr> <tr> <td>CO5</td> <td style="background-color: #cccccc;"></td> <td></td> <td style="background-color: #cccccc;"></td> <td style="background-color: #cccccc;"></td> <td style="background-color: #cccccc;"></td> <td style="background-color: #cccccc;"></td> <td></td> <td></td> </tr> <tr> <td>CO6</td> <td style="background-color: #cccccc;"></td> <td style="background-color: #cccccc;"></td> <td></td> <td style="background-color: #cccccc;"></td> <td></td> <td style="background-color: #cccccc;"></td> <td style="background-color: #cccccc;"></td> <td style="background-color: #cccccc;"></td> </tr> </tbody> </table>		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	CO1									CO2									CO3									CO4									CO5									CO6								
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## B.Sc. Mathematics 6<sup>th</sup> Semester

### Course: MTH-602: Linear Algebra - II

Course Outcomes	<p>The course will enable the students to:</p> <p>CO1 : Explain the insight of the Linear algebra.</p> <p>CO2 : Understand Linear Transformation and their properties</p> <p>CO3 : Learn about rank nullity and their properties</p> <p>CO4 : Recognize Matrix associated with linear transformations.</p> <p>CO5 : Analyze Inner product spaces, Norm of a vector and properties.</p> <p>CO6 : Apply linear algebra in social sciences, physical sciences, life sciences and a host of other disciplines</p>
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Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
	CO3								
	CO4								
	CO5								
	CO6								

B.Sc. Mathematics 6<sup>th</sup> Semester

Course: MTH-603: Real Analysis - III

Course Code	MTH-603								
Course Outcomes	<p>The course will enable the students to:</p> <p>CO1 : Explain the insight of the real analysis.</p> <p>CO2 : Understand the Convergence and divergence of series of real numbers</p> <p>CO3 : Recognize Sets of measure zero, definition of the Riemann Integral, Algebraic properties of Riemann Integral.</p> <p>CO4 : Learn about different type of series .</p> <p>CO5 :Analyze Algebraic properties of Riemann Integral Fundamental theorems of Integral Calculus.</p> <p>CO6 : Apply real analysis .in social sciences, physical sciences, life sciences and a host of other disciplines</p>								
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
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	CO6								

B.Sc. Mathematics 6<sup>th</sup> Semester

Course: MTH-604: Real Analysis - IV

Course Outcomes	The course will enable the students to:
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B.Sc. Mathematics 6<sup>th</sup> Semester

Course: MTH-606: Number Theory - II

<p>Course Outcomes</p>	<p>The course will enable the students to:</p> <p>CO1 : Explain the insight of the number theory.</p> <p>CO2 : Understand Fermat’s little theorem, Pseudo-primes, Wilson’s theorem</p> <p>CO3 : Compute the solutions of linear congruence , the Chinese Remainder Theorem</p> <p>CO4 :Learn about The number of positive divisors, multiplicative nature of functions, The Möbius Inversion formula</p> <p>CO5 :Analyze Euler’s Phi-function and related theorem.</p> <p>CO6 : Apply Number theory .in social sciences, physical sciences, life sciences and a host of other disciplines</p>								
<p>Mapping between COs with PSOs</p>		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
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CO4									
CO5									
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B.Sc. Mathematics 6<sup>th</sup> Semester

Course: E.G. 6001: Operations Research-II (ElectiveGeneric)

<p>Course Outcomes</p>	<p>The course will enable the students to:</p> <p>CO1 : Explain the insight of the Operations research.</p> <p>CO2 : Understand the transportation problem and their solutions.</p> <p>CO3 : Compute the solutions of Assignment problem</p> <p>CO4 :Learn about Competitive games theory</p> <p>CO5 : Find the solution Game theory problem by graphical method</p>								
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	CO6 : Apply Operations Research in social sciences, physical sciences, life Science and a host of other disciplines								
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
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### B.Sc. Mathematics 6<sup>th</sup> Semester

Course: E.G.-6002: Computer Oriented Numerical Methods – II (ElectiveGeneric)

Course Outcomes	<p>The course will enable the students to:</p> <p>CO1 : Explain the insight of the Computer Oriented Numerical Methods.</p> <p>CO2 : Understand Control statements, Relational operators, Logical IF statement, Arithmetic IF statement, Block IF statement</p> <p>CO3 : Apply the Statement labels, GO TO statement and DO statement</p> <p>CO4 :Learn about Rules to be followed in utilizing DO loops, Subscripted variables, Subscripted expression, Dimension statement, DO type notation for input / output statement.</p> <p>CO5 : Familiarize with FORMAT specification and FORMAT specification for a numerical data.</p> <p>CO6 : Apply Computer Oriented Numerical Methods in social sciences, physical sciences, life Science and a host of other disciplines</p>								
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
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## B.Sc. Mathematics 6<sup>th</sup> Semester

Course: E.G.-6003: Fourier Transform and its Applications (ElectiveGeneric)

Course Outcomes	<p>The course will enable the students to:</p> <p>CO1 : Explain the insight of the Fourier Transform and its Applications.</p> <p>CO2 : Understand the Integral transforms, Fourier Transforms, Properties of Fourier Transform</p> <p>CO3 : Compute the Fourier Transform</p> <p>CO4 :Learn about Convolution, Convolution theorem for Fourier transforms, Parseval’s Identity for Fourier transform</p> <p>CO5 : Familiarize with Relation between Fourier and Laplace Transforms, Fourier transforms of the derivatives of a function</p> <p>CO6 : Apply Fourier Transform in social sciences, physical sciences, life Science and a host of other disciplines</p>																																																															
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# Bachelor of Science (Chemistry)

## Program Outcomes

- PO-1: Students will have a firm foundation in the fundamentals and application of current chemical and scientific theories including those in Organic, Inorganic, Physical and Analytical Chemistries.
- PO-2: To develop critical thinking, students carry out scientific experiments as well as accurately record and analyze the results of such experiments.
- PO-3: Students will be skilled in independent problem solving, critical thinking and analytical reasoning as applied to scientific problems.
- PO-4: Students will be able to explore new areas of research in both chemistry and allied fields of science and technology.
- PO-5: Students will appreciate the central role of chemistry in our society and use this as a basis for ethical behavior in issues facing chemists including an understanding of safe handling of chemicals, environmental issues and key issues facing our society in energy, environment, health and medicine.
- PO-6: To inculcate the scientific temperament in the students and outside the scientific community.
- PO-7: To develop skills in the proper handling of apparatus and chemicals. To be exposed to the different processes used in industries and their applications.

## Program Specific Outcomes (PSO)

After successful completion of the course the student will be able to:

- PSO-1: have sound knowledge about the fundamentals and applications of chemical and scientific theories;
- PSO-2: demonstrate knowledge and understanding of essential facts, concepts, principles and theories related to the subject;
- PSO-3: acquire technical skills required for synthesis, Identification and structural characterization of chemical compounds;
- PSO-4: apply appropriate techniques for qualitative and quantitative analysis of chemicals in laboratories. Handling of basic equipments, acquiring technical skills accurately and effectively communicate scientific ideas in graphic oral and written form;
- PSO-5: be familiar with the different branches of chemistry like analytical, organic, inorganic, physical, environmental and polymer;
- PSO-6: gain knowledge to correlate Chemistry with other disciplines of science;
- PSO-7: help in understanding the causes of environmental pollution and can open up new methods for environmental pollution control;
- PSO-8: develop analytical skills and problem solving skills requiring application of chemical principles.

F.Y.B.Sc.

Sem-I Paper-I: Physical and Inorganic Chemistry

At the end of the course, student will be able to

- CO-1: define noble gases, clathrate compounds, atomic size, atomic radii, ionic radii, ionization energy, electron affinity, electro-negativity and diagonal relationship of s-block

- elements, nuclear charge, Lewis acid and base, Lowry Bronsted acid-base, hard of acid-base;
- CO-2: discuss electronic configuration of noble gas, composition of clathrate compounds, bonding in clathrate compounds, coordination in clathrate compounds, fluorides of xenon, uses of vanadium metal, properties of vanadium metal, properties of s-block elements, importance of metal ion of s-block elements in biosystem, historical perspective of atomic structure, Rutherford's atomic model, Bohr's model, spectrum of H-atom;
- CO-3: explain geometry and bond angle in xenon compounds, properties of xenon fluoride, structure and bonding in xenon fluoride as per VBT, bonding in xenon compounds on the basis of MOT, reduction of  $V_2O_5$ , trend of atomic/ionic radii, ionization energy, electron-affinity, electro-negativity in the periodic table, difference between Arrhenius, Lowry Bronsted and Lewis concept of acid-base, HSAB, quantum number, Aufbau, Hund and Pauli exclusion principles;
- CO-4: describe steps involved in extraction of vanadium from some ores, salivation and hydration of s-block elements, complexation of cation of s-block elements;
- CO-5: understand and basic characteristics of noble gases and fluorides of xenon, basic concept of extraction of metal from ores, acid-base character of oxides and hydroxides of elements in the periodic table, ionic character and its effect on covalent bond;
- CO-6: calculate % ionic character of covalent bond; classify ionic, polar and non-polar covalent bond theoretically;
- CO-7: definition of space lattice, Unit cell, Difference between crystalline and amorphous state, types of crystals with illustrations, Law of crystallography; Steno's law and laws of symmetry, lattice planes, Miller indices, Bravais indices, type of cubic system, diagrammatic representation of cubic system and  $d_{100}, d_{110}, d_{111}$  planes, Bragg's equation (X-ray diffraction), Crystal structure of NaCl, KCl;
- CO-8: chemical kinetics and its scope, rate of reaction, factors affecting rate of reaction: temperature, concentration, pressure, solvent, light and catalyst, molecularity of reaction, classification of chemical reaction, order of reaction with illustration (first order, second order, third order, zero order, pseudo first order) reaction, : second order ( $a=b$ ), half life and mean life.

#### SemI Paper-II: Organic Chemistry

At the end of the course, student will be able to

- CO-1: describe and identify the isomerism to structures of organic compounds;
- CO-2: define and identify the optical activity in to structures of organic compounds
- CO-3: explain the chemical Preparation and separation of isomers;
- CO-4: explain Stereochemistry of chiral and achiral chemistry organic compounds;
- CO-5: interpret R/S Configurations of organic compounds;
- CO-6: describe E/Z, Syn/Anti, D/L and R/S isomers;
- CO-7: have basic information of heterocyclic compounds, nomenclature, classification, five and benzofused heterocyclic compounds, Aromaticity and resonance structure of heterocyclic compounds;
- CO-8: five membered heterocyclic compound, synthesis and important chemical reactions and some examples, Benzo fused heterocyclic compound, synthesis is an important chemical reactions and some examples;
- CO-9: have basic knowledge of polycyclic aromatic hydrocarbon and type, classification and nomenclature, some examples of polycyclic aromatic hydrocarbon, important chemical reactions of PAHs;
- CO-10: understand and oxidation and reduction and their uses.

#### SemI: Chemistry Practical

At the end of course student will be able to



- CO-1: handle laboratory glassware's, hazardous chemicals safely in laboratory;
- CO-2: set up the apparatus properly for the given experiments;
- CO-3: perform all the activities in the laboratory with neatness and cleanness;
- CO-4: to develop skills for quantitative estimation using the different branches of volumetric analysis;
- CO-5: to develop skills required for the qualitative analysis of organic compounds.

#### SemII Paper-I: Physical and Inorganic Chemistry

At the end of the course student will be able to

- CO-1: define covalent, co-ordination covalent, ionic, metallic, H-bond and van der Waals force of attraction, bonding molecular orbital, non-bonding molecular orbital, antibonding molecular orbital, acid radicals, base radicals and CFSE, argentiferous lead;
- CO-2: understand basic concepts of bonding between atoms, crystal field theory, linkage between metal ion and Ligand, separation of cation in inorganic qualitative analysis, extraction of metal from its ores, electroplating and purification of metal, application of common ion effect;
- CO-3: explain bonding, non-bonding and bonding molecular orbital, bond order and magnetic properties of heteronuclear diatomic molecules, theory behind borax bead test, flame test, effect of solubility product constant, complexometric reaction involved in inorganic qualitative analysis;
- CO-4: describe polarizability (Fajan's rule), VSEPR theory, structure of flame, properties of uses of pure silver metal, extraction of silver metal from its ore, use of silver metal in photography and electroplating;
- CO-5: identify practically metal ions from the given mixture, separate ion in presence of each other;
- CO-6: explain definition of conductance, resistance, specific conductance and equivalent conductance and the relation between specific conductance and equivalent conductance;
- CO-7: define cell constant, numerical related cell constant, specific conductance and equivalent conductance, Discuss about Ostwald dilution law;
- CO-8: explain buffer solution, buffer capacity and numerical;
- CO-9: explain second law of thermodynamics, state different scientists about second law of thermodynamics, Carnot cycle, define efficiency of engine and numerical, discussion of entropy and change of entropy for reversible, isothermic, isobaric and isochoric processes as well as change for ideal gases;

CO-10: explain classification of physical properties, atomic volume, molar volume and chemical constitution, discussion about surface tension, parac or, viscosity, Ostwald viscometer method and numerical.

#### SemII Paper-II: Organic Chemistry

After completion of course student will able to

- CO-1: define the terms related to organic reactions such as Homolytic and Heterolytic fission free radicals carboniumions, carbanions, carbenes, arynes and nitrenes;
- CO-2: classify organic reactions like Addition, substitution, elimination, rearrange-ments ,addition, and substitution with respect to electrophilic and nucleophilic, SN<sub>1</sub>, SN<sub>2</sub>, Mechanism of addition reaction to alkenes and dienes, substitution in benzene, Perkin reaction, Benzoin condensation and Cannizero's reaction;
- CO-3: determine empirical formula and its relation with molecular formula determination of molecular weight of organic acid by titration and silver salt method and organic base by chloroplatinate method and its limitations;
- CO-4: define the term carbohydrate, its classification, structure of glucose and fructose, conversion of glucose to fructose and fructose to glucose, step up, step down and kilyani synthesis;
- CO-5: identify Alkenes: Nomenclature, method of preparation, properties and uses of ethylene and propylene Morkwonik offs rule and Satytzeff rule, polymerization of ethylene styrene and vinylchloride;
- CO-6: identify dienes: nomenclature, classification of dienes methods of formation ofbutadienechemicalreactions1,2 and 1, 4additions,Diel's–Aiderreaction;
- CO-7: identify Alkynes: nomenclature, methods of formation, chemical reactions, electrophilic and nucleophilic addition reactions if acetylene.

#### SemII: Chemistry Practical

At the end of course student will able to

- CO-1: explain moleconcept and its application in the preparation of normal and molar solutions, and use of moleconceptin quantitative calculations for inorganic analysis;
- CO-2: develop skills for quantitative estimation using the different branches of volumetric Analysis;
- CO-3: impart the students a thorough knowledge of Systematic qualitative analysis of inorganic compounds.

S.Y.B.Sc.

#### Sem-III Paper-III: Inorganic Chemistry

After completion of course student will able to

- CO-1: acquire working knowledge of the quantum mechanics postulate on the evolution of physical system;
- CO-2: solve the time independent Schrodinger's equation, derive the equation for particle in the one dimensional box, applies boundary conditions to constraint the set of possible states;
- CO-3: understand wave function, probability function, well behaved wave function.
- CO-4: define and derivation of different operators, derivation of Hamiltonian equation, Hamiltonian operators for H – atom, H<sub>2</sub><sup>+</sup>, He<sub>2</sub><sup>+</sup> and Li;
- CO-5: principle of chromatography, classification of chromatography according to mobile phase and stationary phase, types of paper chromatography, Rf values, use of paper chromatographyin inorganic analysis, separation of groups,halide and amino acid;

- CO-6: define d-block elements; explain characteristic properties of d-block elements and properties of the elements of the first transition series, their binary compounds and complexes illustrating relative stability of their oxidation states;
- CO-7: understand L-S coupling, J-J coupling (introduction) and term symbol, determination of microstate of *p* and *d* orbital for several atom, calculation of term symbol of C, N, O, Ni, Ni<sup>+2</sup>, Fe, Fe<sup>2+</sup>, Fe<sup>3+</sup>, Cr, Cr<sup>3+</sup>, Co<sup>2+</sup>, V, V<sup>+3</sup> and Cl<sup>-</sup>;
- CO-8: define potable water;
- CO-9: explain different methods of purification of water for potable and industrial purposes, explain soft and hard water, discuss method of desalination of sea water by reverse osmosis and electro dialysis.

#### Sem-III Paper-IV: Organic Chemistry

After completion of course student will be able to

- CO-1: write and explain mechanism of Michael reaction, Wolff-Kishner reduction, Wittig reaction, Friedel-Crafts reaction, Mannich reaction, Benzoin reaction (condensation), Reimer-Tiemann reaction, Aldol Condensation;
- CO-2: explain the Elimination reactions, stereochemistry of elimination reaction, elimination reaction vs substitution reaction;
- CO-3: recall definition, classification, IUPAC nomenclature of heterocyclic compounds with synthesis of some heterocyclic compounds;
- CO-4: define, classify, and nomenclature of poly-nuclear aromatic hydrocarbons with synthesis;
- CO-5: determine configuration of D (+) glucose, D (-) fructose – method of ascending and descending sugar series, Objections against open chain structure of D (+) glucose and D (-) fructose- ring structure of them, determination of size of the ring of glucose and fructose, methods of methylating sugars;
- CO-6: synthesize and apply compound containing reactive methylene group like malonic ester and acetoacetic ester, Keto-enol tautomerism: factors affecting Keto-enol tautomerism and its mechanism.

#### Sem-III Paper-V: Physical Chemistry

At the end of the course student will be able to

- CO-1: explain Arrhenius theory and collision theory of rate of reaction, energy of activation, effect of catalysis on it;
- CO-2: solve numerical problems related to theories of reaction rate;
- CO-3: understand fundamentals of photochemistry, basics of electromagnetic radiations, photons, thermal and photochemical laws (a) Grothuss Draper's law (b) Lambert Beer's law (c) Einstein's law of photochemical equivalence;
- CO-4: explain quantum efficiency, experimental determination of quantum yields; reasons of low and high quantum efficiency, primary and secondary photochemical reactions, factors affecting quantum efficiency, isomeric changes, polymerization, photosensitization, photophysical processes fluorescence, phosphorescence, chemiluminescence, factor affecting fluorescence, phosphorescence and solve numerical problems related to quantum efficiency;
- CO-5: discuss formation of ions in solutions, difference between metallic conductance and electrolytic conductance, electrolysis, migration of ions, transport number of ions and its determination by moving boundary method;
- CO-6: explain Kohlrausch law of ionic conductance and application of Kohlrausch law to (a) determine degree of dissociation of weak electrolyte, (b) determine equivalent conductivity of weak electrolyte at infinite dilution, (c) determine solubility and solubility product of sparingly soluble salts (d) determine ionic product of water;

- CO-7: solve numerical problems related to determination of transport number and applications of Kohlrausch law;
- CO-8: explain basics of electromagnetic radiation with wavelength and energy, radio frequency, microwave, IR, UV/visible region, pure rotational spectra, vibrational and vibrational-rotational spectra, Raman spectra, rotational spectra, calculation of bond-length, vibrational rotational spectra, Hook's law, vibrational energy level;
- CO-9: solve numerical problems related to moment of inertia, force constant, reduced weight and bond length.

#### Industrial Chemistry

At the end of this course, student will able to

- CO-1: manufacturing process of synthetic fibres with uses;
- CO-2: general information and synthesis of some synthetic and natural rubber with flow sheet diagram;
- CO-3: industrial important and manufacturing process of Plastics and Resins with flowsheet diagram;
- CO-4: get knowledge about the synthesis of some herbicides, pesticides, insecticides and fungicides used for household and agriculture purpose;
- CO-5: manufacture process of soap and detergents with the classification of detergents;
- CO-6: get general information and manufacturing process of explosive;
- CO-7: explain the therapeutic uses and manufacture processes of drugs;
- CO-8: find industrial uses and manufacturing process of some important dye pigment and dye intermediate;
- CO-9: synthesis of perfume which is resemble to natural perfume such as vanillin and musk;
- CO-10: explain industrial importance and various methods for the synthesis of phenol;
- CO-11: explain industrial uses and various Industrial important manufacturing process of acetylene.

#### Sem-III: Chemistry Practical:

At the end of this course, student will able to

- CO-1: study their action kinetic practically [1<sup>st</sup> order];
- CO-2: study the conduct metric and pH metric principles and application of conductmetric, and pH metric measurement in quantitative analysis;
- CO-3: do viscosity measurement and its application;
- CO-4: study the adsorption of given organic acid on charcoal;
- CO-5: get trained in the quantitative analysis using gravimetric method;
- CO-6: develop skills required for the qualitative analysis of organic compounds.

#### Sem-IV Paper-III: Inorganic Chemistry

At the end of this course, student will able to

- CO-1: define lanthanides and actinides, electronic configuration, sources, occurrence, extraction by solvent and ion exchange, properties, lanthanide contraction, use of lanthanide compounds, industrial use uranium and plutonium, misch metal;
- CO-2: study of theory of hydrogen bonding, classification, importance of hydrogen bond in gaseous, Effect of hydrogen bonding in various fields;
- CO-3: define CFSE, chromatography, ion exchange, influent, effluent, sorption, desorption, elution, eluant, eluate, break through capacity;
- CO-4: understand basic concept of CFT, CFSE, splitting of d-orbital in octahedral and tetrahedral geometry, interaction of visible light and complex compound, ion exchange chromatography, separation of ion through ion exchange chromatography, purification of water;

CO-5: explain effect of strong and weak ligand on CFSE, magnetic property and color of the metal complexes, synthesis of ion exchange resin, type of resin, steps of ion exchange chromatography, application of ion exchange chromatography, function of various metals in to biological system, importance of metallo-proteins, hemoglobin (with reactions), myoglobin.

#### Sem-IV Paper-IV: Organic Chemistry

At the end of this course, student will able to

- CO-1: basics of diazonium salt, its mechanism, mole ratio, different salts, preparation of the diazonium salt;
- CO-2: study nomenclature of diazonium salts;
- CO-3: study reactions of diazonium salts, replacement reactions in which nitrogen is eliminated, its application in the synthesis of aromatic compounds;
- CO-4: laws of coupling, coupling agents, synthesis of diazo and azo compounds;
- CO-5: prepare and physical properties and chemical reactions of nitriles, isonitriles, carbamates, semi-carbazides and their application in synthetic organic chemistry;
- CO-6: structure and nomenclature of amines, preparation of aryl amines, physical properties and chemical reactions. Gabriel-phthalimide reaction, Hofmann Bromamide reaction;
- CO-7: structure and nomenclature of acid chloride, ester, amides of mono carboxylic acid; method of formation of mono carboxylic acid derivatives and chemical reactions; their definitions, classification, analytical and synthetic evidences to prove the structure of Ascorbic acid and Adrenaline;
- CO-8: how to use of reagents anhydrous aluminium chloride, nbs, grignard reagents, lithium aluminium hydride;
- CO-9: aliphatic sulphur compounds: nomenclature, general methods of preparation and Reaction, Aromatic sulfonic acid: nomenclature, preparation, reactions and uses of sulfonic acids of toluene;
- CO-10: UV and visible spectroscopy, ultraviolet absorption spectroscopy, absorption laws(Beer-Lambert law) terminology used in UV and visible spectra, molar absorptivity, types of electronic transitions, effect of conjugation, concept of chromophore and auxochrome and hypso chromic shifts UV spectra of conjugated enes and enones, effect of solvent substitution on electronic transition.
- CO-11: solve problems based on calculation of  $\lambda_{\max}$  for conjugated dienes and unsaturated carbonyl compounds and substituted Benzene derivatives using relevant rule.

#### Sem-IV Paper-V: Physical Chemistry

At the end of course, students will able to

- CO-1: explain Nernst distribution law and its conditions for the validity, complications arising in distribution law due to association of solute in one of the phases, dissociation of solute in one of the phases, dissociation of solute in both the phase, derivation of distribution law from kinetic consideration explanation of solvent extraction process;
- CO-2: solve problems related to determination of molecularity and quantity of solvent extracted;
- CO-2: distinguish between adsorption and absorption, physical adsorption and chemical adsorption, explain heat of adsorption, characteristics of adsorption, Freundlich's adsorption isotherm, Langmuir's adsorption isotherm, catalysis, general features of catalysis, heterogeneous catalysis, adsorption theory of catalysis;
- CO-3: explain free energy or work function [Gibbs free energy (G) and Helmholtz free energy (A)], Derive equation  $G = G^0 + RT \ln p$ , relation of  $\Delta G$  and equilibrium constant  $K_p$  (VanHoff isotherm), derive Clausius-Clapeyron and Clausius-Clapeyron equation

- equations, apply Clapeyron–Clausius equation in the derivation of molal elevation constant and molal depression constant;
- CO-4: solve numerical problems related to latent heat of fusion, latent heat of vaporization, elevation of boiling point and depression of freezing point;
- CO-5: use Principle of conductometric titrations to explain following titrations: (1) strong acid v/s strong base (2) strong acid v/s weak base (3) weak acid v/s strong base (4) weak acid v/s weak base (5) mixture of strong acid and weak acid v/s strong base (6) precipitation titrations of (i)  $\text{BaCl}_2$  v/s  $\text{K}_2\text{CrO}_4$  (ii)  $\text{NaCl}$  v/s  $\text{AgNO}_3$ , explain advantages of conductometric titrations over indicator method;
- CO-6: discuss relation between degree of hydrolysis, hydrolysis constant and pH of solutions of (1) salts of weak acid and strong base (2) salts of strong acid and weak base (3) salts of weak acid and weak base, explain theories of acid-base indicators, choice of indicators, indicator exponent and useful range of pH of an indicator, solve numerical problems related to degree of hydrolysis, hydrolysis constant, determination of pH.

#### Industrial Chemistry

At the end of course, students will be able to

- CO-1: give details processes of manufacture of some industrial important in organic chemicals with uses;
- CO-2: industrial uses and manufacturing process of lime, cement and refractories;
- CO-3: industrial preparation and uses of some important chemical such as potassium permanganate, potassium dichromate, titanium dioxide, bleaching powder, white lead;
- CO-4: information about plant nutrient and symptom so nutrient deficiency in plant kingdom. Classify fertilizer and industrial manufacturing process of widely used some fertilizer;
- CO-5: classify fuel, information and synthesis of some synthetic and eco friendly fuel;
- CO-6: property, classification and industrial manufacturing process of glass use frequently for industries and household purpose;
- CO-7: property and industrial making process of various ferrous and non ferrous alloys;
- CO-8: define fermentation, various factors affecting fermentation process, micro-organisms and various chemical nutrient uses for fermentation process.

#### Sem-IV: Chemistry Practical

At the end of course, students will be able to

- CO-1: develop laboratory skills for the purpose handling different instruments; interpret results of experiments and their correlation with theory;
- CO-2: determine the molecular condition of benzoic acid in its solution in benzene by the method of partition coefficient;
- CO-3: determine their relative strength of mineral acids;
- CO-4: study the conductometric and pH metric principles and application of conductometric, and pH metric measurement in quantitative analysis;
- CO-5: maintain records of chemical and instrumental analysis; develop laboratory skills for the purpose of collecting, interpreting, analyzing, practical data;
- CO-6: impart the students a thorough knowledge of systematic qualitative analysis of inorganic mixtures.

T.Y.B.Sc.

#### Sem-V Paper-VI: Inorganic Chemistry

At the end of course, student will be able to

- CO-1: study postulates of quantum mechanics, particles in three dimensional box, Schrodinger's wave equation in polar coordinates, its separation into  $R$ ,  $\theta$  and  $\Phi$ ;

- CO-2: JahnTeller Theorem, distortion in octahedral complexes, crystal field splitting energy level diagram for octahedral and tetrahedral, tetragonal and square planar complexes;
- CO-3: concept of Lig and field theory;
- CO-4: distinguish between atomic and molecular orbitals, bonding and anti bonding molecular orbitals, different theories of co-ordination chemistry;
- CO-5: draw MO energy level diagram for metal complexes and its magnetic properties;
- CO-6: define classify metal carbonyls, metal ligand  $\pi$ -bonding (back bonding), define EAN and 18 electron rule, calculate EAN for metal carbonyl, bonding in metal carbonyl structure and IR spectrain metal carbonyl;
- CO-7: differentiate between terminal and bridge carbonyl, constitution of metal carbonyls;
- CO-8: define boron hydride and its classification, Wade's rule, bonding and structure in tetraBorane(10), pentaborane(9) and dodecaborane(12) anion;
- CO-9: outline thermodynamic stability of metal complexes and factors affecting a stability of metal complexes, Lability and inertness, factors affecting lability of metal complexes, trans effect, theories of trans effect: (i) electrostatic polarization theory (ii) - bondtheory;
- CO-10: define and give importance of corrosion, types of corrosion: uniform, pitting, inter crystalline and stress cracking corrosion, electro-chemical theory of corrosion, protection methods and importance of coating, inhibitors (organic, inorganic, anodic, cathodic), anodic and cathodic protection.

#### Sem-V Paper-VII: Organic Chemistry

At the end of course, students will able to

- CO-1: give (a) Differenttypes of mechanism foresterification and hydrolysis:  $B_{AC}^2 A_{AC}^2 A_{AC}^1 A_{AL}^1 B_{AL}^2$  (b)mechanism off ormation and hydrolysis of amides.(c)pyrolytic elimination: Cope and Chugaev reactions;
- CO-2: give structural determinations of pyriodoxine and thyroxine and their synthesis, general introduction, structural determination of ribofllevin (Lactoflavin) and its synthesis;
- CO-3: have basic concepts of alkaloids, occurrence and classification of alkalodis, general methods of determine of their structure, analytical and synthetic evidence to prove the structure of nicotine and papavarine;
- CO-4: have general discussion about carbohydrates, definition of carbohydrates, classification of carbohydrates with example, introduction of disaccharide and polysaccharide, structure determination of maltose, lactose starch;
- CO-5: introduce drugs, define drugs and ideal drugs,classify drugs based on pharmacologicalor functions, give important synthesis and uses of drugs;
- CO-6: define peptide, synthesis of Merry Field method, Sangers method, Edman method, N-terminal determination, C-terminal determination by generation of amino alcohol and using digestive enzymes, end group analysis, selective hydrolysis of peptides classical levels of protein structure, proteindenaturation /renaturation.

#### Sem-V Paper-VIII:Physical Chemistry

At the end of the course student will be able to

- CO-1: understand and explain partial molal free energy, derive from Gibb's Duhem equation, chemical potential in case of a system of ideal gases, concept of fugacity, fugacity function, fugacity at low pressures, physical significance of fugacity, graphical method for determination of fugacity, Lewis fugacity rule, activity and activity coefficient, standard state of solid, liquid and gas, the Nerns the at theorem, its limitations, statement of the third law of thermodynamics, consequence of third law ofthermodynamics,determinationofabsoluteentropyofgasesandliquidsandsolid,

- applications of third law of thermodynamics, concept of residual entropy, exceptions to the third law of thermodynamics, solve numerical problems related to fugacity, graphical method to determine fugacity and determination of absolute entropy;
- CO-2: explain and discuss concept of oxidation and reduction, electrochemical series, definition of half cell and cell, single electrode potential, sign of electrode potential, standard electrode potential, electrochemical process, Galvanic cell with example of Daniel cell, emf of a cell and its measurements, Standard Weston cell, different types of reversible electrodes, determination of single electrode potential, calculation of standard emf of cell and determination of cell reaction, standard hydrogen electrode, calomel electrode and Ag-AgCl electrode, chemical and concentration cell, electrode and electrolyte concentration cell, liquid junction potential (LJP), salt bridge in elimination of LJP, concentration cell with and without transference, free energy change and electrical energy, prediction of spontaneity of cell reaction, relation of standard free energy change with equilibrium constant, temperature coefficient of emf of a cell, entropy change and enthalpy change of cell reaction;
- CO-4: solve numerical problems related to cell construction from electrochemical reaction, electrode potential, emf of various types of cell, rate constant, LJP;
- CO-3: explain stable and unstable isotopes, separation of isotopes by different methods, gaseous diffusion, thermal diffusion, distillation, chemical exchange methods, Bainbridge velocity focusing mass spectrograph, Dempster's direction focusing mass spectrograph, different types of particle accelerators.

#### Sem-V Paper-IX: Industrial Chemistry

At the end of course, students will be able to

- CO-1: study nomenclature of chloro-fluoro derivatives of methane and ethane, uses of fluoro carbons;
- CO-2: manufacture of freon-12 from fluorspar, manufacture of freon-12 from vinylidene fluoride;
- CO-3: pollution hazard of Fluoro carbons;
- CO-4: metallurgy of different metals occurrence, extraction, properties and uses: (1) Tungsten (2) Molybdenum (3) Titanium (4) Chromium (5) Aluminium;
- CO-5: do small scale preparation of (1) safety matches (2) naphthalene balls (3) wax candles (4) shoe polish (5) writing/ fountain pen ink (6) chalk crayons (7) plaster of paris;
- CO-6: define nitration, nitrating agent, reaction mechanism of nitration, nitration of acetylene, nitration of benzene, nitration of naphthalene, artificial perfumes: musk xylene, musk ketone, musk ambrette. explosives: trinitrophenol, trinitrotoluene, trinitroglycerine, emitol;
- CO-7: define amination, amination by reduction: metal-acid reduction, metal-alkali reduction, catalytic reduction, sulphide reduction. amination by ammonolysis: amination of chlorobenzene, phenol and sulphonic acid, importance of amination in industry in the manufacture of m-phenylenediamine, hmda, anthranilic acid, hexamethylenetetramine;
- CO-8: define sulphonation, methods of sulphonation, sulphonating agents, mechanism of sulphonation, sulphonation of benzene, toluene, naphthalene.

#### Sem-V Paper-X: Analytical Chemistry

At the end of course, students will be able to

- CO-1: study chemical and instrumental analysis, advantages and disadvantages, overview of methods used in quantitative analysis, classification of classical and instrumental analysis;
- CO-2: define and explain error, types of errors: determinate errors, indeterminate errors, constant and proportional errors, define and explain the following terms—accuracy



and precision, mean, median, deviation, average deviation, standard deviation, variance, coefficient of variation, relative mean deviation, range, absolute errors, relative errors, minimization of determinates errors, normal error curve, rejection of result from a set of results, 2.5 d rule, 4.0 d rule and Q-test;

- CO-3: study factors affecting solubility of precipitates: (1) common ion (2) diverse ions (3) pH (4) hydrolysis (5) complex formation, the precipitation process, nucleation growth, Von Weimarn's theory of relative super saturation. digestion of precipitates;
- CO-4: factor affecting quality of precipitate: Co-precipitation and post precipitation, Precipitation from homogeneous solution with illustration of barium and aluminum; thermo gravimetry, general principle, application with following two specific examples (1)  $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$  (2)  $\text{MgC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ ;
- CO-5: calculate of pH at different stages of titrations of monobasic and dibasic acid with strong base construction of titration curve, titration of carbonate mixture, numerical;
- CO-6: explain EDTA titration, absolute and conditional stability constant, distribution of various species of EDTA as function of pH, absolute and conditional stability constants, derivation of factors:  $\alpha_4$  for effect of pH,  $\beta_4$  for the effect of auxiliary complexing agent, construction of titration curves: theory of metallochromic indicators, masking, demasking and kinetic masking, types of EDTA titrations.

#### Sem-V Paper-XI: General Chemistry

At the end of course, students will able to

- CO-1: define spectroscopy, wavelength, frequency of radiation, wavenumber.
- CO-2: classify spectroscopy atomic and molecular spectroscopy, different region of IR radiation.
- CO-3: describe instrumentation of IR spectroscopy, preparation of sample for IR spectroscopy, stretching vibration of different molecule.
- CO-4: explain effect of IR radiation on matter, factors affecting on absorption frequencies.
- CO-5: calculate estimated absorption frequencies for various functional groups.
- CO-6: study dry reaction: theory behind borax bead test with equation, flame test, analysis of cation: (a) application of common ion effect and solubility product constant. (b) complexometric reaction involved in qualitative analysis, for identification [Reaction between Cu (II) ion with ammonia, Fe (III) with thiocyanide,  $\text{NH}_4^+$  with Nessler reagent 2, for masking  $[\text{Cd}^{+2}, \text{Cu}^{+2}]_3$ , separation of two ion  $[\text{Ag-Hg, Zn}]^{+2}, \text{Mn}^{+2}$ ;
- CO-7: organic qualitative analysis, elemental analysis, solubility of organic compounds;
- CO-8: understand laboratory hygiene and safety, handling of chemicals, general procedure for avoiding accidents, first aid techniques;
- CO-9: define terms: solute, solvent, and solution composition of solution-normal solution, molar solution, molal solution, mole fraction, % solution, saturated, unsaturated and supersaturated solution and solubility, effect of temperature on various units of concentration, inter conversion of one unit into another unit, preparation of solutions of some primary standard substances, standardization of the solution using primary standard solutions/standardized solution.

#### Sem-V: Petro chemicals

At the end of course, students will able to

- CO-1: source of petrochemicals, natural gas: composition, natural gas as petro-chemical feedstock, crude oil: composition, distillation, and refining, utilization of various fractions;
- CO-2: classify petrochemicals, first, second and third generation petrochemicals, conversion process: cracking reforming, isomerisation, hydrogenation, alkylation and hydrodealkylation, dehydrocyclisation of petroleum products, polymerization of gaseous hydrocarbons;

- CO-3: study petrochemicals obtained from C<sub>1</sub> cut of petroleum manufacture and application of methanol, synthesis gas, ammonia, HCN, formaldehyde, hexamethylenetetramine, chlorinated methanes, per chloroethylene and CS<sub>2</sub>;
- CO-4: study industrial fuels, natural fuels, synthetic fuels, hydrogen fuel of tomorrow, fuel for rocket, intermediates of pharmaceuticals and dyes;
- CO-5: study petrochemicals obtained from C<sub>2</sub> cut of petroleum, manufacture and industrial applications of chemicals obtained from ethylene: ethanol, acetaldehyde, ethylene oxide, ethylene glycol, ethanolamines, acrylonitrile, styrene, vinyl acetate, manufacture and industrial application of chemicals obtained from acetylene, acrylic acid, acrylonitrile, vinyl chloride, vinyl acetate, acetaldehyde, chloroprene, trichloroethylene, methyl vinyl ether;
- CO-6: have general account of petrochemicals used as monomers in the manufacture of nylon-6, nylon-6-6, nylon-6-10, nylon-12 and nylon-8-6 fibers, industrial production of caprolactam, HMDA, adipic acid, sebacic acid, lauryllactam.

#### Sem-V: Chemistry Practical

At the end of course, students will be able to

- CO-1: study and justify kinetics of 2<sup>nd</sup> order reaction practically;
- CO-2: study precipitation titration, mixed acid titration using conductivity meter;
- CO-3: determine degree of dissociation and dissociation constant of weak mono basic acid using pHmetry;
- CO-4: determine solubility and solubility product of sparingly soluble salt using potentiometry;
- CO-5: study angle of rotation as well as specific rotation of optically polar substances using polarimeter;
- CO-6: maintain records of chemical and instrumental analysis. Develop laboratory skills for the purpose of collecting, interpreting, analysing, practical data;
- CO-7: develop laboratory skills for the purpose of handling different instruments, interpretation of results of experiments and their correlation with theory;
- CO-8: get training in the quantitative analysis using gravimetric method;
- CO-9: develop skills required for the qualitative analysis of organic mixture.

#### Sem-VI Paper-VI: Inorganic Chemistry

At the end of course, students will be able to

- CO-1: define symmetry, symmetry elements, symmetry operations;
- CO-2: enlist of symmetry elements, types of planes;
- CO-3: define point group, Classification of molecules into point-groups, point-group of different molecules;
- CO-4: study basic properties of a group theory;
- CO-5: derive the multiplication table for C<sub>2v</sub>, C<sub>3v</sub> and C<sub>2h</sub> point group;
- CO-6: understand reaction mechanisms of ligand substitution in octahedral complexes (i) S<sub>N</sub> (ii) S<sub>N</sub>Acid hydrolysis and Base hydrolysis-Redox (Single Electron Transfer) reactions;
- CO-7: define of hybridisation Bond angles in sp, sp<sup>2</sup> and sp<sup>3</sup> hybrid orbital using wave function;
- CO-8: study water pollution: types of water pollutants, trace elements in water and their effects; Determination of BOD, COD, DO, Total hardness, Total dissolved solids.

#### Sem-VI Paper-VII: Organic Chemistry

At the end of course, students will be able to

- CO-1: have basic concept of green chemistry, fundamental principle of green chemistry, green chemistry examples, green synthesis of important compounds
- CO-2: have general discussion about polymers, definition of polymer, classification of polymer with example, introduction of various type of polymerization, some important method of polymerization;
- CO-3: study various types of resin phenol- formaldehyde resin, urea -formaldehyde resin, epoxyres in, natural and synthetic rubbers;
- CO-4: understand pigments, classification of pigments;
- CO-5: have general introduction of carotenoids, analytical and synthetic evidence of  $\beta$ -carotene;
- CO-6: get general introduction of anthocyanines and anthocyanidines analytical and synthetic evidence of Cyandine chloride;
- CO-7: have an introduction of flavones and flavonols analytical and synthetic evidence of quercetin;
- CO-8: have general discussion about dyes, definition of dyes and pigments;
- CO-9: discuss about color and constitution–Witt's theory difference between dyes and pigments;
- CO-10: classify of dyes with example, introduction of various types of dyes;
- CO-11: study mechanism of rearrangements involving C to C migrations as illustrated by Wagner– Meerwein and Pinocol-Pinacolone rearrangements;
- CO- 12: study mechanism of rearrangements involving C to N migrations as illustrated by Hoffmann, Curtius, and Beckmann rearrangements.

#### Sem-VI Paper-VIII: Physical Chemistry

At the end of course, students will be able to

- CO-1: discuss application of radio isotopes as tracers in medicines, agriculture, in studying reaction mechanism in photosynthesis and aged determination by Carbon-Dating method, Q-value of nuclear reactions, chemical and physical atomic weight scale, mass defect and binding energy, packing fraction and its relation with the stability of the nucleus, nuclear fission, atom bomb, nuclear reactor for power generation and critical mass, stellar energy and hydrogen bomb, hazard so nuclear radiation, numerical problems on Q-value, binding energy, packing fraction, and energy released during nuclear reactions;
- CO-2: apply EMF measurements in the determination of (1) solubility product and solubility of sparingly soluble salts (2) ionic product of water by galvanic cell (3) transport number of ions (4) equilibrium constant (5) pH by hydrogen, glass and quinhydrone electrodes, solve numerical based on above application to determine solubility, solubility product, ionic product of water, equilibrium constant, transport number and  $p^h$  of solution, have detail information on energy sources like Ni-Cd Cell and Li-ion cell;
- CO-3: discuss statement and meaning of the terms phase, component, degree of freedom, phase rule, phase equilibria of one component system like water,  $CO_2$ , sulphur system, phase equilibria of two component system like Pb-Ag systems, KI-Water system, desilverisation of lead, basics freezing mixtures and Definition of solid solutions with congruent and incongruent melting point using example;
- CO-4: explain liquid-liquid mixtures, ideal liquid mixtures, Raoult's law, non ideal or real solutions, positive and negative deviations from Raoult's law, temperature composition curves for ideal and nonideal binary solution so miscible liquids, azeotropes, partially miscible liquids explained using phenol-water systems, immiscible liquids, steam distillation, solve numerical problems related to this topic.

#### Sem-VI Paper-IX: Industrial Chemistry

At the end of course, students will be able to

- CO-1: pulp and paper industry, Type of pulp, manufacture of chemical pulp and mechanical pulp;
- CO-2: study manufacture of paper (conversion of pulp into paper, beating process, importance of fillings, sizing, colouring material in manufacture of paper and calendaring);
- CO-3: understand principles of detergency;
- CO-4: classify of surface active agents, anionic detergents, cationic detergents, non-ionic detergents, amphoteric detergents, suds regulators, builders additives.
- CO-5: get introduction, manufacture of sugar from sugarcane;
- CO-6: study extraction of juice, purification of juice, concentration and crystallisation of purified juice, refining of sugar;
- CO-7: define fermentation and fermentation process with example pH, temperature and substance;
- CO-8: study various type compounds like ethanol, citric acid, acetone and penicillin –G manufacture and flowchart with uses;
- CO-9: define insecticide type of insecticides, inorganic, organic, synthetic and natural insecticides, manufacture and uses of various type of compound like dieldrin, BHC, TEPP;
- CO-10: define of fungicides, Bordeaux mixture, dithiocarbamates, Baygon, termikzineb;
- CO-11: study manufacture and uses of various compounds like methanol from synthesis gas, isopropanol from propylene, acetone from isopropanol, formaldehyde from methanol by oxidation dehydration method, acetylene from natural gas.

#### Sem-VI Paper-X: Analytical Chemistry

At the end of course, students will be able to

- CO-1: explain components of spectrophotometer –sources, grating and prism as dispersing device, sample handling, detectors – photo tube, photomultiplier tube, block diagram and working of single beam and double beam spectro-photometer, terms involved in Beer's law, causes of deviation from Beer's law, analysis of unknown by calibration curves method, standard addition method, and ratio method, determination of  $\text{Cu}^{+2}$ ,  $\text{Fe}^{+3}$ ,  $\text{NO}_2^{-1}$  using spectrophotometer, problems based on quantitative analysis;
- CO-2: discuss classification of chromatography, principles of GC separation, components of GC, carrier gas and its selection - stationary phases: solid adsorbents, inert supports and liquid stationary phases, detectors: FID, TCD, qualitative and quantitative analysis using GC;
- CO-3: know about limitation of conventional liquid chromatography, technique of HPLC, elementary idea about technique and layout diagrams of instrument, components of instrument of HPLC technique, elementary idea of TLC;
- CO-4: study titrations involving Silver salts, detection of end points by Mohr's method, Volhard's method, adsorption indicators, construction of titration curves;
- CO-5: study construction of titration curves for titration of  $\text{Fe}^{+2}$  and  $\text{Ce}^{+4}$ , explain types of indicator and theory of redox indicator, know about oxidants –  $\text{KMnO}_4$ ,  $\text{K}_2\text{Cr}_2\text{O}_7$ , reductants – sodium thiosulphate, sodium arsenite and problems.

#### Sem-VI Paper-XI: General Chemistry

At the end of course, students will be able to

- CO-1: define adulteration;
- CO-2: understand different types of adulteration, techniques of adulteration, methods of detection of different adulterants in some common food items like milk, milk products, oil and fats, food grains and their products, spices and miscellaneous

- product, hazardous effect of adulteration of human, consumer's rights and some legal procedures;
- CO-3: realize their social responsibility and inspire to think its solution on a student of chemistry;
- CO-4: study nano-particles, properties of nano-particles, semiconductors, ceramic nano-particles, catalytic aspects of nano-particles, carbon nano-tubes, applications of nano particles;
- CO-5: study different types of pollutions such as: (1) gaseous pollution in air, acid rain, green house effect and ozone depletion, (2) radiation pollution cause, effect and control, (3) noise pollution and their effect and control, (4) oil pollution and their control;
- CO-6: study Nuclear Magnetic Resonance Spectroscopy–Proton Magnetic Resonance ( $^1\text{H NMR}$ ) Spectroscopy–nuclear shielding and deshielding–chemical shift and molecule structure, spin-spin splitting and coupling constants – areas of signals – interpretation of NMR spectra of simple organic molecule such as ethyl bromide, acetaldehyde, 1,1,2-tribromoethane, ethylacetate, toluene, acetophenone, nitrobenzene, cyclopropane, isomers of pentane and hexane.

#### Sem-VI: Petrochemicals

At the end of course, students will able to

- CO-1: petrochemicals obtained from C<sub>3</sub>-cut of petroleum, manufacture and industrial applications of chemicals obtained from propylene: isopropyl alcohol, acetone, propylene oxide, acrylonitrile, glycerol and isoprene, propylene tetramer, acrylic acid, n-butyraldehyde, methyl isobutyl ketone, acrolein, acrylamide, methyl methacrylate;
- CO-2: have general account of petrochemicals used as monomers in the manufacture of polyester fibers, manufacture of DMT, terephthalic acid, phthalic anhydride, maleic anhydride, 1,4 butanediol and other monomers like pentaerythritol and diisocyanates;
- CO-3: study method for the large scale production with flow diagram and uses of: (i) acetoacetanilide (ii) anthraquinone (iii)  $\beta$ -naphthol from naphthalene (iv) Benzoic acid (v) aspirin (vi) chloramphenicol (vii) paracetamol (viii) p-amino phenol (ix) saccharin (x) 2,4-Dicid;
- CO-4: defines synthetic detergents, hard and soft detergents, synthesis of DDBS, basic petrochemical raw materials for organic dyes, dyes derived from these raw materials with uses, synthesis of fluorescein, malachite green, chrysoidine and indigo, definition of explosive, list of basic raw materials for explosives and list of explosives derived from these raw materials, synthesis of tetryl, PETN and dynamite;
- CO-5: define insecticides, classification of insecticides on basis of mode of action. Synthesis of Methoxychlor, Captan, Parathion, Malathion and Perthane;
- CO-6: study chemicals obtained from C<sub>4</sub> and C<sub>5</sub> cut of petroleum, manufacture and industrial applications of butadiene, butyl alcohols, methyl tert-butyl ether (MTBE) cyclopentadiene, sulpholane;
- CO-7: study recovery process of BTX, manufacture and industrial applications of benzene, toluene, xylene, naphthalene, phenol, styrene, aniline, maleic anhydride, cyclohexanol.

#### Sem-VI: Chemistry Practical:

At the end of course, students will able to

- CO-1: study and justify kinetics of 2<sup>nd</sup> order reactions practically;
- CO-2: determine quantity of active ingredient in commercial product [Vanilla] using conductometric principles and conductometric titration;
- CO-3: determine degree of dissociation and dissociation constant of weak mono basic acid by titration method using pH metry;

- CO-4: verify Lambert-Beer law for colored solution using colorimeter/ spectrophotometer;
- CO-5: determine normality and amount of given acid in mixture using conductivity meter;
- CO-6: maintain records of chemical and instrumental analysis, develop laboratory skills for the purpose of collecting, interpreting, analyzing, practical data;
- CO-7: develop laboratory skills for the purpose handling different instruments, interpret results of experiments and their correlation with theory;
- CO-8: get knowledge of Systematic qualitative analysis of Inorganic mixtures.

# Bachelor of Science (Biology)

## F. Y. B. Sc.

Course: Introduction to microbiology (BS 101)

After successfully completing this course, the student will be able to learn about,

CO1: Understand history, scope & relevance of microbiology, biogenesis and abiogenesis, contribution of scientist in the field of microbiology.

CO2: Know about the microscope – resolution power, NA & working principle, component of microscope, types of microscope and microscopy. Electron microscope

CO3: Study dye, stain and staining techniques, Introduction to microbial control; antiseptics, sterilization, preservation, disinfection, sanitization, sterilization by heat, filtration & radiation. Control of microbes by chemicals.

Course: Basic Genetics (BS 102)

After successfully completing this course, the student will be able to learn about,

CO1: Know the Mendelian genetics, Mendel's experiments, Mendel's law. Incomplete dominance & epistasis, multiple allele & Blood group inheritance. Gene concept, Morgan classical concept, modern concept of gene, Gene-enzyme relationship, Fine structure of gene.

CO2: Understand sex-linked inheritance, X & Y linked inheritance, Intermediate inheritance & sickle cell anemia, Sex determination in drosophila & human.

CO3: Study human karyotype, Banding technique, Chromosomal abnormality: Structural & Numerical.

Course: Bioscience Practical (BS 100P)

After successfully completing this course, the student will be able to:

CO1: Demonstrate an understanding of laboratory procedures using scientific methods demonstrate an ability to collect data through observation;

CO2: Acquire technical skills in using laboratory equipment, tools and materials, staining, microscopy.

CO3: Demonstrate various microorganisms, Monochrome staining, viability staining, study barr body, human karyotype & chromosomal abnormalities.

Course: Microbial Diversity (BS 201)

After successfully completing this course, the student will be able to learn about,

CO1: Understand the basics of microbial taxonomy, current position & 3 domains of life, Criteria for microbial taxonomy. Morphology & types of bacteria, Cyanobacteria & archeobacteria. Introduction to viruses.

CO2: Know the general characteristics & classification of protozoan and algae. Study and importance of some protozoa and algae

CO3: Study of some fungi. General characteristics and Outline classification of fungi. Life cycle & reproduction of Mucor, Yeast & Mushroom. Importance of fungi.

Course: Eucaryotic cell structure & function (BS 202)

After successfully completing this course, the student will be able to learn about,

CO1: Understand the cell, cell theory, types, prokaryotic and eukaryotic cell, cell structure & eukaryotic cell organization.

CO2: Study various cell organelles mitochondria, golgi body, lysosome, ER, chloroplast, cell membrane, ribosome, nucleus, centriole, cilia & flagella.

CO3: Know about chromosome - morphology, types, structure, special chromosome and cell cycle – mitotic cell division, meiosis and apoptosis.

Course: Bioscience Practical (BS 200P)

After successfully completing this course, the student will be able to:

CO1: Demonstrate an understanding of laboratory procedures using scientific methods demonstrate microscopic form of life

CO2: Acquire technical skills in using laboratory equipment, tools and materials, staining, microscopic observation of cyanobacteria, algae, protozoa, fungi.

CO3: Demonstrate various cell component, nucleus, chloroplast, mitotic cell division Chromosome, types and giant chromosomes.

## S. Y. B. Sc.

Course: Microbial Chemistry (BS 301)

After successfully completing this course, the student will be able to:

CO1: Basic knowledge of biological macromolecules. Classification, structure & biological importance of carbohydrates, amino acids, protein, fatty acids, lipid.

CO2: Detail information regarding biocatalyst, Nomenclature, classification of enzymes. Mechanism of action & biological role

CO3: Types of mixture; solution, colloids & suspension.

Course: Microbial Genetics (BS 302)

After successfully completing this course, the student will be able to:



CO1: Basic knowledge of NA. Structure & component of nucleic acid. DNA structure, RNA structure & types. Central dogma of the life, flow of genetic information,  
CO2: DNA replication, Gene expression – Transcription, Genetic code. Gene mutation & DNA repair mechanism.

Course: Instrumentation & Biostatistics (BS 303)

After successfully completing this course, the student will be able to:

CO1: Basic knowledge of electromagnetic radiation, types of EM radiation. Radioactivity & Radioisotopes, their uses. Radiation hazards.  
CO2: Introduction, principle, operational technique of pH meter, colorimeter, Basics of spectrophotometer & electrophoresis. Chromatographic technique, types. Detail about paper chromatography, TLC.  
CO3: Introduction to biostatistics, data, table & frequency, sampling, statistical averages. Graphical representation of data, normal curve, test of significance.

Course: Bioscience Practical (BS 300P)

After successfully completing this course, the student will be able to:

CO1: Qualitative determination of monosaccharide, disaccharides, polysaccharides, protein.  
CO2: Preparation of normal, molal, molar, % & buffer solutions.  
CO3: Measurement of pH of samples, take the OD of sample, prepare a standard graph of protein & sugar.  
CO4: Paper chromatography of amino acids, sugar.  
CO5: Separation of chlorophyll by ascending chromatography.

Course: Microbial Cytology & Physiology (BS 401)

After successfully completing this course, the student will be able to:

CO1: Bacterial & archaeal cell wall and membrane. Structure & functions of various cell components. Uptake of nutrient & membrane transport. Nutritional requirement & types.  
CO2: Culture media: Ingredients, types and application of media.  
CO3: Isolation techniques, Anaerobic cultivation, Preservation & maintenance of culture.  
CO4: Microbial growth, Mathematics of growth, Generation time and growth rate. Measurement of growth, Growth curve.

Course: Introductory Medical Microbiology (BS 402)

After successfully completing this course, the student will be able to:

CO1: Basic knowledge of immune system, cell, tissue & organs of immune system, immune response, immunity; natural & acquired.

CO2: Host defense system – internal & external. Detail aspect of antigen, types. Immunoglobulins – structure and types.

CO3: Normal flora, Pathogen & their entry. Infection, its types, virulence & virulence factor, pathological condition. Types of diseases.

Course: Human Physiology (BS 403)

After successfully completing this course, the student will be able to:

CO1: Basic knowledge regarding tissues, Types of tissue, detail about various tissues.

CO2: Detail about the blood, its component and its functional aspect.

CO3: Blood coagulation, mechanism, pathway, Blood pressure & its measurement.

➤ CO4: Temperature regulation, heat regulation mechanism.

➤ CO5: Osmo regulation and body fluids.

Course: Bioscience Practical (BS 400P)

After successfully completing this course, the student will be able to:

CO1: Determination of blood groups, Blood cell count: RBC, WBC & Differential counts DC.

CO2: Estimation of hemoglobin, Measurement of blood pressure, Determination of clotting time.

CO3: Various types of bacterial staining: Gram's staining, Acid -fast staining, Spirochete staining, Capsule and Cell wall staining, Volutin and Endospore staining.

CO4: Preparation culture media, biochemical media, study of biochemical properties of some bacteria.

CO5: Study of bacterial growth curve, effect of heat, chemical agents on bacterial growth.

CO6: Pure culture study of *Escherichia coli*, *Klebsiella mobilis* (*E. aerogenes*), *Proteus vulgaris*, *Serratia marcescens*, *B. megaterium*, *B. subtilis*, *B. cereus*, *Staph. aureus* & *S. epidermidis*.

## T. Y. B. Sc.

Course: Histophysiology (Paper – 501)

After successfully completing this course, the student will be able to learn about,

CO1: Microscopic organization and physiological aspects of some organs of alimentary tract, esophagus, stomach, small and large intestine.

CO2: Microscopic organization and physiological aspects of liver, pancreas, gall bladder

CO3: Microscopic organization and physiological aspects of Other organs kidney, heart, lung & skin

Course: Endocrinology (Paper – 502)

After successfully completing this course, the student will be able to learn about,

CO1: Introduction to endocrine glands, hormone, neurohormone, Hypothalamus

CO2: Microscopic organization of endocrine gland, their physiological functions – Hypophysis, adrenal, Thyroid gland

CO3: Endocrine abnormalities. Gonads –Testes and ovary

Course: Metabolism (Paper – 503)

After successfully completing this course, the student will be able to learn about,

CO1: Basic knowledge of EMP, TCA, ETC, Glycogen metabolism

CO2: Protein catabolism, Deamination, transamination & Decarboxylation

CO3: Lipid catabolism, Oxidation of fatty acids

CO4: Basics of biosynthesis, Gluconeogenesis

Course: Clinical biochemistry (Paper – 504)

After successfully completing this course, the student will be able to learn about,

CO1: Basic knowledge & details of organ function tests; LFT, KFT, PFT, CPT, thyroid function test.

CO2: Physiology, collection of body fluids. Physical, chemical & microscopic examination of Urine, CSF, semen.

CO3: Routine examination of Sputum and of Stool.

Course: Hematology (Paper – 505)

After successfully completing this course, the student will be able to learn about,

CO1: Basic knowledge & detail of hematopoietic system of the body, Blood cell production.

CO2: Blood collection and Clinical hematology, CBC, Hb, absolute count

CO3: Study of Blood disorder, bleeding and coagulation disorder. Automation in hematology

Course: Basic Biotechnology (Paper – 506)

After successfully completing this course, the student will be able to learn about,

CO1: Basic knowledge of Gene expression in prokaryotes and eukaryotes, Regulation of gene expression,

CO2: Endonuclease, cloning vectors, Recombinant DNA technology, Basic fundamental process & application in various field

CO3: Advanced techniques like PCR, Blot tech, DNA finger printing etc.

Course: Bioscience Practical (500P)

After successfully completing this course, the student will be able to:

CO1: Study of some system of Rat - Digestive, Reproductive. Microscopic structure of organs, gonads, endocrine gland

CO2: Physical, chemical & microscopic examination of urine, CSF, Semen

CO3: Quantitative estimation of various blood constituents and enzymes.

CO4: Skill to collect the blood & hematological analysis of various parameters. Blood banking, grouping techniques & Cross-matching.

Course: Nutrition (Paper – 601)

After successfully completing this course, the student will be able to learn about,

CO1: Basic knowledge of Nutrition, types, classification of food, major & minor food component,

CO2: Vitamins – Fat & water soluble, minerals, trace elements

CO3: Malnutrition, Balance diet, Nutritional anemia, nutrition during pregnancy & lactation.

Course: Blood Banking (Paper – 602)

After successfully completing this course, the student will be able to learn about,

CO1: Blood transfusion practice, Documentation & QC in blood banking,

CO2: Blood donor – types, requirement, screening of donor, testing of blood for transfusion.

CO3: Transfusion complications – types, investigation, prevention.

Course: Clinical Immunology (Paper – 603)

After successfully completing this course, the student will be able to learn about,

CO1: Introduction to antigen antibody reaction, Neutralization, Opsonization, complement system & CFT.

CO2: Agglutination – active & passive, their application. Precipitation, gel precipitation.

CO3: Allergic reaction – Immediate & Delayed type, Introduction to some autoimmune diseases.

Course: Medical Microbiology (Paper – 604)

After successfully completing this course, the student will be able to learn about,

CO1: Basic knowledge & detail of various bacterial diseases - airborne, water & food borne, soil borne, STD.

CO2: Introduction to fungal infection, Study of some viral diseases - Polio, hepatitis, Rabies, AIDS.

CO3: Basics of Nosocomial infection – UTI, sore throat.

Course: Parasitology & Clinical Microbiology (Paper – 605)

After successfully completing this course, the student will be able to learn about,

CO1: Basic knowledge & detail of various protozoan diseases, Introduction to Helminthology, some parasitic & worm infection.

CO2: Collection, aseptic handling & transport of clinical specimens, Microbiological examination of various sample.

CO3: Chemotherapeutic agents, antimicrobial susceptibility testing, MIC & MBC determination.

Course: Applied Microbiology (Paper – 606)

After successfully completing this course, the student will be able to learn about,

CO1: Basic knowledge & detail about microbiology of water, water quality, microbiological analysis of water. Sewage, municipal sewage treatment.

CO2: Microbiology of milk, pasteurization, curdling, spoilage of milk. Microbiological analysis of milk, Milk products cheese.

CO3: Basic knowledge & detail of food microbes, food preservation technique, food spoilage, food borne diseases, food intoxication. Control of microbes from air.

Course: Bioscience Practical (600P)

After successfully completing this course, the student will be able to:

CO1: Various immunological test like Widal, RPR, RA test

CO2: Demonstration of Gel precipitate, ELISA, immunodot, Immunochromatographic test.

CO3: Microbiological analysis of milk, water and sewage sample.

CO4: Diagnostic medical problem: Collection of clinical sample - Blood / Urine / Stool & Wound/Abscess/ Purulent exudates. Routine examination of stool & sputum. Pure culture study of Salmonella group, UTI pathogen & Staphylococci.

# Bachelor of Science (Physics)

F.Y. B.Sc. Sem-I

Course: Physics Paper-I (PH-101)

After successfully completing this course, student will be able to:

CO1: Apply the concept of gradient, divergence and curl for understand the various theorems

CO2: Understand uniform circular motion and relative motion

CO3: Obtain knowledge of collision and its types for solving the real life problems

CO4: Examine the various physical properties of materials

Course: Physics Paper-II (PH-102)

After successfully completing this course, student will be able to:

CO1: Understand Gauss law for electrostatics and its applications for specific charge distributions

CO2: Establish relationship between electric field and electrostatic potential through concept of electrostatic potential and potential energy

CO3: Study the different kinds of rectifiers and filter circuits

CO4: Use geometrical and matrix optics methods for understand the behavior of lenses and its parameters

Course: Physics Paper-III (PH-103)

After successfully completing this course, student will be able to:

CO1: Acquire complementary skills of collaborative learning and teamwork in the laboratory work

CO2: Experimentation and interpretation of data

CO3: Set up experimental equipment for generating the experimental approach

CO4: Collect data through observation and performing the experiments

F.Y. B.Sc. Sem-II

Course: Physics Paper-I (PH-201)

After successfully completing this course, student will be able to:

CO1: Understand concept of angular momentum and gravitation through various topics

CO2: Get basic ideas of oscillations and oscillatory motion, waves and its classification

CO3: Discuss various particle wave properties through experiments and phenomena

CO4: Solve the problems of twisting of cylinder, torsional pendulum and beams/cantilevers

Course: Physics Paper-II (PH-202)

After successfully completing this course, student will be able to:

CO1: Understand the Magneto-statics and Electromagnetic induction concept through related laws and models

CO2: Discuss laws of thermodynamics and details of heat engines.

CO3: Study the basic ideas of construction of special purpose of diode and BJTs

CO4: Apply the various phenomena of optics to solve real life problems

Course: Physics Practical

After successfully completing this course, student will be able to:

CO1: Analysis the collected data through performing the experiments

CO2: Do the experimentation and interpretation of data

CO3: Acquire complementary skills of collaborative learning and teamwork in the laboratory work

CO4: Acquire technical skills in using laboratory equipment

F.Y. B.Sc. Sem-III

Course: Physics Paper-I (PH-303)

After successfully completing this course, student will be able to:

CO1: Use thermal and statistical principles in the various applications

CO2: Apply the basic concepts of oscillations, SHM and damping

CO3: Discuss various parameters associated with damped harmonic and forced oscillator

CO4: Understand the construction and working of the mass spectrograph and electron microscope.

Course: Physics Paper-II (PH-304)

After successfully completing this course, student will be able to:

CO1: Understand the experimental confirmation of wave nature of particle by particle diffraction

CO2: Describe uncertainty principle and its applications

CO3: Understand the atomic orbits behaviours and quantized energy levels of electrons in an atom through the Bohr's atomic model

CO4: Establish the theory of transmission grating for different ways of incident light and solve problems based on it

Course: Physics Paper-III (PH-305)

After successfully completing this course, student will be able to:

CO1: Apply the Cauchy's theorem, Cauchy's integral formula and Cauchy's residue theorem to solve problems

CO2: Solve problems using complex algebra and complex calculus

CO3: Understand the thermoelectricity through various effects and experiments

CO4: Discuss the Transistor Biasing and AC Models concept through various parameters and models

CO5: Study the Power amplifiers and its applications

F.Y. B.Sc. Sem-IV

Course: Physics Paper-I (PH-403)

After successfully completing this course, student will be able to:



CO1: Understand the various thermodynamic processes through various theories and scientific equations

CO2: Apply the laws of thermodynamics its consequences to solve real life problems

CO3: Describe simple crystal structure and direct imagining of atomic structure and non-ideal crystal structure

CO4: study vibrations of crystals with mono atomic bases

Course: Physics Paper-II (PH-404)

After successfully completing this course, student will be able to:

CO1: Understand the significance of operators of physical quantities/observables in Quantum Mechanics problems

CO2: Use Schrodinger's Equation for solving problems of particle in a box finite potential, harmonic oscillator and tunnel effect

CO3: Apply the optical activity and specific rotation to solve the real life problems

CO4: Understand the application of Laser in the field of optical fiber

Course: Physics Paper-III (PH-405)

After successfully completing this course, student will be able to:

CO1: Discuss properties and advantages of Fourier series

CO2: Understand different ac bridges and their applications

CO3: Understand the Various Class amplifiers

CO4: Discuss Various FET amplifiers and its applications

Course: Physics Practical (PH-406)

After successfully completing this course, student will be able to:

CO1: Express their knowledge and ideas through oral and written language

CO2: Work in a group for planning, implementation and report writing on a project/experiment

CO3: Set up experimental equipment for generating the experimental approach

CO4: Collect data through observation and performing the experiments

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**  
**SYLLABUS FOR B.Sc. SEMESTER - I**  
**BOTANY PAPER - 101**  
**(Effective from June 2018)**

**BOT - 101 : PLANT DIVERSITY**

**Unit - I      Introduction to Plant Diversity**

- Concept, Plant Kingdom (Eichler system)- cryptogams and phanerogams, diversity in plant kingdom, position of plants in five kingdom system.
- Prokaryotic and Eukaryotic cell structure

**Unit - II      Microbes**

- Bacteria : Discovery, general character, structure and importance
- Virus: Discovery, general character, structure and importance

**Unit - III      Algal diversity**

- Occurrence, classification, thallus, cell structure, pigments, reserve food material and reproduction of *Nostoc* and *Spirogyra*

**Unit - IV      Fungal diversity**

- Occurrence, classification, thallus, cell structure, nutrition and reproduction of *Mucor* and *Agaricus*

**Unit - V      Lichen**

- Classification, general characters, external and internal characters, reproduction and economic importance of *Lichen*

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**  
**SYLLABUS FOR B.Sc. SEMESTER - I**  
**BOTANY PAPER - 102**  
**(Effective from June 2018)**

**BOT - 102 : PLANT DIVERSITY, NURSERY MANAGEMENT AND UTILIZATION**

Unit - I      **Bryophytes**

- Study of life history, occurrence, thallus structure, reproduction and sporophyte diversity (external and internal) of *Funaria*.

Unit - II      **Pteridophytes**

- Study of life history, sporophyte, gametophyte (external and internal) and reproduction of *Nephrolepis*.

Unit - III      **Nursery Management**

- Introduction, types of nurseries
- Plant propagation- cutting, budding, grafting and layering
- Fertilizer and pesticides
- Methods of irrigation: drip and sprinkler,

Unit - IV      **Plant Morphology**

- **Root:** Definition, parts of root, types of root, functions and modification of root.
- **Stem:** Definition, characters of stem, shape and surface of stem, types of stem, functions & modification of stem,
- **Leaf:** Definition, characters & parts of leaf, types of stipules, venation, types of leaf, functions and modification of leaf.
- **Flower:** Definition, structure of typical flower, arrangement of floral leaf, types of flower.

Unit - V      **Food plants**

- Cultivation of the following crops in relation to their origin, distribution, climate, soil, propagation, method of cultivation and uses.
- Sugar cane, Paddy, Mango, Brinjal

# VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

## SYLLABUS FOR B.Sc. SEMESTER - I

### BOTANY PRACTICAL - 103

(Effective from June 2018)

#### BOT - 103 : PLANT DIVERSITY, NURSERY MANAGEMENT AND UTILIZATION

- The candidates should study the typical vegetation in natural condition and should record their observation in journals. Excursion should be arranged during the year to local places.
- Every candidate shall complete laboratory course in accordance with the regulations issued from time to time by Academic Council on the recommendation of the Board of Studies.
- Every candidate shall record observation directly in the laboratory journal. Every journal shall be signed periodically. At the end of the semester candidate shall produce certified journal during the practical examination.

Practical :1 To study microscopic examination of curd.

Permanent slides of Bacteria

Chart/Specimen of different types of Virus.

Practical :2 **Nostoc:**

To study thallus structure and akinets in Nostoc.

Practical :3 **Spirogyra:**

To study the thallus structure, Scalariform conjugation and Lateral conjugation in Spirogyra.

(Permanent slides of thallus W.M, Scalariform conjugation, Lateral Conjugation.)

Practical :4 **Mucor :**

To study the thallus structure and reproductive structure.

Permanent slides of Mucor vegetative W.M., Mucor sporangia, Mucor Zygosporangium.

Practical :5 **Agaricus:**

To study the vegetative structure, basidiocarp, gills, basidia and basidiospores.

Permanent slides : Stipe T.S.; Pileus T.S.

Practical :6 **Lichen:**

To study external features and internal structures of Usnea

(Permanent slides of Lichen thallus T.S., Lichen apothecium V.S., Lichen soridia)

Practical :7 **Moss (Funaria):**

To study the external features of gametophyte and sporophyte.

(Permanent slides of Funaria antheridia W.M.; Funaria archegonia W.M.)

Practical :8 **Nephrolepis :**

Preparation of slides from the fresh material of T.S of Stolon & T.S. of Rachis by the students.

(Permanent slides: T.S. of Stolon, T.S. of Rachis, T.S. of leaflet passing through sori, Nephrolepis prothallus, Fern sori W.M., prothallus with antheridia, prothallus with archegonia, prothallus with sporophyte.)

Practical :9 **Nursery Management**

- i) Study of methods of propagation with the help of suitable materials - tubers, bulbs, rhizomes, corms, suckers and runners.
- ii) Propagation of horticultural plants by stem cuttings, air layering, grafting and 'T' budding.

Practical :10 **Roots:**

- To study different types of roots:
  - ❖ Tap root- *Vinca*
  - ❖ Fibrous- *Grass*
  - ❖ Adventitious- *Sugarcane*
- To study modification of root:
  - ❖ Prop root- *Banyan tree*
  - ❖ Stilt root- *Maize*
  - ❖ Pneumatophores- *Avicennia*
  - ❖ Storage root- *Carrot, sweet potato*

Practical :11 To study different types of stem

- To study Aerial stem
  - ❖ Cudex- *Palms*,
  - ❖ Clum- *Bamboo*,
  - ❖ Scape- *Canna and Onion*
  - ❖ Excurrent- *Polyalthialongifolia, Casurina*
  - ❖ Deliquescent- *Mango*
  - ❖ Weak stem: *Ipomoea*
- To study underground stem
  - ❖ Rhizome- *Ginger, Turmeric*
  - ❖ Tuber- *Potato*
  - ❖ Bulb- *Onion*
  - ❖ Corm- *Amorphophollus*
- To study Specialized stem
  - ❖ Phylloclade- *Opuntia*
  - ❖ Cladode- *Asparagus*

Practical :12 Leaf:

- To study different types of leaf:
  - ❖ Simple leaf: *Banyan, Mango*
  - ❖ Pinnate Compound Leaf:
    - ✓ Unipinnate: *Cassia, Rose*
    - ✓ Bipinnate: *Mimosa, Caesalpinia*
    - ✓ Tripinnate: *Moringa*
    - ✓ Decompound: *Coriander*
  - ❖ Palmately Compound Leaf
    - ✓ Unifoliote: *Citrus*
    - ✓ Bifoliolate: *Balanites, Bauhinia*
    - ✓ Trifoliolate: *Crotalaria, Oxalis*
    - ✓ Quadrifoliolate: *Marsilea*
    - ✓ Multifoliolate: *Bombax*

Practical :13 Flower:

- To study different types of flower:
  - ❖ Regular flower: *Ipomoea*
  - ❖ Irregular flower: *Clitoria, Caesalpinia*
  - ❖ Unisexual flower: *Coccinia*
  - ❖ Bisexual flower: *Hibiscus*

Practical :14 Botanical name, family, origin, distribution and uses of the following crops.

- *Sugarcane*
  - *Paddy*
  - *Mango*
  - *Sapota(Chikoo)*
  - *Brinjal*
  - *Tomato*
- 

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VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - II

BOTANY PAPER - 201

(Effective from June 2018)

BOT - 201 :PLANT PHYSIOLOGY, PLANT ECOLOGY, PLANT ANATOMY,  
MEDICINAL PLANTS AND PLANT PATHOLOGY

Unit - I **Plant Physiology**

- Imbibition and Osmosis
- Plant Movement: Definition and types of movements
- Photosynthesis: Definition, pigments, light and dark reaction, C<sub>3</sub> and C<sub>4</sub> cycle, factors affecting photosynthesis

Unit - II **Plant Ecology**

- Ecological adaptations, morphological and anatomical characters of Hydrophytes, Mesophytes and Xerophytes with appropriate examples

Unit - III **Plant Anatomy**

- Tissue system: Meristematic and Permanent tissue
- Vascular Bundle: Definition and types
- Stele: Definition and types
- Ergastic matters: starch grain, raphides, sphaerephides, aleurone grain and cystolith

Unit - IV **Medicinal Plants**

- Scientific name, family, part use and medicinal uses of following:
  - ❖ *Ocimum sanctum*
  - ❖ *Adhatodavasica*
  - ❖ *Aloe barbedense*
  - ❖ *Azadirachta indica*
  - ❖ *Abrus precatorius*
  - ❖ *Zingiber officinale*

Unit - V **Plant Pathology**

- Causal organisms, symptoms and control measures of the following plant diseases:
  - ❖ Leaf spot of Mango
  - ❖ Red rot of Sugarcane
  - ❖ Bacterial blight of Paddy
  - ❖ Little leaf of Brinjal
  - ❖ Citrus canker

**BOT - 202 :PLANT DIVERSITY AND WEED MANAGEMENT**

**Unit - I Weed management**

- Introduction
- Invasive weeds: concept and causes of their dominance
- Weed control: Physical, chemical and biological methods
- Sustainable use of weeds

**Unit - II Gymnosperm**

- Classification, external morphology, internal structure, reproduction and alternation of generation in Cycas.

**Unit - III Morphology**

- Phyllotaxy: Definition and Types with examples.
- Aestivation: Definition and types with examples
- Inflorescence: Definition and Types: Racemose and Cymose
- Placentation: Definition and Types with examples.

**Unit - IV ANGIOSPERMS**

- Classification as per Bentham & Hooker's system of Classification, general characters, economic and medicinal importance, Botanical name of common important plants of the following families.

- ❖ Malvaceae
- ❖ Apocynaceae
- ❖ Convolvulaceae
- ❖ Nyctaginaceae
- ❖ Amarillidaceae

**Unit - V Conservation of plant diversity**

- Concept and need, Methods of in-situ and Ex-situ conservation
- Botanical garden
- Forests: Importance of forests and their conservation.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - II

BOTANY PRACTICAL - 203

(Effective from June 2018)

BOT - 203 :PLANT PHYSIOLOGY, PLANT ECOLOGY, PLANT ANATOMY,  
MEDICINAL PLANTS AND PLANT PATHOLOGY, PLANT  
DIVERSITY AND WEED MANAGEMENT

- The candidates should study the typical vegetation in natural condition and should record their observation in journals. Excursion should be arranged during the year to local places.
- Every candidate shall complete laboratory course in accordance with the regulations issued from time to time by Academic Council on the recommendation of the Board of Studies.
- Every candidate shall record observation directly in the laboratory journal. Every journal shall be signed periodically. At the end of the semester candidate shall produce certified journal during the practical examination.

Practical :1 **Plant physiology** (Experiment to be demonstrated)

- (i) Imbibition and Imbibition force
  - ❖ Test tube experiment.
  - ❖ Indicator experiment
- (ii) Plant movements
  - ❖ Geotropism
  - ❖ Phototropism
  - ❖ Hydrotropism
- (iii) Photosynthesis
  - ❖ Mohl's half leaf experiment
  - ❖ Light is necessary for photosynthesis

Practical :2 **Plant ecology** (Fresh specimens to be shown to the students):

- Hydrophytes:
  - ❖ Hydrilla, Vallisneria, Eichhornia, Pistia, Nymphaea, Marsilea.
- Mesophytes:
  - ❖ Coriander, Trigonella, Garlic (Entire plants)
- Xerophytes:
  - ❖ Solanumxanthocarpum, Casuarina, Aloe vera, Opuntia, Euphorbia tiruculli

Practical :3 **Tissue:**To study following permanent slides:

- i Root apex
- ii Shoot apex
- iii Parenchyma
- iv Aerenchyma
- v Chlorenchyma
- vi Collenchyma
- vii Sclerenchyma
- viii Xylem- Spiral vessels, Pitted vessels
- ix Phloem elements

Practical :4 **Stele:** Study of stele from permanent slides:

- Actinostele
- Plectostele
- Amphiphloic siphonostele
- Eustele
- Atactostele

Practical :5 **Vascular Bundles:** Study of various types of Vascular bundles from Permanent slides.

- Radial
- Amphicribal (Hadrocentric)
- Collateral and open
- Collateral and closed
- Bicollateral

Practical :6 **Non living cell contents:** Slides are to be prepared by the students from given materials.

- Starch grains: Potato tuber, Wheat or Rice, Euphorbia tiruculli.
- Mineral Crystals:
  - (a) Raphides: Pothos, Colocasia petiole
  - (b) Sphaeraphides: Opuntia, Nerium leaf

Practical :7 **Medicinal plants:** Scientific name, family, part use and medicinal uses of following:

- Ocimum sanctum
- Adhatodavastica
- Aloe barbedense
- Azadirachta indica
- Abrus precatorius
- Zingiber officinale

Practical :8 **Plant pathology:** Causal organisms, symptoms and control measures of the following plant diseases

- Leaf spot of Mango
- Red rot of Sugarcane
- Bacterial blight of Paddy
- Little leaf of Brinjal
- Citrus Canker

Practical :9 **Weed Management:** Observation of weeds with reference to Botanical Name, Family, Morphological peculiarities:

- Native – Cynodon, Cyprus, Amaranthus, Panicum
- Exotic/Invasive – Alternanthera, Desmostachya, Euphorbia, Malachra

Practical :10 Gymnosperms (Cycas)

- Preparation of slides from the fresh material by the students -:
  - ❖ T.S. of Rachis
  - ❖ T.S. of Leaflet
- Permanent Slides: T.S. of Leaflet, T.S. of Rachis, T.S. of Coralloid root, T.S. of Microsporophyll, T.S. of Megasporophyll, L.S. of Ovule
- Preserve Specimen: Coralloid root, Microsporophyll and Megasporophyll

Practical :11 **Phyllotaxy:**

- (i) Distichous phyllotaxy
- (ii) Tristichous
- (iii) Pentastichous
- (iv) Opposite superpose
- (v) Opposite decussate
- (vi) Verticillate or Whorled
- (vii) Leaf mosaic
- (viii) Heterophylly

Practical :12 **Aestivation**

- Valvate: Calyx of *Hibiscus rosasinensis*
- Twisted: Corolla of *Hibiscus rosasinensis*
- Imbricate: Corolla of *Caesalpinia pulcherrima*
- Quincuncial : Corolla of *Antigonon leptopus*
- Vexillary : Corolla of *Clitoria ternatea*

Practical :13 **Inflorescence:**

- RACEMOSE
  - (a) Raceme: *Caesalpinia pulcherrima*, *Brassica juncea*
  - (b) Spike: *Achyranthus aspera*, *Polianthes tuberosa*
  - (c) Spadix: *Colocasia*

- (d) Catkin: Acalyphahispida
- (e) Spikelets: Poaceae (any plant)
- (f) Corymb: Cassia, Ixora
- (g) Umbel: Coriandrum
- (h) Capitata: Acacia, Albizzia
- (i) Capitulum: Helianthus, Tridax

➤ **CYMOSE**

Unbranched:

- (a) Solitary Terminal: Datura
- (b) Solitary Axillary: Hibiscus

Branched:

- (c) Helicoid: Hamelia
- (d) Scorpioid: Heliotropium
- (e) Dichasial or Biparous: Clerodendrum, Nyctanthus, Jasminum
- (f) Polychasial or Multiparous: Nerium, Calotropis

Practical :14 **Placentation:** Study of Placentation to be demonstrated by permanent slides.

- (i) Marginal
- (ii) Axile
- (iii) Free central
- (iv) Parietal
- (v) Superficial
- (vi) Basal

Practical :15 **Angiosperm: (Families)**

- Study of Morphological characters, floral dissection, T.S. of Ovary and floral formulae of following families.
  - (i) Malvaceae : *Hibiscus rosasinensis*, *Thespesia*, *Gossypium*
  - (ii) Convolvulaceae: *Ipomeapalmeta*
  - (iii) Apocynaceae : *Nerium*, *Allamanda*, *Catharanthusroseus*
  - (iv) Nyctaginaceae : *Bougainvillia*, *Mirabilis*
  - (v) Amaryllidaceae : *Crinum*, *Polianthes*

## References:

1. College Botany Vol. I - III Gangulee, etal. 5th Edi. 1990 New central book agency Calcute
2. College Botany A. C. Datta 3rd Edi. 1989 Oxford Bombay
3. Taxonomy of Angiosperms V. Singh 1st Edi. 1981 Rastogi pub.
4. Plant Physiology by Frank B. Salisbury.
5. Plant Pathology by R.S. Mahrotra
6. Vansptishaastra J.V.Joshi & H.K.Patel 4th edi. 2002 Popular prakashan, Surat
7. Plant pathology R.S. Mehrotra 4th Edi. 1987 Tata McGRAW Hill, New Delhi
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9. A text Book of Botany paper III Dr. T.G.Gohil and Dr. Alpesh B. Thakor 1st Edi. 2007 - 2008 Popular prakashan, Surat
10. A text book of Plant Ecology R.S. Ambasht 1st Edi. 1969 Students friends & co., Varanasi
12. Botany for Degree Student- P.C. Vashishta 1st Edi.
13. Modern Practical Botany Vol. II B.P. Pandey 1995 S. Chand & Company, New delhi.
14. Plant Anatomy B.P. Pandey 1st Edi 1978 S. Chand & Company, New delhi.
15. Taxonomy of Angiosperms V. Singh 1st Edi. 1981 Rastogi pub.
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17. Vansptishaastra paper 1 (Semester II) Dr. T.G.Gohil and Dr. Alpesh B. Thakor 1st Edi. 2011 Popular prakashan, Surat
18. Economic Botany Albert F. Hill 2nd Edi. 1976 Tata McGRAW Hill, New Delhi
19. Plant Physiology Susbeela M. Das 1st Edi. 2003 Dominant publisher, New Delhi
20. Plant Physiology by Taiz and ZeigerSinauer Associates inc. publishers21. Fundamentals of Ecology by E P Odum and G W Barrett. Thompson Asia Pvt Ltd. Singapore.

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**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**  
**SYLLABUS FOR B.Sc. SEMESTER - III & IV**  
**BOTANY**  
(Effective from June 2019)

Semester	Paper No.	Title	
III	301	Plant Physiology and Plant Ecology	
	302	Plant Anatomy, Plant Embryology and Genetics	
	303	Diversity of Gymnosperms and Angiosperms	
	Pra. 304	Practical 304	
	ID	Nutrition and Dietetics (I.D.)	
IV	401	Lower Cryptogams	
	402	Higher Cryptogams	
	403	Plant Geography, Economic Botany, Seed Plants and Plant Pathology	
	Pra. 404	Practical 404	
	ID	Biodiversity (I.D.)	



**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**  
**SYLLABUS FOR B.Sc. SEMESTER - III**  
**BOTANY PAPER - 301**  
**(Effective from June 2019)**

**BOT 301 : Plant Physiology and Plant Ecology**

**Unit - I Plant Physiology I**

- (A) Water Potential and Root Absorption
  - Method, path and types of root absorption
  - Factors affecting root absorption
- (B) Ascent of Sap
  - Introduction
  - Ascent of sap by xylem
  - Root pressure theory
  - Dixon's theory of Cohesion of water
- (C) Transpiration
  - Introduction
  - Types and structure of Stomata
  - Mechanism of stomatal transpiration
  - Significance of transpiration
  - Factors affecting transpiration

**Unit - II Plant Physiology II**

- (A) Respiration
  - Introduction
  - Types of respiration
  - Mechanism of respiration
    - (i) Glycolysis
    - (ii) Kreb's cycle
  - Oxydative phosphorylation
  - ATP synthesis in aerobic respiration
  - Factors affecting respiration

**Unit - III Plant Ecology I**

- (A) Ecosystem
  - Concept of Ecosystem
  - Types & Components of Ecosystem
  - Food chain, Food webs and Ecological Pyramids
  - Energy flow in ecosystem

**Unit - IV Plant Ecology II**

- (A) Plant communities:
  - Halophytes
  - Epiphytes
  - Lithophytes
- (B) Ecological Factors: Climatic and Edaphic factor
- (C) Soil erosion and conservation:
  - General introduction, types of soil erosion, factors responsible for soil erosion, control of soil erosion.

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**  
**SYLLABUS FOR B.Sc. SEMESTER - III**  
**BOTANY PAPER - 302**  
**(Effective from June 2019)**

**BOT 302 : Anatomy, Embryology and Genetics**

**Unit - I     Anatomy I**

- Primary tissue structure in Roots
  - Monocot Root
  - Dicot Root
- Primary tissue structure in Stems
  - Monocot Stem
  - Dicot Stem
- Primary tissue structure in Leaf
  - Monocot Leaf
  - Dicot Leaf

**Unit - II     Anatomy II**

- Definition and Study of normal & anomalous secondary growth seen in the following plants.  
(i) Bignonia (ii) Nyctanthus (iii) Boerhaavia (iv) Dracena.

**Unit - III     Embryology I**

- Microsporangium and Male gametophyte
  - Structure of Microsporangium, Microsporogenesis and Male Gametophyte.
- Megasporangium and Female gametophyte
  - Structure of Megasporangium, Megasporogenesis and Female Gametophyte.
- Fertilization

**Unit - IV     Genetics**

- Heredity
  - Mendel's experiments
  - Mendel's laws of inheritance
  - Linkage and Crossing over
- Genetic material and its Structure
  - Chemical Composition of gene
  - Nucleic Acids
  - Structure of DNA
  - Types of RNA

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**  
**SYLLABUS FOR B.Sc. SEMESTER - III**  
**BOTANY PAPER - 303**  
**(Effective from June 2019)**

**BOT 303 : Diversity of Gymnosperm and Angiosperms**

**Unit - I    Gymnosperm**

- Classification with reason, External Morphology, Internal Structure, Reproduction, (Except development) Male gametophyte, Female gametophyte, Fertilization, Germination of seed of following:

- (i)    Pinus
- (ii)   Gnetum

**Unit - II    Plant Structure I**

- Weak stem plants
- Bracts
- Special types of inflorescence
- Fruits

**Unit - III    Plant Structure II**

- **Pollination**  
Pollination Definition, Self-pollination and Cross pollination;  
Pollination in Salvia, Ficus, Orchids and Vallisneria
- Defensive devices of plants

**Unit - IV    Angiosperm**

- Plant taxonomy : Principle of Plant taxonomy
- Classification with reasons (according to Bentham and Hooker system), general and distinguishing characters and examples (scientific name) of important plants of the following families.
  1. Brassicaceae
  2. Papilionaceae
  3. Caesalpiniaceae
  4. Mimosaceae
  5. Rubiaceae
  6. Asclepiadaceae
  7. Euphorbiaceae
  8. Pontideriaceae

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**  
**SYLLABUS FOR B.Sc. SEMESTER - III**  
**BOTANY PRACTICAL - 304**  
**(Effective from June 2019)**

**BOT - 304 :**

- The candidates should study the typical vegetation in natural condition and should record their observation in journals. Excursion should be arranged during the year to local places.
- Every candidate shall complete laboratory course in accordance with the regulations issued from time to time by Academic Council on the recommendation of the Board of Studies.
- Every candidate shall record observation directly in the laboratory journal. Every journal shall be signed periodically. At the end of the semester candidate shall produce certified journal during the practical examination.

**Practical : 1** To study Physiological experiments for demonstration.

1. To demonstrate anaerobic respiration
2. Release of CO<sub>2</sub> during aerobic respiration. (Conical flask method).
3. To demonstrate that energy is released in the form of heat during respiration.
4. To demonstrate the phenomenon of transpiration. (Bell-jar method)
5. Demonstration of the stomatal transpiration by four leaves method.
6. To demonstrate that water moves through the xylem.

**Practical : 2** To Study principle and working method of ecological instruments.

1. Thermograph
2. Hygrograph
3. Anemometer
4. Rain gauge
5. Sling Psychrometer
6. Soil thermometer.

**Practical : 3** To study ecological peculiarities of Orchid Root and Leaf.

**Practical : 4** To study ecological peculiarities of Avicennia Root and Leaf.

**Practical : 5** To study primary tissue structure in stem of Sunflower and Maize.

**Practical : 6** To study anomalous secondary growth in Bignonia.

**Practical : 7** To study anomalous secondary growth in Nyctanthus.

**Practical : 8** To study anomalous secondary growth in Boerhaavia.

**Practical : 9** To Study permanent slides of Anatomy.

1. Sunflower root T.S.
2. Maize root T.S.
3. Sunflower stem T.S.
4. Maize stem T.S.
5. Sunflower leaf T.S.
6. Maize leaf T.S.
7. Bignonia old stem T.S.
8. Boerhaavia old stem T.S.
9. Nyctanthus old stem T.S.
10. Dracina old stem T.S.

- Practical : 10** To Study permanent slides of Embryology.
1. T.S. of young anther
  2. T.S. of mature anther showing dehiscence
  3. Pollen tetrad
  4. Germination of pollen grain
  5. Pollinia
  6. L.S. of ovule showing megasporogenesis
- Practical : 11** (A) To study external morphology and anatomy of pinus needle (leaf).  
(Preparation of slides from the fresh/Preserved material by the students)
- (B) To Study permanent slides of Pinus.
1. Pinus young stem T.S.
  2. Pinus needle T.S.
  3. Pinus male cone T.S.
  4. Pinus male cone L.S.
  5. Pinus female cone T.S.
  6. Pinus female cone L.S.
- Practical : 12** (A) To study external morphology and anatomy of Gnetum.  
{Preparation of slides from the fresh/Preserved material (twig, male cone and female cones) by the students}.
- (B) To study Permanent slide of Gnetum.
1. Gnetum young stem T.S.
  2. Gnetum old stem T.S.
  3. Gnetum Leaf T.S.
  4. Gnetum male cone T.S.
  5. Gnetum male cone L.S.,
  6. Gnetum Female cone T.S.
  7. Gnetum Female cone L.S.
  8. Gnetum ovule L.S.
- Practical : 13** To study weak stem plants.
1. Creepers: Cynodon, Centella
  2. Trailers: Boerhaavia diffusa
  3. Twiners: Ipomea carica (Ipomea palmeta)
  4. Dolichos lablab
  5. Tendril climber: Passion flower, Vitis sp., Pisum Sp., Clematis, Tropeolum, Gloriosa superb, Smilax, Antigonon
  6. Root climbers: Pothos
  7. Scramblers and hook climbers: Rose, Cane, Artobotrys, Zizyphus
  8. Adhesive climber: Ficus repens
- Practical : 14** To study Bracts.
1. Foliaceous- Adhatoda
  2. Petaliod- Bougainvillia
  3. Spathy- Colocasia
  4. Involucral -Halianthus/Tridex
  5. Scaly- Halianthus/Tridex (disk florets)
  6. Cupule- Hibiscus
  7. Glumes- Maize, grass
- Practical : 15** To study special types of inflorescence.
1. Hypanthodium: Ficus
  2. Cyathium: Euphorbia
  3. Coenanthium: Doerstania
  4. Verticillaster: Ocimum

Practical : 16 To study defensive devices of plants.

1. Thorns- Carissa, Bougainvillea
2. Spines – Zizyphus, Accacia, Opuntia
3. Prickles- Rose, Smilax
4. Stinging hair- Urtica
5. Glandular hairs – Jatropha
6. Sticky latex – Euphorbia, Calotropis

Practical : 17 To Study Morphological characters, floral dissection, T.S. of Ovary and floral formulae of following families (any local plants of these family)

1. To study family Brassicaceae
2. To study family Papilionaceae
3. To study family Caesalpiniaceae
4. To study family Mimosaceae
5. To study family Rubiaceae
6. To study family Asclepiadaceae
7. To study family Euphorbiaceae
8. To study family Pontideriaceae

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**  
**SYLLABUS FOR B.Sc. SEMESTER - IV**  
**BOTANY PAPER - 401**  
**(Effective from June 2019)**

**BOT 401: Lower Cryptogams**

**Unit - I     Phytoplankton and Algae**

- General characters, structure and importance of Phytoplankton
- Occurrence, general characters, thallus structure, economic importance of Algae
- Outline of algal classification given by G.M. Smith

**Unit - II     Life history of Algae**

- Classification, occurrence, thallus & cell structure and reproduction of following algal genera:
  - (i) Oscillatoria
  - (ii) Oodogonium
  - (iii) Ectocarpus
  - (iv) Batrachospermum

**Unit - III    Fungi**

- Occurrence, general characters, vegetative structure, economic importance of Fungi.
- Outline of fungal classification given by C.J. Alexopoulos.

**Unit - IV    Life history of Fungi**

- Classification, occurrence, vegetative structure and reproduction of following fungal genera:
  - (i) Pythium
  - (ii) Aspergillus
  - (iii) Peziza
  - (iv) Puccinia

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**  
**SYLLABUS FOR B.Sc. SEMESTER - IV**  
**BOTANY PAPER - 402**  
**(Effective from June 2019)**

**BOT 402 : Higher Cryptogams**

**Unit - I    Bryophytes**

- General characters
- Classification
- General account of Hepaticopsida, Anthocerotopsida and Bryopsida
- Amphibian adaptation of Bryophytes
- Economic importance of Bryophytes
- Ecological aspects of Bryophyta

**Unit - II    Life history of following Bryophytes**

- Classification and life history of following types.(except development)
  - (i) Riccia
  - (ii) Anthoceros

**Unit - III    Pteridophytes**

- Habit and Habitate
- General characters
- Classification
- General account of Lycopsida, Sphenopsida, Pteropsida

**Unit - IV    Life history of following Pteridophytes**

- Classification and life history of following types.(except development)
  - (i) Equisetum
  - (ii) Marsellia
  - (iii) Sellaginella



VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - IV

BOTANY PAPER - 403

(Effective from June 2019)

**BOT 403: Plant Geography, Economic Botany, Seed Plants and Plant Pathology**

**Unit - I Plant Geography**

- Minor forest products of gujarat
- Cultivation of the following crops in relation to their origin, distribution, climate, soil, propagation, method of cultivation and uses.  
(i) Wheat (ii) Lady's finger (iii) Chilly (iv) Rose

**Unit - II Economic Botany**

- Scientific name, family, parts used and medicinal uses of the following plants.
  - i.) Tylophora indica (Dam vel)
  - ii.) Hemidesmus indicus (Anant mool)
  - iii.) Achyranthes aspera (Aghedo)
  - iv.) Mucuna pruriens (Kavach)
  - v.) Aloe barbedense (Kuvarpathu)
  - vi.) Terminalia belerica (Behda)
  - vii.) Embelica officinalis (Ambla)
  - viii.) Centella asiatica (Bhrami)
  - ix.) Helicteres isora (Marda singh)
  - x.) Santalum album (Chandan)
- Rubber and its products :  
Chemical properties, tapping, grading, packing, marketing and uses

**Unit - III Seed plants**

- Classification with reasons (according to Bentham and Hooker system), general and distinguishing characters and examples (scientific name) of important plants of the following families.
  - 1. Anonaceae
  - 2. Rosaceae
  - 3. Combretaceae
  - 4. Myrtaceae
  - 5. Asteraceae
  - 6. Loranthaceae
  - 7. Liliaceae
  - 8. Arecaceae

**Unit - IV Plant pathology**

- Pathogen (Scientific name) and symptoms of following diseases
- (a) Late blight of potato
  - (b) Tikka disease of ground nut
  - (c) White rust of Crucifer
  - (d) Red stripe of Sugarcane
  - (e) Soft rot of apple
  - (f) Tobacco Mosaic Virus (TMV)

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**  
**SYLLABUS FOR B.Sc. SEMESTER - IV**  
**BOTANY PRACTICAL - 404**  
**(Effective from June 2019)**

**BOT - 404 :**

- The candidates should study the typical vegetation in natural condition and should record their observation in journals. Excursion should be arranged during the year to local places.
- Every candidate shall complete laboratory course in accordance with the regulations issued from time to time by Academic Council on the recommendation of the Board of Studies.
- Every candidate shall record observation directly in the laboratory journal. Every journal shall be signed periodically. At the end of the semester candidate shall produce certified journal during the practical examination.

- Practical : 1      To study thallus structure and hormogonia of algae *Oscillatoria*.  
(Permanent slides of *Oscillatoria* thallus W.M.)
- Practical : 2      To study thallus structure, oogonium and antheridium of algae *Oodogonium*.  
(Permanent slides of *Oodogonium* thallus W.M.; oogonium and antheridium.)
- Practical : 3      To study thallus structure, unilocular and plurilocular sporangium of algae *Ecocarpus*.  
(permanent slides of *Ectocarpus* thallus W.M.; Unilocular sporangium, Plurilocular sporangium.)
- Practical : 4      To study thallus structure and cystocarp of algae *Batrachospermum*.  
(Permanent slides of *Batrachospermum* thallus structure; cystocarp)
- Practical : 5      To study vegetative structure of fungi *Pythium*.  
(Permanent slide of *Pythium* W.M.)
- Practical : 6      To study vegetative structure of fungi *Aspergillus*.  
(Permanent slide of *Aspergillus* W.M.; Conidia)
- Practical : 7      To study structure of *Peziza*.  
(Permanent slide of *Peziza* Apothecia V.M.)
- Practical : 8      To study the stages on wheat leaf (Uredospore and Teleuto spore)  
(Permanent slide of Uredospore, Teleuto spore, Pycnidiospores, Aecidiospores)
- Practical : 9      To study external features of gametophytes, anatomy of thallus and sporophytes of *Anthoceros*.  
(Permanent slides of *Anthoceros* thallus T.S., *Anthoceros* antheredia, *Anthoceros* archegonia, *Anthoceros* sporophyte)
- Practical : 10      To study external features of gametophytes, anatomy of thallus and sporophytes of *Riccia*.  
(Permanent slides of *Riccia* thallus T.S., *Riccia* sporophyte).
- Practical : 11      To study external morphology, anatomy of internode of aerial stem and cone of *Equisetum*.  
(Permanent slides of *Equisetum* stem T.S., *Equisetum* cone T.S. and L.S.)

- Practical : 12 To study external morphology and anatomy of Marsellia plant with structure of spore producing organs.  
(Permanent slides of Marsellia stem T.S., petiole T.S., Sporocarp T.S. and L.S.)
- Practical : 13 To study external morphology of Selaginella and anatomical characters of stem, leaf and strobilus.  
(Permanent slides of Root T.S., Leaf T.S., Stem T. S. Strobilus L.S., Microsporangium L.S. and Megasporangium L.S.)
- Practical : 14 To study following minor forest products.
- i. Gum (Acacia gum)
  - ii. Bidee wrappers (Diospyros sp.)
  - iii. Fiber (Jute)
  - iv. Match box
  - v. Paper
  - vi. Dye (Bixa orellana)
  - vii. Baj (Butea monosperma)
- Practical : 15 To study Botanical name, family, origin and distribution of the following.
- i. Wheat
  - ii. Lady's finger
  - iii. Chilly
  - iv. Rose
- Practical : 16 To study Scientific name, family, parts used and medicinal uses of the following plants.
- i.) Tylophora indica (Dam vel)
  - ii.) Hemidesmus indicus (Anant mool)
  - iii.) Achyranthes aspera (Aghedo)
  - iv.) Mucuna pruriens (Kavach)
  - v.) Aloe barbedense (Kuarpathu)
  - vi.) Terminalia belerica (Behda)
  - vii.) Embelica officinalis (Ambla)
  - viii.) Centella asiatica (Bhrami)
  - ix.) Helicteres isora (Marda singh)
  - x.) Santalum album (Chandan)
- Practical : 17 To Study Morphological characters, floral dissection, T.S. of Ovary and floral formulae of following families (any local plants of these family)
1. To study family Anonaceae
  2. To study family Rosaceae
  3. To study family Combretaceae
  4. To study family Myrtaceae
  5. To study family Asteraceae
  6. To study family Loranthaceae
  7. To study family Liliaceae
  8. To study family Arcaceae

Practical : 18 To study Pathogen (Scientific name) and symptoms of following diseases.

- (a) Late blight of potato
- (b) Tikka disease of ground nut
- (c) White rust of Crucifer
- (d) Red stripe of Sugarcane
- (e) Soft rot of apple
- (f) Tobacco Mosaic Virus (TMV)

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- 4. Cryptogamic Botany Vol. I - II G.M.Smith 2nd Edi. 1955 Tata MCGrow Hill Bombay**
- 5. Vansptishaastra (Semester II) Dr. T.G.Gohil and Dr. Alpesh B. Thakor 1st Edi. 2011 Popular prakashan, Surat**
- 6. Vansptishaastra J.V.Joshi & H.K.Patel 4th edi. 2002 Popular prakashan, Surat**
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- 9. A text Book of Botany paper III Dr. T.G.Gohil and Dr. Alpesh B. Thakor 1st Edi. 2007 - 2008 Popular prakashan, Surat**
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- 13. Modern Practical Botany Vol. II B.P. Pandey 1995 S. Chand & Company, New delhi.**
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- 25. A text book of Plant Ecology R.S. Ambasht 1st Edi. 1969 Students friends & co., Varanasi**
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**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**  
**SYLLABUS FOR B.Sc. SEMESTER - III**  
**NUTRITION AND DIETETICS (I.D.)**  
**(Effective from June 2019)**

**Unit: 1 - Definition of Food, Nutrition And Nutrients.**

- Function of Food, Classifications Food Groups, Importance of Food

Group and Nutritive Value of Food Groups. (i) Cereals, (ii) Pulses (iii) Fruits and Vegetables (iv) Milk (v) Sugar And Jaggery (vi) Fats and Oil.

- Concept of Balance Diet, use of food group in planning balance diet.

- Use of recommended dietary intake (RDIs) in planning balance diet, factors affecting RDIs.

**Unit: 2**

**Macronutrients:**

-Carbohydrate: Definition, sources, functions and deficiency symptoms.

-Protein: Definition, sources, functions and deficiency symptoms.

-Fat and lipids: Definition, sources, functions and deficiency symptoms.

**Micronutrients:**

-Vitamins: Definition, sources, functions and deficiency symptoms.

- Minerals: Definition, sources, functions and deficiency symptoms.

- Water: As a nutrient, requirements, and functions

**Unit: 3 Food preservation -Introduction and Definition**

-Importance and Principles of food preservation

-Methods for food preservation -Food spoilage.

**Unit: 4 Meal planning Definition and principles**

- Factors to be considered in meal planning,

- meal planning for School children, teen age and during travel,

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**  
**SYLLABUS FOR B.Sc. SEMESTER - IV**  
**BIODIVERSITY (I.D.)**  
**(Effective from June 2019)**

**Unit-1. - Introduction and scope of biodiversity.**

- Importance and values of biodiversity.

**Unit-2 - General pattern of vegetation of Gujarat.**

- Deciduous forest. - Scrub forest
- Vegetation of ponds and ditches.
- Vegetation of river bank.
- Vegetation along Sea shore and saline ground.

**Unit-3. - Conservation of biodiversity.**

- Endangered, endemic, threatened and rare species of Gujarat and efforts for its conservation.

**Unit-4. - Biodiversity of flora, fauna, mangroves and medicinal Plants of Gujarat.**

- In-situ & Ex-situ conservation
- Biodiversity act.
- Biological hot-spots.