Estd. 1962
NAAC 'A' Grade

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दुरध्वनी (ईपीएबीएक्स) २६०९००० (अभ्यास मंडळे विभाग– २६०९०९४)
फॅक्स : ००९१-०२३१-२६९१५३३ व २६९२३३३.e-mail:bos@unishivaji.ac.in

जा.क्र./एसयु/बीओएस/ No 0 0 1 6 1 दिनांक : 4 MAR 2021

प्रति,

मा.प्राचार्य,/संचालक
सर्व संलग्नित महाविद्यालये/मान्यताप्राप्त संस्था,
(विज्ञान विद्याशाखे अंतर्गत)
शिवाजी विद्यापीठ, कोल्हापूर

मा.अधिविभाग प्रमुख,
सर्व पदव्युत्तर अधिविभाग व महाविद्यालये,
(विज्ञान विद्याशाखे अंतर्गत)
शिवाजी विद्यापीठ, कोल्हापूर

विषयः– शैक्षणिक वर्ष 2020–21 च्या परिक्षेसाठीच्या प्रश्ननियोजनासाठी अभ्यासक्रम कमी करण्यात आला असलेबाबत.

महोदय/महोदया,

उपरोक्त विषयासंदर्भात विद्यापीठ अधिकार मंडळाच्या निर्णयानुसार आपणास कळविण्यात येते की, विज्ञान व तंत्रज्ञान विद्याशाखा अंतर्गत येणाऱ्या अभ्यासक्रमामधील शैक्षणिक वर्ष 2020–21 च्या परिक्षेच्या प्रश्नपत्रिका नियोजनासाठी अभ्यासक्रम कमी करण्यात आला आहे. (सोबतच्या यादीप्रमाणे.) तथापी जे घटक प्रश्नपत्रिका नियोजनासाठी वगळण्यात आले आहेत, त्यांचे अध्यापन पूर्ण करण्यात यावे.

सदरचा कमी करण्यात आलेला अभ्यासक्रम विद्यापीठाच्या www.unishivaji.ac.in (Students-Online Syllabus) या संकेतस्थळावर उपलब्ध करण्यात आला आहे. सदरचे परिपत्रक विद्यार्थी/पालक /शिक्षक/शिक्षकेतर सेवक यांच्या निदर्शनास आणून द्यावे. व महाविद्यालयाच्या नोटीस बोर्डवर लावावे,

कळावे,

आपला विश्वासू

उपकुलसचिव

सोबतः वरिलप्रमाणे.

प्रत :– 1) संचालक,परीक्षा व मुल्यमापन मंडळ.
2) प्र.अधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा.
3) अध्यक्ष,सर्व अभ्यासमंडळ/अस्थायी मंडळ,विज्ञान व तंत्रज्ञान विद्याशाखा.
4) उपकुलसचिव, परीक्षा व बी.एस्सी./एम.एस्सी. परीक्षा विभाग

Statistics		
Program	**Sem/Paper**	**Syllabus not to be considered for examination**
B.Sc -I	Paper - I	2.3 Attributes
	Paper - II	Bayes theorem and 2.2 Independence
	Paper - III	2.2 Test of Index no.
	Paper - IV	2.2 Bivariate Discrete Distributions
B.Sc -II	Paper - V	2.2 Transformations Continuous r.v.s.
	Paper - VI	2.2 Demography
	Paper - VII	1.2 Gamma and Beta distribution
	Paper - VIII	1.1 Time Series
B.Sc -III	Paper -IX	2.1 Truncated distribution
	Paper -X	2.3 Method of estimation
	Paper -XI	1.2,1.3,1.4 :- IV - Visual inspection of treatment effects using treatment wise Box-plot for CRD,RBD,LSD 1.2- VII- Model adequacy Cheak using residual analysis 2.1 Analysis of non-normal data in CRD,RBD,LSD
	Paper -XII	2.2 Process control 2.3 Product control
	Paper -XIII	2.3 Ageing Properties
	Paper -XIV	2.2 Non-Parametric Methods
	Paper -XV	2.4 Ratio method 2.5 Regression method
	Paper -XVI	2.2 Simulation Techniques

Statistics and Applied Statistics and Informatics		
Program	**Sem/Paper**	**Syllabus not to be considered for examination**
M.Sc. Part I and II Statistics	all Semesters	Unit No.4 Deleted of all Papers for all Semesters.
M.Sc. Part I and II Applied Statistics		

Mathematics		
Program	**Sem/Paper**	**Syllabus not to be considered for examination**
B.Sc. Part I Sem I	DSC – 5A (DIFFERENTIAL CALCULUS)	2.3 Partial differentiation, Chain rule (without proof) and its examples. 2.4 Euler's theorem on homogenous functions. 2.5 Maxima and Minima for functions of two variables. 2.6 Lagrange's Method of undetermined multipliers.
	DSC – 6A (CALCULUS)	2.6 Theorem: Continuity is necessary but not a sufficient condition for the existence of a derivative. 2.7.1. If a function f is continuous in a closed interval [a, b] then it is bounded in [a, b]. 2.7.2. If a function f is continuous in a closed interval [a, b] then it attains its bounds at least once in [a, b]. 2.7.3. If a function f is continuous in a closed interval [a, b] and if f(a), f(b) are of opposite signs then there exists c ∈ [a, b] such that f(c) = 0. (Statement Only) 2.7.4. If a function f is continuous in a closed interval [a, b] and if f(a) ≠ f(b) then f assumes every value between f(a) and f(b). (Statement Only)
B.Sc. Part I Sem II	DSC – 5B (DIFFERENTIAL EQUATIONS)	2.2: Homogeneous Linear Differential Equations (The Cauchy-Euler Equations) 2.2.1: Introduction and Method of Solution. 2.2.2: Legendre's Linear Equations. 2.2.3: Method of Solution of Legendre's Linear Equations. 2.2.4: Examples.
	- DSC – 6B (HIGHER ORDER ORDINARY DIFFERENTIAL EQUATIONS AND PARTIAL DIFFERENTIAL EQUATIONS)	2.3: Charpit's method 2.3.1: Special methods of solutions applicable to certain standard forms 2.3.2: Only p and q present 2.3.3: Clairaut's equations 2.3.4: Only p, q and z present 2.3.5: f(x,p) = g(y,q) 2.3.6: Examples
	Practical	4) Maxima and Minima of functions of two variables

		17) Examples on Charpit's method. 18) Examples on Clairaut' s Forms.
B.Sc. Part II Sem III	DSC – 5C Real Analysis–I	2.4. Completeness property of R 2.4.4. **Theorem: (Archimedean Property)** If $x \in \mathbb{R}$, then there ex that $x \leq n_x$. 2.4.5. **Corollary:** If $S = \left\{\frac{1}{n} : n \in \mathbb{N}\right\}$, then inf$S = 0$. 2.4.6. **Corollary:** If $t > 0$, then there exists $n_t \in \mathbb{N}$ such that $0 <$ 2.4.7. **Corollary:** If $y > 0$, then there exists $n_y \in \mathbb{N}$ such that n_y 2.4.8. **Theorem:** There exists a positive real number x such that 2.4.9. **Theorem: (The Density theorem)**If x and y are any real nu then there exists a rational number $r \in \mathbb{Q}$ such that $x < r <$ 2.4.10. **Corollary:** If x and y are real numbers with $x < y$, then the irrational number z such that $x < z < y$. **2.5. Intervals** 2.5.1. **Characterization theorem:** If S is a subset of $\mathbb{R}$ that contai points and has the property if $x, y \in S$ and $x < y$, thenthe closed interval$[x, y] \subseteq S$, then$S$ is an interval.
	DSC – 6C Algebra–I	2.4. **Cyclic Groups and its Properties** 2.4.1. **Definition** of Cyclic group generated by an element, Cyclic sub and examples 2.4.2.**Theorem:** If G is a group and a ∈ G is a fixed element of G, ther | n ∈ Z } is a subgroup of G. 2.4.3. **Definition** of Order of an element of a group and its propertie 2.4.4. **Theorem:** Every cyclic group is abelian.

		2.4.5. **Theorem:** If a is a generator of a cyclic group G, so is a^{-1}. 2.4.6. **Theorem:** If a is a generator of a cyclic group G, then O(a) = O(2.4.7. **Theorem:** If G is a finite group of order n containing an elemer then G is cyclic. 2.4.8. **Theorem:** If in a cyclic group <a> of order k, $a^m = a^n$ (m ≠ n), th k). 2.4.9. **Theorem:** Every subgroup of a cyclic group is cyclic. 2.4.10. **Theorem:** A cyclic group of order d has ∅(d) generators. 2.5. **Cosets** 2.5.1. **Definition** of Left and Right Cosets in group G and examples 2.5.2. **Theorem:** If H is a subgroup of G, then (i) Ha = H if and only if a ∈ H (ii) Ha = Hb if and only if $ab^{-1} \in H$ (iii) Ha is a subgroup of G if and only if a ∈ H 2.5.3. **Theorem:** If H is a subgroup of G, then for all a ∈ G Ha = {x ∈ G H}. 2.5.4. **Theorem:** If H is a subgroup of G then there exists a one to one between any two right (left) cosets of H in G.
B.Sc. Part II Sem IV	DSC – 5D Real Analysis – II	**2.3.10** Raabe's Test: If $\sum u_n$ is a positive term series such that Lim n{ $(u_n / u_{n+1}) - 1$ } = L, then the series (i) converges, if L (ii) diverges, if L < 1, and (iii) the test fails, if L = 1. **2.3.11** Examples. **2.4 Alternating Series** **2.4.1** Definition and examples. **2.4.2** Leibnitz Test: If the alternating series $u_1 - u_2 + u_3 - u_4 + \cdots$ every n) is such that (i) $u_{n+1} \leq u_n$, for every n and (ii) lim series converges. **2.4.3** Examples. **2.5 Absolute and Conditional Convergence** **2.5.1** Definition and examples . **2.5.2** Theorem: Every absolutely convergent series is convergent **2.5.3** Examples.

<table>
<tr>
<td></td>
<td>DSC – 6
Algebra-II</td>
<td>2.1.7 (iii) Any infinite cyclic group is isomorphic to the group Z of integers, under addition.

(iv) Any finite cyclic group of order n is isomorphic to additive group of integers modulo n.

2.3. Rings 2.3.1. Definition and examples. 2.3.2. Basic Properties. 2.3.3. Homomorphism and isomorphism in a ring. 2.3.4. Multiplicative questions: Fields 2.3.5. Examples of Commutative and non-commutative rings. 2.3.6. Rings from number system, Zn the ring of integers modulo n. 2.4. Subrings 2.4.1. Definition and examples. 2.4.2. Basic properties 2.4.3. Ideals: Definition and examples. 2.4.4. Examples of subring which are not ideals.</td>
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<tr>
<td></td>
<td>Core Course Practical in Mathematics (CCPM – II)
Marks 50 (Credit 04) (Real Analysis I & II and Algebra I & II)</td>
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<table>
<tr><th colspan="3">SEMESTER-IV</th></tr>
<tr><td>9</td><td>Rabbi’s test</td><td>1</td></tr>
<tr><td>11</td><td>Cyclic subgroup</td><td>1</td></tr>
<tr><td>12</td><td>Permutation group</td><td>1</td></tr>
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<tr>
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<td>Core Course Practical in Mathematics (CCPM – III) Marks 50 (Creit 04) (Nuerical Recipes in Scilab)</td>
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<tr><th colspan="3">SEMESTER-IV</th></tr>
<tr><td>12</td><td>Graph theory: Havel-Hakimi Theorem, Transitive closure.</td><td>1</td></tr>
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<tr>
<td>B.Sc. Part III
Sem V</td>
<td>DSE – E9
Mathematical Analysis</td>
<td>Fourier Series: Definition of Fourier series and examples on the expansion of functions in Fourier series, Fourier series corresponding to even and odd functions, half range Fourier series, half range sine and cosine series.</td>
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<tr>
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<td>DSE – E10
Abstract Algebra</td>
<td>Polynomial Rings, degree of Polynomial, addition and multiplication of Polynomials and their properties, UFD, Gauss’ Lemma.</td>
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</table>

	DSE – E11 Optimization Techniques	Graphical method for 2 x n games and m x 2 games. Principle of dominance, Job sequencing : Introduction. Terminology and notations. Principal assumptions. Solution of sequencing problems. Processing n jobs through 2 machines. Processing n jobs through 3 machines. Processing 2 jobs through m machines. Processing n jobs through m machines.
	DSE – E12 Integral Transforms	Examples. Finite Fourier Transform and Inverse, Fourier Integrals : Finite Fourier sine and cosine transform with examples. Finite inverse Fourier sine and cosine transform with examples. Fourier integral theorem. Fourier sine and cosine integral (without proof) and examples.
	CCPM IV Operation Research	13 Graphical method for 2 x n games and m x 2 games. 14 Processing n jobs through 2 machines. 15 Processing n jobs through 3 machines. 16. Processing 2 jobs through m machines. Processing n jobs through m machines.
	CCPM V Laplace and Fourier Transform	13 Convolution theorem of Fourier transform 14 Finite Fourier sine transform and inverse 15 Finite Fourier cosine transform and inverse
B.Sc. Part III Sem VI	DSE – F9 Metric Spaces	It is decided not to eliminate any syllabus of this course
	DSE – F10 Linear Algebra	Inner product spaces: Norm of a vector, Cauchy- Schwarz inequality, Orthogonality, Generalized Pythagoras Theorem, orthonormal set, Gram-Schmidt orthogonalization process, Bessel's inequality,
	DSE – F11 Complex Analysis	Residues, Cauchy's residue theorem, Residue at infinity, The three types of isolated singularities, Residues at poles and examples, Zeros of analytic functions, Zeros and poles, Application of residue theorem to evaluate real integrals.
	DSE – F12 Discrete Mathematics	Trees: Definitions and examples of trees, rooted trees, binary trees and their properties. spanning trees , minimal spanning trees, Kruskal'salgorithm , Prim's algorithm, Dijkstra's shortest path algorithm.

B.Sc. (Mathematics) (Part-III) (Semester–V & VI)
(Choice Based Credit System)
(Introduced from June 2020)

Course Code: CCPM IV **Title of Course: Operation Research**

Sr.No.	Title of the experiment	Sessions
13	Graphical method for 2 x n games and m x 2 games.	1
14	Processing n jobs through 2 machines.	1
15	Processing n jobs through 3 machines.	1
16.	Processing 2 jobs through m machines. Processing n jobs through m machines.	1

B.Sc. (Mathematics) (Part-III) (Semester–V & VI)
(Choice Based Credit System)
(Introduced from June 2020)

Course Code: CCPM V **Title of Course: Laplace and Fourier Transform**

14	Finite Fourier sine transform and inverse	1
15	Finite Fourier cosine transform and inverse	1

Course Code: CCPM VI

Title of Course: Mathematical Computation Using Python

It is decided not to eliminate any syllabus of this course

Course Code: CCPM VII

Title of Course: Project, Study- Tour, Viva – Voce

It is decided not to eliminate any syllabus of this course

Mathematics		
Program	**Sem/Paper**	**Syllabus not to be considered for examination**
M.Sc. Part I and II	all Semester	Unit No. IV in all papers

Mathematics		
Program	**Sem/Paper**	**Syllabus not to be considered for examination**
M.Sc. Tech. Part I to II	all Semester	Unit No. IV in all papers

Chemistry		
Program	**Sem/Paper**	**Syllabus not to be considered for examination**
B Sc. I Sem I	**DSC-3A-Paper I** Inorganic Chemistry	**Unit IV- Chemical Bonding and Molecular Structure(C) Molecular Orbital theory(MOT)** (whole unit)
B Sc. I Sem I	**DSC-4A-Paper II** Organic Chemistry	Unit IV -**Cycloalkenes, and Alkadienes**
B Sc. I Sem II	**DSC-3B-Paper III** Physical	**Unit II Chemical Equlibria** (whole unit)

	Chemistry	
B Sc. I Sem II	**DSC-4B-Paper II** Analytical Chemistry	Unit V **Analysis of Fertilizers**(whole unit)
B Sc. II Sem III	**DSC- C3 Paper V** Physical Chemistry	**Unit II Physical Properties of liquids** (whole unit)
B Sc. II Sem III	**DSC-C4 Paper VI** Industrial Chemistry	**Unit IV Paper Industry** (whole unit)
B Sc. II Sem IV	**DSC- D3 Paper VII** Inorganic Chemistry	**Unit V Inorganic semimicro qualitative analysis** (whole unit)
B Sc. II Sem IV	**DSC-D4 Paper VIII** Organic Chemistry	**Unit III Carbohydrates** (whole unit)
B Sc. III Sem V	**Paper IX DSE-E5** Inorganic Chemistry	**Unit I – Acids ,Bases and Nonaqueous solvents** 1.3 Chemistry of nonaqueous solvents 1.3.1 Introduction, definition, Characteristics of Solvents 1.3.2 Classification of solvents 1.3.3 physical properties and Acid Base reactions in liquid ammonia and liquid sulphur dioxide **Unit IV organometallic Chemistry**(whole unit)
B Sc. III Sem V	**Paper- X DSE-E6** Organic Chemistry	**Unit V Mass Spectroscopy** (whole unit)
B Sc. III Sem V	**Paper XI DSE-E7** Physical Chemistry	**Unit I Elementary Quantum Mechanics** (Whole unit)
B Sc. III Sem V	**Paper XII-DSE-E8** Analytical Chemistry	**Unit II Flame photometry** (whole unit)
B Sc. III Sem VI	**Paper XII DSE-F5** Inorganic Chemistry	**Unit I V Iron and Steels** (whole unit)
B Sc. III Sem VI	**Paper- X DSE-F6** Organic Chemistry	**Unit II Retrosynthesis** (whole unit)

B Sc. III Sem VI	**Paper XV DSE-F7** Physical Chemistry	**Unit V Distribution law** (Whole unit**)**
B Sc. III Sem VI	**Paper XII-DSE-F8** Analytical Chemistry	**Unit IV Petroleum industry and eco-friendly fuels** (whole unit)
B.Sc. I	**Practical**	A) Inorganic Chemistry (**Any Four)** B) Organic Chemistry 1. Estimations (**Any One)** 2. Organic Qualitative Analysis: Detection of physical constant, type, functional group, elements, and Confirmatory test. Identification of Organic Compounds **at least Six**.(two from acids, one from phenols, two from bases and one from neutrals) 3. Purification of organic compounds by crystallization (from water and alcohol) and distillation. (**deleted)** C) Physical Chemistry Practical's (**Any Four)**
B. Sc II	**Practical Course**	**Inorganic Chemistry Practical's** 1. Gravimetric Analysis (**Any two)** 2. Inorganic Preparations (**Any two**) 3. Titrimetric Analysis (**Any two**) 4. Semi micro qualitative Analysis **(deleted)** **Organic Chemistry Practical's** A) Organic Qualitative Analysis Identification of at least **SIX** Organic compounds with reactions including two from acids, one from phenols, two from bases and one from neutrals. B) Organic Quantitative Analysis I) Estimations (**Any Two**) II) Organic preparations **(Any Two)** III) Demonstration of Thin layer chromatography.(**deleted)** **Practical's Physical chemistry** • Chemical Kinetics (Any Two) • Viscometry (one) • Conductometry(Any Two) • Refractometry (one) • Polarimetry (One)
B. Sc. III	Practical's	INORGANIC CHEMISTRY I) Gravimetric Estimations (G).(**Any two**) II. Inorganic Preparations (P).(**Any four**)

		A) Percentage Purity (Any two) B) Analysis of Commercial Sample.(**Any Three**) C) Ion exchange method. (deleted) ORGANIC CHEMISTRY **I)** Qualitative analysis Separation of binary mixture and Identification of one component.(**At least Six)** mixtures **II)** Quantitative analysis: Organic estimations:(**Any three)** **III)** Organic Preparations: (**Any three**) **IV)** Preparation of Derivatives(**Any Five)** PHYSICAL CHEMISTRY PRACTICALS **I.** Non instrumental Experiments: **A. Any one** of the following four. **i)** Partition Law. **ii)** Viscosity. **iii)** Adsorption. **iv)** Solubility. B) Chemical kinetics. (**Any three)** C) Partial molar volume. **II.** Instrumental experiments **A.** Potentiometry (**Any three)** B Conductometry (**Any two).** C Refractometry.(**Any One**) D. Colorimetry (**Any one).** E pH – metry (**Any One**)

M. Sc. Part – I

(Inorganic, Organic, Physical, Analytical, Applied and Industrial Chemistry)

Semester I

	Course code	**Paper No.**		**Title of course**	**Topics to be not considered for examination**
CGPA	CC-101	I	CH.1.1	Inorganic Chemistry - I	Unit-IV: Part B Nuclear and radiochemistry
	CC-102	II	CH.1.2	Organic Chemistry - I	Unit IV : Conformational analysis : Cyclohexane derivatives, stability and reactivity,Conformational analysis of disubstituted cyclohexanes. Introduction of optical activity in the absence of chiral carbon (spiranes and allenes)
	CC-103	III	CH.1.3	Physical Chemistry - I	Unit IV: Chemistry of polymerization: Ceiling temperature, Free radical polymerization (Initiation, propagation and termination), kinetics of free radical polymerization, step growth polymerization (Polycondensation), molecular weight distribution, kinetics of step polymerization, cationic and anionic polymerization. Electronically conducting polymers, thermodynamics of polymer solutions: Flory-Huggins Theory. Glass transition temperature and molecular weight, factors influencing Glass transition temperature, determination of glass transition temperature
	CC-104	IV	CH.1.4	Analytical Chemistry - I	Unit IV: Voltametry: Voltammetric methods of analysis, basic principles, instrumentation, voltammetric measurements, voltametric techniques, current in voltammetry, shape of voltammograms, quantitative and qualitative aspects of voltammetry, quantitative applications, characterization applications, Evaluation of CV in research and analytical applications.
	CCPR-105		CHP.1.1	Practical- I	

Semester II

	Course code	Paper No.		Title of course	Topics to be not considered for examination
CGPA	CC-201	V	CH.2.1	Inorganic Chemistry – II	Unit IV: B) Bioinorganic Chemistry
	CC-202	VI	CH.2.2	Organic Chemistry – II	Unit IV: B) Methodologies in organic synthesis
	CC-203	VII	CH.2.3	Physical Chemistry – II	Unit IV: Catalysis: Classification of catalysis, mathematical expression of autocatalytic reactions, Michaelis–Menten enzyme catalysis, Homogeneous catalysis: acid and base catalyzed reactions, Heterogeneous catalysis: Adsorption of gas on a surface and its kinetics, Catalyzed hydrogendeuterium exchange reaction.
	CC-204	VIII	CH.2.4	Analytical Chemistry - II	Unit IV: b) Inductively Coupled Plasma Spectroscopy

M. Sc. Part – II (Inorganic Chemistry)

Semester III

	Course code	Paper No.		Title of course	Topics to be not considered for examination
CGPA	CC-301	IX	ICH 3.1	Inorganic Chemical Spectroscopy	Unit IV : B) X-ray Photo electron Spectroscopy (XPS)
	CCS-302	X	ICH 3.2	Coordination Chemistry – I	Unit IV : Amino acids ester hydrolysis, peptide synthesis & hydrolysis, Decarboxylation of □- keto acids, Applications of mixed ligand complexes in catalysis.
	CCS-303	XI	ICH 3.3	Nuclear Chemistry	Unit IV: Tracer technique in the field of analytical chemistry structure determination elucidation of reaction mechanism, isotopic dilution analysis, neutron activation analysis applications in biological, medical, industrial fields, Age determination.

	DSE-304(A)	XII(A)	ICH 3.4(A)	Organometallic and Bioinorganic Chemistry	Unit IV: Oxygen adsorption isotherm and cooperativity, physiological significance of haemoglobin, role of globin chain in gaemoglobin, Cyanide poisoning and treatment.
	DSE-304(B)	XII(B)	ICH 3.4(B)	Selected Topics in Inorganic Chemistry	Unit IV Design and synthesis of co-receptor molecules and multiple recognition, supramolecular reactivity and catalysis, supramolecular devices, supramolecular photochemistry

Semester IV

	Course code	**Paper No.**		**Title of course**	**Topics to be not considered for examination**
CGPA	CC-401	XIII	ICH 4.1	Instrumental Techniques	Unit IV: Temperature programmed techniques (temperature programmed desorption/oxidation/reduction: TPD/TPR), methods of determination of surface acidity and basicity of solid catalysts, Computer softwares for plotting and analysis of the XRD data, Structure drawing softwares (VESTA)
	CCS-402	XIV	ICH 4.2	Coordination Chemistry II	Unit IV: The Ziegler-Natta Catalyst, Metal complexes in alkene conversions, Complexes and Electroplating, Complexes in Metallurgy. Copper Metal dissolves in Aqueous Potassium Cyanide, Complexes in water softening. Metal complexes in Agriculture.
	CCS-403	XV	ICH 4.3	Chemistry of Inorganic Materials	Unit IV: Applications in the various fields
	DSE-404(A)	XVI(A)	ICH 4.4(A)	Energy and Environmental Chemistry	Unit IV: B) Techniques in Environmental Analysis
	DSE-404(B)	XVI(B)	ICH 4.4(B)	Radiation Chemistry	Unit IV: Instrumentation and health physical instruments and counting statistics. Working of Scintillation and Geiger Muller Counter

M. Sc. Part – II (Organic Chemistry)

Semester III

	Course code	**Paper No.**		**Title of course**	**Topics to be not considered for examination**

CGPA	CC-301	IX	OCH 3.1	Organic Reaction Mechanism	Unit IV: Allylic hydrogenation (NBS), oxidation of aldehydes to carboxylic acids, auto oxidation, coupling of alkynes and arylation of aromatic compounds by diazonium salt,Sandmeyers reaction. Hunsdiecker reaction.
	CCS-302	X	OCH 3.2	Advanced Spectroscopic Methods	Unit IV: Part B
	CCS-303	XI	OCH 3.3	Advanced Synthetic Methods	Unit IV: Microwave and Ultrasound techniques and their applications.
	DSE-304(A)	XII(A)	OCH 3.4(A)	Drugs and Heterocycles	Unit IV: Part B, Benzofused heterocycles with two hetero atom
	DSE-304(B)	XII(B)	OCH 3.4(B)	Polymer Chemistry	Unit IV: Part B , Structural features, properties and uses of commercial polymers
	CCPR-305		OCHP 3.1	Practical –III	

Semester IV

	Course code	**Paper No.**		**Title of course**	**Topics to be not considered for examination**
CGPA	CC-401	XIII	OCH 4.1	Theoretical Organic Chemistry	Unit IV: B) Non-classical carbocations: Formation, stability and reactivity.
	CCS-402	XIV	OCH 4.2	Stereochemistry	Unit IV: (C) O.R.D. and C.D.
	CCS-403	XV	OCH 4.3	Chemistry of Natural Products	Unit IV: C) Vitamins:
	DSE-404(A)	XVI(A)	OCH 4.4(A)	Applied Organic Chemistry	Unit IV: Polymer processing, Plasticizers and anti -oxidants for polymers,
	DSE-404(B)	XVI(B)	OCH 4.4(B)	Bioorganic Chemistry	Unit IV: The chemical basis for heredity, an overview of replication of DNA, transcription, translation and genetic code. Chemical synthesis of mono and poly nucleosides.

M. Sc. Part – II (Physical Chemistry)

Semester III

	Course code	Paper No.		Title of course	Topics to be not considered for examination
CGPA	CC-301	IX	PCH 3.1	Advanced Quantum Chemistry	Unit IV: AM1, PM3, PM5, PM6 etc. methods, comparisons in various above mentioned methods, limitations of semi-empirical methods. Introduction to various software packages for performing semi-empirical calculations.
	CCS-302	X	PCH 3.2	Electrochemistry	Unit IV : Part B Corrosion
	CCS-303	XI	PCH 3.3	Molecular Structure – I	Unit IV : Predissociation, classification of electronic states. The spectrum of molecular hydrogen. Electronic spectra of polyatomic molecules. Chemical analysis by electronic spectroscopy. (d-d),) and (¬-n*) transitions. Photochemical mechanism of vision.
	DSE-304(A)	XII(A)	PCH 3.4(A)	Solid State Chemistry	Unit IV : Part B, Crystal Defect and Non Stiochiometry
	DSE-304(B)	XII(B)	PCH 3.4(B)	Advanced Chemical Kinetics	Unit IV : Catalysis, Induced and cooxidations. Mechanisms other than Westheimer mechanism.
	DSE-304(C)	XII(C)	PCH 3.4(C)	Radiation and Photochemistry	Unit IV : photochemical formation of smog , photodegradation of polymers, photochemistry of vision
	CCPR-305		PCHP 3.1	Practical –III	

Semester IV

	Course code	Paper No.		Title of course	Topics to be not considered for examination
CGPA	CC-401	XIII	PCH 4.1	Thermodynamics and Molecular Modeling	Unit IV: Diffusion, electromotive force, electroosmosis, thermoelectric effect and other reactions involving cross relations. Saxen's relations.
	CCS-402	XIV	PCH 4.2	Chemical Kinetics	Unit IV: Kinetics of Fast reactions: Relaxation techniques, pressure jump

					and temperature jump methods, NMR relaxation, flash photolysis and molecular beam methods.
	CCS-403	XV	PCH 4.3	Molecular Structure - II	Unit IV: Fluorescence quenching, Energy transfer, Excited state proton transfer, Synchronous spectrum, Fluorescent nanomaterials and its applications.
	DSE-404(A)	XVI(A)	PCH 4.4(A)	Surface Chemistry	Unit IV: Emulsion:
	DSE-404(B)	XVI(B)	PCH 4.4(B)	Chemistry of Materials	Unit IV: Materials of Solid Devices
	DSE-404(B)	XVI(C)	PCH 4.4(C)	Biophysical Chemistry	Unit IV: kinetic properties of muscle, mechano- chemical systems , Biomechanics

M. Sc. Part – II (Analytical Chemistry)

Semester III

	Course code	**Paper No.**		**Title of course**	**Topics to be not considered for examination**
CGPA	CC-301	IX	ACH 3.1	Advanced Analytical Techniques	Unit IV: X-Ray Photoelectron Spectroscopy (XPS)- Introduction, principle, instrumentation, applications Auger Electron Spectroscopy - Introduction, principle, instrumentation, applications Secondary Ion Mass Spectrometry (SIMS)- Introduction, principle, instrumentation, applications Practical applications and examples in analytical chemistry and research.
	CCS-302	X	ACH 3.2	Organo Analytical Chemistry	Unit IV: B) Forensic Analysis
	CCS-303	XI	ACH 3.3	Electroanalytical Techniques in Chemical Analysis	Unit IV : B) Electrophoresis
	DSE-	XII(A)	ACH	Environmental	Unit IV : Analysis of organochlorine

	304(A)		3.4(A)	Chemical Analysis and Control	pesticides, volatile organic pollutants and their analysis
	DSE-304(B)	XII(B)	ACH 3.4(B)	Recent Advances in Analytical Chemistry	Unit IV : Applications in quantitative analysis. Numerical problems
	CCPR-305		ACHP 3.1	Practical –III	Compulsory course

Semester IV

	Course code	**Paper No.**		**Title of course**	**Topics to be not considered for examination**
CGPA	CC-401	XIII	ACH 4.1	Modern Separation Methods in Analysis	Unit IV: nature of stationary phase in extraction chromatography, inert support, techniques in extraction chromatography, extraction chromatography with tributyl phosphate and other applications. Practical applications and examples in analytical chemistry and research.
	CCS-402	XIV	ACH 4.2	Organic Industrial Analysis	Unit IV: (B)Analysis of petroleum products
	CCS-403	XV	ACH 4.3	Advanced Methods in Chemical Analysis	Unit IV: Fluorescence and Diffraction methods of analysis and their applications
	DSE-404(A)	XVI(A)	ACH 4.4(A)	Applied Analytical Chemistry	Unit IV: Analysis of luminescent paints, Analysis of lubricants and adhesive.
	DSE-404(B)	XVI(B)	ACH 4.4(B)	Quality Assurance and Accreditation	Unit IV: Requirements of ISO 9001-2000 QMS and applications, Steps for effective implementations. Significance of ISO - 9001, 9002, 9003 & 9004. Requirements of ISO9000/ IS14001. Concepts of OHSMS (BS 8800) Quality Managament Principles in QMS, QMS documentation, Quality Manual, Quality policy, conformities and Nonconformities

M. Sc. Part – II (Industrial Chemistry)

Semester III and IV

Topics to be not considered for examination are Unit IV of all Papers from IX to XVI

M. Sc. Part – II (Applied Chemistry)

Semester III and IV

Topics to be not considered for examination are Unit IV of all Papers from IX to XVI

Practical evaluation will be on the basis of actual practical's performed by the students depending upon the situation.

(Agrochemistry and Pest Management)

Program	Paper No.		Title of course	Topics to be not considered for examination
M. Sc. Part – I Sem I	I		CC-101- CHEMISTRY OF PESTICIDES AND THEIR FORMULATIONS – I	Unit IV : Part B
	II		CC-102- SOIL SCIENCE, FERTILIZERS AND MICRONUTRIENTS	Unit IV: Part B Bio-fertilizers
	III		CC-103- INTRODUCTORY AND INDUSTIRIAL ENTOMOLOGY	Unit IV: Biocontrol
	IV		CC-104- BASIC CONCEPTS IN PLANT PATHOLOGY	Unit IV: Deseases of Cash crops Cotton - Rust, wilt, leaf spot Sugarcane- Rust, smut, GSD, rot, viral disease Tobacco – Early blight, wilt

Program	Paper No.		Title of course	Topics to be not considered for examination
M.Sc. Part – I Sem II	V		CHEMISTRY OF PESTICIDES AND THEIR FORMULATIONS-II	Unit IV : B) Formulations in seed treatment:
	VI		ANALYTICAL TECHNIQUES FOR AGROCHEMICALS	Unit IV: Atomic Absorption Spectroscopy: Principle, Instrumentation, production of atoms, ions and their applications in the analysis of Soil, Water and Pesticides.
	VII		ECONOMIC ENTOMOLOGY	Unit IV: B) Molluscan Pests of Agriculture crops:
	VIII		AGRONOMY, SEED TECHNOLOGY, PATHOLOGY, WEED SCIENCE AND BIOSTATISTICS	Unit IV:B) Disease caused by Parasitic algae, Parasitic higher plant. Parasitic nematodes, viroid, infection process and management.

Program	Paper No.		Title of course	Topics to be not considered for examination
M. Sc. Part II Sem III	IX		PESTICIDE RESIDUES AND TOXICOLOGY	Unit IV: Further prospects of Research and Technology, Development of safe pesticides. Effluents of Agrochemicals and their disposal.
	X		PESTS OF CROP PLANTS AND THEIR CONTROL- I	Unit IV: d) Miscellaneous Approaches, e) Recent advances in pest control: Green Chemistry in pesticides:
	XI		ANALYSIS OF AGROCHEMICALS	Unit IV: b) Mass spectrometry:
	XII		DISEASES OF VEGETABLES, FRUIT TREES, PLANTATION TREES, FOREST TREES AND ORNAMENTAL PLANTS.	Unit IV: Geranium- Leaf spot, Blossom blight, Rust, Bacterial spot. Gladiolus- Botrytis rot, Dry rot, Fusarium dry rot. Rose- Black spot, Rust, Powdery mildew, Die back. Sunflower- Leaf spots, Rusts, Powdery mildew. Jasmine- Leaf spot, Crown gall, Rust. Lily- Leaf spot, Foot rot, Stump rot

Semester IV

Program	Paper No.		Title of course	Topics to be not considered for examination
M. Sc. Part II Sem IV	XII		AGRO-BASED MARKETING MANAGEMENT	Unit IV : e) Details studies on marketing process in the Netherlands, Israel, Japan USA, Australia. Present status of Indian export in comparison to developed countries. f) Agricultural project analysis Agri-food, Service, Industry. g) Case studies: Agri. Input industry, Food, Whole selling, Retailing, mall
	XIV		PESTS OF CROP PLANTS AND THEIR CONTROL – II	Unit IV: i) Banana: I) Major: Aphid, Pseudostem weevil, Root Stock Weevil & Burrowing nematode. j) Fig: I) Major: Jassid, Mealy bug. II) Minor: Fig borer, Fruit fly. k) Ber: I) Major: Fruit fly, Fruit borer, Jassid. II) Minor: Ber beetle. l) Pineapples: I) Major: Thrips. m) Jackfruit: I) Major: White tailed mealy bug, Bark borer. II) Minor: Pink waxy scale.
	XV		MANUFACTURES OF AGROCHEMICALS	Unit IV: b) Regulatory Requirements of for Transportation of Agrochemical Products
	XVI		AGRICULTURAL BIOTECHNOLOGY AND INTEGRATED DISEASE MANAGEMENT.	Unit IV:Biofertilizers- Definition. Rhizobium- Mass production of Rhizobium and field application of Rhizobium inoculants, Crop response. Azotobacter- Production and field application. Azospirillium- Production and application of inoculants. Genetics of nitrogen fixation. Nif- gene of Klebsiella pneumoniae, Nif- gene of Azotobacter, Gene transfer for nitrogen

				fixation. BlueGreen algae- Production of BGA inoculants. Field uses of BGA inoculants. Nostoc-Mass production and utilization of Nostoc inoculants, Phosphate, Biofertilizers uses.

Physics		
Program	**Sem/Paper**	**Syllabus not to be considered for examination**
B. Sc. I	DSC A 1 Mechanics I	**Rotational Motion:** Angular velocity, angular momentum and Torque, Kinetic energy of rotation and moment of Inertia, Moment of inertia of a spherical shell, solid cylinder (only about axis of symmetry), Motion of spherical Shell and solid cylinder rolling down an inclined plane.
	DSC A 2 Mechanics II	**Surface Tension:** Surface tension (definition), Angle of contact and wettability, Relation between surface tension, excess of pressure and radius of curvature, Experimental determination of surface tension by Jaeger's method, Applications of surface tension.
	DSC B 1 Electricity and Magnetism I	**Electrostatics:** Capacitance of an isolated spherical conductor, parallel plate, spherical and cylindrical condenser, Energy per unit volume in electrostatic field, Dielectric medium, Polarization, Displacement vector, Gauss's theorem in dielectrics, Parallel plate capacitor completely filled with dielectric.
	DSC B 2 Electricity and Magnetism II	**Maxwell's equations and Electromagnetic wave propagation:** electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves, polarization.
B. Sc. II	DSC C1 Thermal Physics and Statistical Mechanics I	**Laws of Thermodynamics:** Second law of thermodynamics, Carnot's ideal heat engine, Carnot's cycle (Working, efficiency), Carnot's theorem, Entropy (concept & significance), Entropy changes in reversible & irreversible

		processes, Third law of thermodynamics, Unattainability of absolute zero.
	DSC C2 Waves & Optics I	**Physics of Low Pressure:** Production and measurement of low pressure, Rotary pump, Diffusion pump, Molecular pump, Knudsen absolute gauge, Pirani gauge, Detection of leakage.
	DSC D1 Thermal Physics and Statistical Mechanics II	**Quantum Statistics:** Bose-Einstein distribution law, photon gas, Fermi-Dirac distribution law, electron gas, comparison of M.B., B.E., and F.D. statistics.
	DSC D2 Waves & Optics II	**Diffraction:** Fraunhofer diffraction- Elementary theory of plane diffraction grating, Determination of wavelength of light using diffraction grating, Theory of Fresnel's half period zones, Zone plate (construction, working and its properties), Fresnel's diffraction at a straight edge.
B. Sc. III	DSE E1 Mathematical Physics	**Complex Analysis:** Types of complex numbers, square roots of complex numbers, Logarithmic function of complex variables, Euler's formula, De'Moivre's theorem, Cauchy-Riemann conditions.
	DSE E2 Quantum Mechanics	**Applications of Schrodinger Equation:** One dimensional simple harmonic oscillator (operator method)- energy levels, zero point energy, Schrodinger equation for Hydrogen atom in spherical polar coordinates, Separation of radial and angular parts, Solution of radial part of Schrodinger's equation - Energy Eigen values.
	DSE E3 Classical Mechanics and Classical Electrodynamics	**Charged Particles Dynamics:** Poisson's and Laplace's equations and their physical significance, Laplace's equation in one dimension and its solutions, Motion of charged particle - in uniform electric field E, magnetic field B, Crossed uniform electric field E and magnetic field B.
	DSE E4 Digital and Analog Circuits and Instrumentation	**Timer IC:** Block diagram of IC555, IC 555 Pin configuration, Applications of IC 555 as astable and monostable multivibrator.
	DSE-F1 Nuclear and	**Particle Physics:** Particle interactions,

	Particle Physics	Classification of elementary particles, Symmetries and conservation laws energy, momentum, angular momentum and parity, Baryon number, Lepton number, Concept of quark model.
	DSE-F2 Solid State Physics	**Elementary Band Theory of Solids:** Concept of density of states, Bloch theorem (statement only), Kroning–Penny model, Origin of energy gap, Velocity of electrons according to band theory, Effective mass of an electron, Distinction between metals, semiconductors and insulators, Hall Effect - Hall voltage and Hall Coefficient.
	DSE-F3 Atomic and Molecular Physics and Astrophysics	**Stellar Evolution:** The H–R Diagram, Evolution of main sequence stars - Red giants and White dwarfs, Evolution of more massive stars- Supernova, Neutron star, Black hole, Surface of the Sun, Sunspots, Sunspot cycle.
	DSE-F4 Energy Studies and Materials Science	**Superconductivity:** Idea of superconductivity, Critical temperature, Critical magnetic field, Meissner effect, Type-I and Type-II superconductors, London equation and penetration depth, Isotope effect, Application (magnetic levitation)
पदवी प्रात्यक्षिक परिक्षेकरीता प्रत्येक ग्रुपधील 80% प्रात्यक्षिक पुर्ण करावीत. मात्र बी.एस्सी. भाग–3 ग्रुप 6 मधील अभ्यास सहल रदद करून त्याचे असणारे गुणांकन सेमीनार मध्ये रूपांतर करावे. घेण्याची शिफारस करण्यात आली.		

Physics		
Program	**Sem/Paper**	**Syllabus not to be considered for examination**
M.Sc Part I and II	all Semister	Unit No. IV in all papers
	Practical	20 % Practical

B.Sc M.Sc Nanoscience and Technology (5 year Inigrated Course)		
Program	**Sem/Paper**	**Syllabus not to be considered for examination**
M.Sc Part I and II	all Semister	Unit No. IV in all papers
	Practical	20 % Practical

Botany				
Program	**Sem/Paper**		**Syllabus not to be considered for examination Program**	
B.Sc. I	**I**	Paper I: DSC- 13 A: BIODIVERSITY OF MICROBES, ALGAE AND FUNGI	1. 1.a VIRUSES	T-Phage, TMV,
			1. 1. b BACTERIA	Modes of reproduction – Vegetative, Asexual
			2.a ALGAE	b. Chlorophyceae: Spirogyra
			2. 2.b FUNGI	a. Zygomycotina: Mucor
		Paper II: DSC- 14 A: BIODIVERSITY OF ARCHEGONIATE- Bryophytes,Pteridophytes, Gymnosperms	BRYOPHYTES	Bryopsida- Funaria
			PTERIDOPHYTES	b. Pteropsida - Pteris
			GYMNOSPERMS	Classification as per Sporne-1965, up to Classes. General characters of class with suitable example.
	II	Paper III: DSC- 13 B: PLANT ECOLOGY	1.a ECOLOGICAL FACTORS AND ADAPTATIONS	Edaphic factors: Soil- Origin and formation, Composition, soil profile. Water- States of water in environment.

				1.b. Plant communities: Introduction, general Characters, forms and structure, Raunkier's life forms.
			2. Ecosystem and Phyto-geography	Composition- Abiotic and Biotic components
				Phytogeographical regions as per Chatterji and Mani
		Paper IV: DSC- 14 B: PLANT TAXONOMY	1. INTRODUCTORY TAXONOMY,ICBN, BOTANICAL GARDENS	Importance of Taxonomy.
				Sir J.C.Bose Botanical Garden, Culcutta.
			2. ANGIOSPERMS AND SYSTEMS OF CLASSIFICATION	Salient features of Angiosperms.
				3. Nyctaginaceae

B.SC. I Botany, 20% Practical syllabus cancelled for the academic year 2020-2021

Practical No.	**Experiment Number**	**title of the experiment**
I	3.	Study of Spirogyra
	4.	Study of Mucor
	7.	Study of Funaria
	9.	Study of Pteris
	24	Family Nyctaginaceae

Program	**Sem/Paper**		**Syllabus not to be considered for examination Program**	
B.Sc. II	**III**	V- Embryology of Angiosperm	**1a. Organization of Flower**	1.1: Concept of Flower as Modified shoot, structure of Typical flower.

			1b. Pollination and Fertilization	1.4: Definition, Types and mechanism in Anemophily (Zea mays), Entomophily (Calotropis) and Hydrophily (Vallisneria)
			2.a. Embryo and Endosperm Development.	2.1 Structure and development ofEmbryo in monocot
			2.b. Polyembryo and apomixis	2.5: Apomix- (entire subunit)
		VI- Plant Physiology	**1.a. Plant water relationship**	1.2. : water transport process: Mechanism of water absorption active and passive absorption theories , water transport through xylem and tracheids.
			1.b. Mineral Nutrition	1.5 : Criteria of essentiality
			2.a. Photosynthesis	2.2.:Photosynthetic pigments.
			2.b. Growth and development	2.9 Vernalization (Entire subunit)
	IV	VII- Plant Anatomy	**1.a. organization of higher plant body**	1.2. Development of plant body
			1.b. Meristematic and permanent Tissue	1.6. Types of Vascular Bundles
			2.a. Primary and Secondary structure of plant body	2.1. Primary structure of Monocotyledons and dicotyledonous root, stem and leaf.
			2.b: Tissue system	2.7. Mechanical Tissue system.
		VIII- Plant Metabolism	**1.a. Enzymes**	1.6. Enzyme inhibition
			1.b: Nitrogen Metabolism	1.9. Mechanism of Nitrogen fixation
			2.a. Respiration	2.7: Fermentation
			2.b: seed dormancy and Germination	2.13: Biochemical changes during seed germination.

B.SC. II Botany, 20% Practical syllabus cancelled for the academic year 2020-2021

Practical No.	Experiment Number	title of the experiment
I	**4**	Estimation of Chlorophylls by Colorimetric method
	7	Estimation of TAN value in CAM plants

	12	Study of effect of light intensity on Photosynthesis
	18	Study of typical flower and its parts
II	**4**	Study of Primary structure of dicotyledonous and Monocotyledons root
	5	Study of Primary structure of dicotyledonous and Monocotyledons stem
	14	Study of Mechanical Tissue system.
	22	Janus Green B staining Technique for mitochondria
	23	Demonstration of Fermentation

Program	**Sem/Paper**		**Syllabus not to be considered for examination Program**	
B.Sc. III	**V**	**Paper no. IX, DSE –E25** Genetics and Plant Breeding	**Unit 1: Mendelism:**	1.3 Gene Interaction-a) Complementary gene interaction b) Supplementary gene interaction.
			Unit 2 : Linkage and Recombination	2.3 Mutation – Definition, Spontaneous and Induced mutation. Types of mutagen Physical and Chemical, Significance
			Unit 3: Chromosomes structure and Variation	3.4 Maternal inheritance-Mendelian versus cytoplasmic inheritance, Plastid inheritance in *Mirabilis jalappa*
			Unit 4: Plant Breeding	4.3 c) Hybridization techniques in self and cross pollinated crops. d) Male sterility and its significance
		Paper No.X DSE –E26 Microbiology, Plant Pathology and Mushroom Culture Technology	**Unit 1: Microbiology**	1.1 Micro organisms in biological world, characteristic features of different groups: Phytoplasma and Actinomycetes
			Unit 2: Industrial Microbiology	2.1 Applications of micro-organisms with reference to Synthesis of **Organic Acids (Lactic Acid)**, 2.2 Bio-pesticides – types.
			Unit 3: Plant Pathology	3.3 Prevention and Control: Physical, Chemical and Biological Control, Role of Quarantine

			Unit 4: Mushroom Technology	4.3 Storage: Short Term (Refrigeration), Long Term Storage (Canning, Pickles, Papads), Drying in Salt Solutions
		Paper No.XI **DSE –E27** Cytology and Research Techniques in Biology	**Unit 1: Cell as a unit of life**	1.2 Cell cycle and Apoptosis
			Unit 2: Cell Organelles	2.1 DNA packaging in Eukaryotes. 2.3 Chloroplasts: Ultrastructure, semiautonomous body and Role.
			Unit 3: Sub Cellular Structures and Cell Membrane	3.4Types of membranes as per permeability
			Unit 4: Research Techniques in Biology	4.3 Intellectual property right (IPR) – Concept and Importance
		Paper No.XII **DSE –E28** Horticulture and Gardening	**Unit 1: Importance and divisions of Horticulture**	1.2: Landscape gardening,
			Unit 2: Horticultural Produce and Management of Pest and diseases	2.2: Fruit preservation technology: b) Chemical - sugar, salt, chemical preservatives.
			Unit 3: Nursery	3.2: Propagation Practices c) By specialized vegetative structure – Bulbs, Corms, Tubers, Rhizomes
			Unit 4: Landscape Gardening	4.3 Outdoor gardens (entire subunit)
	VI	**Paper No.XIII** **DSE –F25** Plant Biochemistry and Molecular Biology	**Unit 1: Carbohydrates**	1.3 Isomerism: Types of Isomers (Structural and Stereoisomer
			Unit 2 : Lipids	2.2 Structure and properties of Saturated Fatty Acids (Stearic and Palmitic acid) and Unsaturated Fatty Acids (Oleic and Linoleic acid)
			Unit 3: Proteins	3.2. Brief Outline of biosynthesis of Amino acid: Proline
			Unit 4: Nucleic Acids	4.5 Regulation of Gene expression- Lac Operon, Tryptophan Operon
		Paper No.XIV **DSE –F26** Bioinformatics, Biostatistics and Economic Botany	**Unit 1: Bioinformatics**	1.3Protein Information Resource (PIR) - Concept, Resources, Databases and Data Retrieval
			Unit 2: Biostatistics	2.4 Statistical methods for testing the hypothesis') Students' T-test ii) Chi-square test.
			Unit 3: Economic Botany: Cereals, Legumes and Oils	3.1 Origin of Cultivated Plants - Concept of centers of origin, their importance with reference to

				Vavilov's work
			Unit 4: Economic Botany: Spices, Beverages and Fibers	4.2 Beverages – Origin, Botanical Name, Morphology, Parts used and uses of Tea.
		Paper No.XV **DSE –F27** Plant Biotechnology and Paleobotany	**Unit 1: Plant Biotechnology**	1.2 Biotechnology in India
			Unit 2: Recombinant DNA Technology	2.4. DNA Fingerprinting, Molecular DNA Markers (RAPD, RFLP)
			Unit 3: Plant Tissue Culture	3.4 Somaclonal Variations
			Unit 4: Paleobotany	4.1 Geological time scale, 4.2 Study of following form genera with reference to systematic position, external morphology and affinities: a) *Lyginopteris*
		Paper No.XVI **DSE –F28** Bio fertilizers and Herbal Drug Technology	**Unit 1: Biofertilizers**	1.2 Organic manures – a) Farm Yard Manure, Green manure, Compost b) Vermicomposting and Vermi-wash
			Unit 2: Herbal Medicines	2.4 Introduction to general methods of extraction, isolation and purification of Phyto constituents.
			Unit 3: Herbal cosmetology	3.2 Facemask (*Santalum album*), bath oil (*Rosa indica*), perfume (*Jasminum sambac*).
			Unit 4: Pharmacognosy	4.3 Adulteration of drugs of natural origin: Evaluation by morphological, Microscopic, Chemical, Physical, Chromatographical, Spectrophotometric

B.SC. III Botany, 20% Practical syllabus cancelled for the academic year 2020-2021

Practical No.	**Experiment Number**	**title of the experiment**
I	**4**	Study of different types of stains in biological studies
	8 and 9	Demonstration of Mushroom Cultivation and Harvesting
	11	Calorimetric estimation of DNA using di-phenyl amine
II		

	4	Determination of chromosome count in PMCs in ***Allium* / *Cyanotis*.**
	5	Detection of meiotic anomalies in chromosomes in ***Rhoeo.***
	9	Mounting of floral parts
III	**7**	Use of dialysis to separate smaller molecules from larger molecules.
	9	Study of DNA packaging by micrographs.
	10	Study of Beer and Lambert's Law
	18	Macroscopic (Organoleptic**)** study of – i) Tulsi ii) Ginger iii) Methii v) Avala
IV	**6**	Demonstration of Bottle garden and hanging baskets.
	9	Study of ornamental plants – Rose, Gerbera, Marigold
	16	Identification of sugars by ascending paper chromatography
	19	Determination of iso-eletric point of plant protein.

Botany

Program	**Sem/Paper**	**Syllabus not to be considered for examination**
M.Sc Part I and II	all Semester	No Change
	Practical	No Change

Botany

Program	**Sem/Paper**		**Syllabus not to be considered for examination**	
B.Sc. II Plant protection	**III**	**Paper I :** (DSC IC 45): Major crops, methods of integrated Plant Protection	**Unit 1** Introduction of plant protection and study of crops	Sub unit1.2 D) Cash crop - Sugarcane
			Unit 2 : Study of crops	Sub unit 2.1: G) Spice – Chilli Sub unit 2.2: C) Bio fungicides

			Unit 3 : General methods of plant protection.	Sub unit 3.3 Physical methods – Heat and soil solarisation
			Unit 4: Methods of Management	4.3 Legal methods – Plant quarantine in India.
		Paper No. II (DSC IC 46): Insect pests and their Management	**Unit 1:** Introduction to insect pests	1.3 Classification of insect pest based on c) Metamorphosis
			Unit 2: Study of insect pests	Sub unit 2.2 Stored grain pests and their management. I) Rice weevil
			Unit 3: Management of Insect pests.	Sub unit 3.2 Classification of insecticides based on: d) Nature of formulation – Dusts, Granules, Wettable powder, Emulsifiable concentrates.
			Unit 4: Recent trends in pest management	e) Chemosterilants
B.Sc. II Plant protection	IV	**Paper No.III** (DSC ID 45): Introduction to weeds and their Management	**Unit 1:** Introduction of weeds	Sub unit 1.3 Reproduction and mode of dispersal of weeds.
			Unit 2: Study of following weeds with reference to….	Sub unit 2.3 Celosia argentea
			Unit 3: Methods of weed management	Sub unit 3.2 Biological methods - Weed management by bacteria, fungi and insects
			Unit 4: Study of Laboratory techniques	Sub unit 4.3 Pesticide application technique: Spraying.
		Paper No. IV (DSC ID 46): Crop diseases, their management and pathophysiological skills	Unit No. 1 Crop diseases	Subunit 1.3 Methods of studying plant pathogens a) Isolation b) Methods of Inoculation c) Incubation
			Unit No. 2 Mechanism of plant infection	Subunit 2.3 Factors affecting infection
			Unit No. 3 Study of following crop diseases with reference to symptoms, pathogen, disease cycle and their	i) Rust of Sugarcane VII) Blight of Marigold

			management.	
			Unit No. 4 Management of crop diseases and pathophysiological skills	Subunit 4.2 Chemical method: Classification of fungicides based on chemical nature and mode of action.

B.Sc. II Plant Protection
20% Practical syllabus cancelled for the academic year 2020-2021

Practical No.	**Experiment Number**	**title of the cancelled experiment**
I	**1 to 5**	Agronomic studies of following crops with reference to gross morphology for crop identification and agronomic conditions Sugarcane and Chili.
	7 to 10	Study of following weeds with reference to gross morphology for identification, reproduction, dispersal and management. f) Celosia argentea
	12	Study of mode of dispersal in following weeds. a) Parthenium hysterophorus
	17	Determination of soil moisture from crop fields (Two samples).
II	**1 to 8**	Fungal Diseases: a) Rust of Sugarcane g) Blight of Marigold
	10 to11	Study of bactericides
	12	Technique of collection and preservation of insect pests. Dry preservation
	13 to 17	f. Rose – Thrips
	18 to 19	b.Pulse bettle

Zoology		
Program	**Sem/Paper**	**Syllabus not to be considered for examination**
B.Sc Part I **Sem I**	DSC–15A (ANIMALDIVERSITY- 1) Paper-1	Unit1: PhylumNemathelminthes Generalcharactersandclassificationuptoclasses;Life historyof*Ascarislumbricoides* anditsparasiticadaptations Unit2: PhylumMollusca

		Generalcharactersandclassificationuptoclasses;Torsioningastropods
Sem I	**DSC–16A(ANIMALPHYSIOLOGY-)** **Paper-1I**	Unit-2 Cardiovascularsystem Compositionofblood,StructureofHeart,Originandconductionofthecardiacimpulse,Cardiaccycle
Sem II	DSC–15B(CELLBIOLOGYANDEVOLUTIONARYBIOLOGY)	Unit-2 IntroductiontoEvolutionaryTheories Lamarckism,Darwinism,Neo-Darwinism
Sem II	DSC–16B(GENETICS)	Unit2: Mutations ChromosomalMutations:Deletion,Duplication,Inversion,Translocation,AneuploidyandPolyploidy,induced genemutation
	DSC–15Aand16A:LAB	Studyofthefollowingspecimens: StudyofMale and female *Ascaris lumbricoides, Chiton,Dentalium,Pila,Unio,Loligo,Sepia,Octopus,* w.r.t.classificationand morphologicalpeculiarities.
	DSC–15Band16B:LAB	Darwin'sFincheswithdiagrams/cutoutsofbeaksofdifferentspecies. StudyofHumanKaryotypes.
B.Sc Part II	PAPER-V DSC (ANIMALDIVERSITY-II)	Unit1I: Aves: Respiratorysystems. Mammals: GeneralcharactersandClassificationuptoorders;CirculatorySystem ofmammals.
	Paper-VI DSC (BIOCHEMISTRY)	Unit2: Protein metabolism: Transamination and Deamination Enzymes: Introduction-classificationandnomencelature.Mechanismofaction,EnzymeKinetics,InhibitionandRegulation.Isoenzymes,Co-enzymesandCo-factors.

	Paper No VII DSC (REPRODUCTIVEBIOLOGY)	Unit3:ReproductiveHealth: Infertilityinmale andfemale:causes,diagnosisandmanagement;AssistedReproductiveTechnology: sex selection, sperm banks, frozen embryos, in vitro fertilization, ET, EFT,IUT,ZIFT,GIFT,ICSI,PROST;Moderncontraceptivetechnologies.
	Paper No VIII DSC (Applied Zoology- I)	Unit3: RickettsiaandSpirochaetes: Briefaccountof*Rickettsiaprowazekii,Borreliarecurrentis*and*Treponema pallidum.* Unit5: PoultryFarming: ProcessingandPreservationofeggs
	PRACTICAL-I(Based on Animal diversity-II and Biochemistry of Semester-III).	Unit No 2 Biochemistry EffectofTemperature,pHandsalinityofactivityonsalivaryamylase. Estimationoftotallipidsfromgivensample. DNAisolationfrom plant/animal. 4. Estimationofuricacidfrombirdexcreta.
	PRACTICAL-II(Based onReproductiveBiologyandApplied ZoologyofSemester-IV).Unit:1	ReproductiveBiology: Examinationofvaginalsmearratsfromliveanimals/Studyofstagesofestruscyclethroughpermanentslides. Surgical techniques: principles of surgery in endocrinology. Ovarectomy,hysterectorny,castrationandvasectomyinrats.Demonstrationorfilmonly. Humanvaginalexfoliatecytology.
B.Sc Part III	Paper- IX DSE-) E29(COMPARATIVEANATOMY OFVERTEBRATES	Unit2:SkeletalSystem Vertebralcolumn Appendicularskeleton Unit6: Evolutionof Kidney Succession of kidney
	Paper- X DSE-F29 (Molecular Cell Biology and Animal Biotechnology)	Unit3:MolecularTechniquesinGenemanipulation Constructionofgenomic andcDNAlibraries DNAsequencing:Sangermethod DNAFingerPrinting DNAmicroarray
	Paper-XI	UnitI:GeneticallyModifiedOrganisms

	Paper- XI DSE-F30 (Biotechniques and Biostatistics)	Knockoutmice. UnitIII:Biostatistics Dispersion –Mean,deviation&standarddeviation Correlation – Scattered diagram, KarlPearson'scorrelation coefficientandSpearman'srankcorrelationcoefficient.
	Paper-XII DSE- F31(AQUATICBIOLOGY)	Unit2:FreshwaterBiology Lakes Physico-chemicalcharacteristics Light Temperature ThermalStratification Dissolvedsolids Carbonates Bicarbonates PhosphatesandNitrates Turbidity Dissolvedgases(OxygenCarbondioxide) NutrientCycle–(Nitrogen,SulphurandPhosphorus) Streams Different stagesofstreamdevelopment
	Paper-XIII DSE-E30(DEVELOPMENTALBIOLOGYOFVERTEBRATES)	Unit2:EarlyDevelopmentofFrog Structureofmatureegganditsmembranes Cleavage Blastulaanditsfatemap Processofgastrulation TypesofMorphogenicMovements Fateofthree germinallayers Neurulation Metamorphosisinfroganditshormonalregulation
	Paper-XIV DSE-E32(IMMUNOLOGY)	Unit1:OverviewoftheImmuneSystem Introductiontobasicconceptinimmunology Principlesofinnateandadaptiveimmunesystem
	Paper-XV	Unit5:FishTechnology

	DSE-E31(Applied Zoology-II)	Geneticimprovementsinaquacultureindustry: 1.Inducedbreeding 2.Transportationoffishseed 3.Feedinganddevelopment 3.HarvestingandMarketing
	Paper-XVI DSE-F32 (Insect Vectors and Histology)	UnitII:SiphonopteraasDiseaseVectors Fleasaimportantinsectvectors Host-specificity StudyofFlea-bornediseases Plague Typhusfever Controloffleas
B.Sc.Part III	Practical–I (Credits-02)	Comparativeanatomyanddevelopmentalbiology ofvertebrates ComparativeStudyoffollowing Osteology Theskeletonoffowl(Disarticulated) Theskeletonofrabbit(Disarticulated) Mammalianskull's– (anyoneherbivorousandonecarnivorousanimal) Studyofdevelopmentalstagesoffrog. Cleavage Blastulation Gastrulation Neurulation Stagesofmetamorphosisinfrog Externalgillstage Internalgillstage Forelimbstage Hindlimbstage Tailbudstage Juvenilestage
B.Sc.Part III	Practical–II (Credits-02)	Unit1: Applied Zoology Preservation&Artificial inseminationincattles Pearl culture Speciesof oyster Processof Pearlformation:naturalandartificial ImportanceofPearl Immunology

		Demonstrationof ELISA Immuno-electrophoresis Cellcountingandviabilitytestfromsplenocytesof farmbreed animals/celllines
B.Sc.Part III	Practical–III(Credits-02)	Molecularbiology,Animal biotechnology,Biostatistics&Biotechniques Biotechniques Tostudythe followingtechnique(photographs) Southernblotting Northernblotting Westernblotting DNAsequencing(Sangersmethod) PCR DNAfingerprinting III)Biostatistics Any10 examplebasedontheory(Example Excluding- Karl pearson's correlation coefficient)
B.Sc.Part III	Practical–IV(Credits-02)	Aquaticbiology,insectvector &diseases Aquaticbiology Instrumentsusedinlimnology&theirsignificance Secchidisc VanDornbottle Conductivitymeter Turbiditymeter PONARgrabsampler Insect Vectors&diseases Studyof houseflyborndiseases–Myiasis Studyoffleaborndiseases– Plague,typhus

Zoology		
Program	**Sem/Paper**	**Syllabus not to be considered for examination**
M. Sc. I Sem I	CC-101: Biosystematics and Biodiversity	• Biochemical and Numerical taxonomy • taxonomic identification • computation of biodiversity by computer

		software • conservation through gene banking preservation
	CC-102: Ecology and Environmental Pollution	• Niche width and overlap. • Primary production. • Environmental Impact Assessment: concept process and evaluation methodology. • Prevention and control of air pollutants. • Radioactive pollution- types, sources and effects of radiation. Radioactive pollution- types, sources and effects of radiation.
	CC-103: Molecular Cell Biology	• Fine structure of chromosome • transcellular transport • Mitochondria: Ultra Structure and functions. • associated motor proteins
	CC-104: Applied Entomology	• Types of Insect pests: Definition with suitable examples. • spike disease of Sandal, • Pulse Beetle, Angoumois grain moth. • Louse fly, Warble fly, Screw worm, bird louse, Flea • History of Sericulture • Moriculture and cultural practices • Strains of lac insect and their propagation
M. Sc. I Sem II	CC-201: Physiological chemistry	• Reaction kinetics, dissociation and association constants, Physical constants, • Pentose phosphate pathway • Structure of RNA, • Biosynthesis of purine and pyrimidine nucleotides • Steroidal hormones- structure and functions. • Lipoprotein metabolism
	CC-202: Bioinstrumentation and Biostatistics	• Electrophoretic techniques – General principles, support media, electrophoresis of • proteins and nucleic acids, Isoelectric focusing.

		• immunoassays, immunohisto/cytochemistry • Probability- Introduction, addition and multiplication theory. • Probability distribution- Binomial, Poisson and Normal. • Analysis of Variance (ANOVA).
	CC-203: Anatomy and Physiology	• Digestion and absorption in gastrointestinal tract • Conduction system and pace maker. • Urinary bladder, process of micturation, Hemodilasis and Artificial kidney.
	CC-204: Biology of Parasites	• Arthropods as vectors: Black flies, Horse flies, Stable fly, Hippobosca, Warble fly, Crew worm fly, ticks and mites. • Cestoda: Diphilabothrium, Diphylidium, Echinococcus. • Trematoda: Diphilabothrium, Diphylidium, Echinococcus. • Nematoda: Ancylostoma, Strongyloides, Entrobius. • Plant & Soil nematodes: Cyst nematode, citrus nematode. • Entomo Pathogenic Nematodes (EPNs
M. Sc. II Sem III	CC-301: Genetics	• Testicular feminization Syndrome • Genetic drift, Genetic pool. • Mutagenicity and carcinogenicity.
	CBE-302: Enzymology	• Effect of inhibitors on enzyme Kinetics. • Effect of temperature • Thermal denaturation • Effect of pH on enzyme kinetics
	Core Course Specialization: Cell Biology Elective paper - I CCS-303:Molecular biology of the gene	• Morphology and Functional Elements of Eukaryotic Chromosomes • Chromosome number, size and shape at metaphase • Banding patterns • Chromosome painting and DNA sequencing

		• Post transcriptional gene control and nuclear transport: a) Processing of pre m-RNA. b) Regulation of pre m-RNA processing. c) Macromolecular transport across the nuclear envelope. d) Cytoplasmic mechanisms of post transcriptional control.
	Core Course Specialization: Physiology Elective paper - I CCS-303: Animal Physiology	• Chemical Senses- Smell • Embryonic development. • Modern techniques in developmental biology.
	Core Course Specialization: Entomology Elective paper - I CCS-303: Basic Entomology	• Historical background • Types of Classification • PTERYGOTE ORDERS: Embidina • PTERYGOTE ORDERS: Hemiptera, Coleoptera,
	Core Course Specialization: Aquaculture and Fisheries Elective paper - I CCS-303: Fisheries Resources — Inland and Marine Fisheries	• Molluscan fishery, Groups of Marine Fishes • Present status of carp seed production in India. • Fertilization of water bodies. • Allocation of shares and limited entry • Training and extension
	Core Course Specialization: Sericulture Elective paper - I CCS-303: General Sericulture and management of mulberry	• Geographical distribution of mulberry and non-mulberry sericulture, • Soil testing and Management • Propagation of Mulberry- Scope and significance of sexual and asexual propagation, • Methods of mulberry propagation • Hemipteran pests (Sap feeders), white fly. • Viral diseases - Mulberry leaf mosaic disease.
	Core Course Specialization: Cell Biology Elective paper - II CCS-304: DEVELOPMENTAL BIOLOGY	• The evolution of differentiation, developmental pattern among metazoans • Implantation in mammals • Eye lens induction- Cascades of induction – reciprocal and sequential inductive events

	Core Course Specialization: Physiology Elective paper - II CCS-304: Applied Physiology	• Exercise, meditation and mental health. • Ergonomic working and applications of Ultrasound and C. T. Scan. • Ergonomic working and applications of Endoscopy and tissue biopsy. • Ergonomic working and applications of MRI and EEG. • Biological and mental stresses
	Core Course Specialization: Entomology Elective paper - II CCS-304: AGRICULTURAL ENTOMOLOGY	• Grasshopper, Paddy Leaf hoppers, armyworm, cutworm, and blister beetle • Turplume moth, Turpod Bug,Turpod fly • Pests of fruits and fruit trees (Temperate): o Sanjose scale, apple wooly aphid, white fly, cherry stem borer, codling moth, apple stem borer, peach fruit fly and Almond weevil. • Bihar hairy caterpillar on jute and sun hemp capsid. • linseed gall midge, Sunflower head borer, safflower aphid
	Core Course Specialization: Aquaculture and Fisheries Elective paper - II CCS-304: Fish Pathology and Reproductive Endocrinology	• Signs of sickness in fishes, • Larvicidal fishes in India • Aquatic Pollution: Introduction • Effect of pesticides substances on fish in relation to water quality. • Socio-economic impact of EUS. • Hormonal regulation in fish reproduction
	Core Course Specialization: Sericulture Elective paper - II CCS-304: Silkworm Biology & Rearing Technology	• Classification and Geographical distribution of Silkworm races • Anatomy, silk gland structure and function • Principles of silkworm rearing, Environmental conditions for silkworm rearing • Pests, Predators , Parasites of mulberry and non-mulberry silkworm and management
M. Sc. II Sem IV	CC-401: Animal Cell Culture	• Cryopreservation for Storage and shipment • Types of cell cultures – Open and closed cell cultures • Monolayer, Suspension, Clonal culture, Mass culture: micro carrier culture, Stem

		• cell cultures (ESC) • Cell cycle analysis and Synchronization of cultures • Hybridoma cell preparations and their properties • Capillary culture Unit
	CBE-402: TOXICOLOGY	• calculation of LD50 / LC50 by graphical and statistical methods • Dose - response relationship and genotoxicity; Target organs and mechanism of action. • Biotransformation sites, Biotransformation reaction (Phase I and Phase II) of organochlorine and organophosphate and Factors affecting biotransformation of xenobiotics. • Molecular and functional diversity of natural toxins and venoms
	Core Course Specialization: Cell Biology Elective paper - III CCS-403: Immunology	• Granulocytic Cells, Mast Cells, Dendritic Cells • Tumor immunology • Type IV or Delayed- Type Hypersensitivity (DTH) • B cell differentiation-cellular events within germinal centers, induction
	Core Course Specialization: Physiology Elective paper - III CCS-403: Physiology of Health	• Digestive glands • Hypertensions and kidney diseases. • Kidney transplantation • Disorders of Cerebrospinal fluid (CSF)
	Core Course Specialization: Entomology Elective paper - III CCS-403: Insect Anatomy and Physiology	• Enzyme dynamics. • Osmoregulation. • Nervous system: Physiology • ENDOCRINE SYSTEM: Hormones and their functions • EMBRYONIC DEVELOPMENT: Formation of amnion and Segmentation
	Core Course Specialization: Aquaculture and Fisheries Elective paper - III CCS-403: Aquaculture Practices	• Objectives of aquaculture. • Brackish water culture • Stripping in fishes • Balanced fish feeds and their preparation. • importance of aquatic weeds.

		• environmental issues of prawn culture, fate of prawn culture. • significance of plankton • Different methods of culture – bottom culture, raft culture, long line culture. • Prospectus in India.
	Core Course Specialization: Sericulture Elective paper - III CCS-403: Breeding of silkworm , mulberry and cytogenetics	• Sex determination, sex linked, sex limited traits and their special significance in sericulture • Chromosome number and nature of chromosomes, parthenogenesis, gynogenesisandrogenesis, polyploidy and population genetics. • Breeding for draught and disease resistant plants, Mutations and polyploidy and its role in host plant breeding. Polyploidy and its practical utility
	Core Course Specialization: Cell Biology Elective paper - IV CCS-404: Cell Pathology	• Mutations causing loss of growth inhibiting and cell-cycle controls • Carcinogens and caretaker genes • Ageing and cell cycle • Strategies against ageing
	Core Course Specialization: Physiology Elective paper - IV CCS-404: Clinical Physiology	• Gonads- Testis, Ovaries. • Defects in Chemoreception. • Hypo and Hypersensitivity mechanism • Altered biomechanics in cancer cells.
	Core Course Specialization: Entomology Elective paper - IV CCS-404: PEST MANAGEMENT CONCEPTS	• Recent Advances in Pest management: • The role of Antifeedent, Attractants, Repellents and Chemo-sterillants in Pest Management. • Green Chemistry in pesticides: Mode of action and Applications of • Neem in plant protection.
	Core Course Specialization: Aquaculture and Fisheries Elective paper - IV CCS-404: Fishery Technology	• Rules and regulations for fishing operations and safety at sea. • Environmental control of reproductive cycles • Maintenance of Freshwater aquarium: Maitenance routine • Application of hybridism technology in aquaculture • HACCP for fish processing industry.

	Core Course Specialization: Sericulture Elective paper - IV CCS-404: Silkworm seed, silk production technology and Economics	• Silk reeling, Cocoon stifling, re-reeling, Raw silk testing, Spun silk yarn, Silk weaving. • Entrepreneurship development in silk reeling, weaving and marketing • Marketing concepts for seed raw silk and finished products • Entrepreneurship development in value added products (Mulberry tea, fodder, pharma, cosmetics products and cocoon handicrafts) • Classification of various extension teaching methods its importance • Mhareshimabhiyan , Various govt .,schemes

B.Sc. Microbiology		
Program	**Sem/Paper**	**Syllabus not to be considered for examination**
B.Sc.Part – I Sem I	**DSC- 25 A: Introduction to Microbiology**	Unit I A. 4.Classification of microorganisms –Whittaker's five kingdom and Carl Woese's three kingdom classification systems Unit II B. 1. Types of microscopes: light and electron microscopes a) Light microscopy: Parts, Image formation, Magnification, Numerical aperture (uses of oil immersion objective), Resolving power and Working distance.
	DSC-26 A:Microbial Diversity	Unit I 2. b) Desiccation c) Osmotic pressure e) Filtration i) Asbestos and Membrane filter 3. c) Halogen compounds (chlorine and iodine) d) Heavy metals (Cu and Hg) Unit II 3. Cultivation of microorganisms: a) Use of culture media for cultivation b) Conditions required for growth of the microorganisms.

Sem II	**DSC –25 B : Bacteriology**	**Unit I** B. g) Endospore: Structure, stages of sporulation. h) Reserve food materials – Nitrogenous and non-nitrogenous **Unit II** 2. Isolation and cultivation of anaerobic organisms by using media components and by exclusion of air/O2
	26B: Microbial Biochemistry	**Unit I** B. glycogen and cellulose. C. Lipids: 1. Simple lipids – Fats and oils, waxes. 2. Compound lipids – Phospholipid, Glycolipids 3. Derived lipids – Cholesterol **Unit II** 3. Bacterial Photophosphorylation – Cyclic and Non-cyclic.
	Practical Course I	**Unit II** 3. Selective media: a) Sabourauds agar b) Glucose yeast extract agar 5. Sterilization of culture medium using Autoclave and assessmentfor sterility.
	Practical Course II	**Unit I** 2. Demonstration of presence of microbes from hand nails, Teethand skin (swabbing) by cultivation methods. 3. c) *Staphylococcus aureus* 4. Enumeration of bacteria from water and milk by SPC method. **Unit II** 4. Study of MBRT test.
B.Sc. Part II Sem III	**DSC-C25:Microbial Physiology & Metabolism**	**Unit I** C) Transport across cell membrane - Diffusion, active transport and group translocation. **Unit II** A) EMP, TCA cycle C) Bacterial electron transport chain – Components, flow of electrons & mechanism of ATP generation - Chemiosmotic hypothesis.
	VIDSC-C26:Applied Microbiology	**Unit I** A) Air Microbiology: a) Sources of microorganisms in air. b) Definitions of - Infectious dust, Droplets & Droplet nuclei c) Sampling methods for microbial examination of air) Solid impaction - Sieve device ii) Liquid Impingement – Bead-bubbler device **Unit II** C) Fermentation Media - Water, carbon source,

		nitrogen source, precursors, growth factors, antifoam agents & chelating agents.
Sem IV	**DSC- D 25: Microbial Genetics & Molecular Biology**	**Unit I** A. a) Forms of DNA B. c) 2- aminopurines , Alkylating agents , Acridine dyes **Unit II** C) DNA repair: i) Photoreactivation ii) Dark repair mechanism (Excision repair)
	DSC-D 26: Basics in Medical Microbiology & Immunology	**Unit I** g) Normal flora of human body & its significance **Unit II** 5. Theories of antibody production. 7. Mechanism of antigen – antibody reaction- Lattice hypothesis. 8. Types of antigen-antibody reaction-Precipitation and Agglutination.
	PRACTICAL COURSE **Course V &VI : Practical Course III**	**Unit I** 1. iii) Nucleus staining (Giemsa's method) using yeast cells. 2. Arginine broth, Hugh and Leifson's medium. **Unit II** vi) Huge and Leifson's test vii) Arginine hydrolysis.
	Course VII & VIII Practical Course IV	**Unit I** 2. i. Antibiotic producers – crowded plate technique 3. Determination of growth phases of E. coli by Optical density **Unit II** 2. Effect of U.V. light on growth of bacteria 3. (b) *Proteus species* 4. Determination of Blood groups – ABO and Rh.
	Practical Examination	(C) Candidates have to visit at least one place of microbiological interest (pharmaceutical / Industry/dairy/research institute etc.) and submit the report of their visit.(Requirement of Study Tour reduced) Q.10. 10 marks of tour report are reduced and marks of Q.No. 4 (Screening / Lac negative mutant) and Q.No. 6 (Effect of environmental factors) are increased by 5 marks, in each.
B.ScPart III Sem V	**DSE - E 49 VIROLOGY**	**UNIT – II** 1) b. • Genetic map for lysogenic interaction • Expression of λ genes • Establishment of repression • Maintenance of repression 4) d) Hypothesis about cancer. i) Somatic mutation hypothesis ii) Defective immunity hypothesis

		iii) Viral gene hypothesis • Role of DNA viruses in cancer with special emphasis on Papova viruses. • Role of RNA tumour viruses o Provirus theory o Protovirus theory o Oncogene theory
	DSE - E 50 - IMMUNOLOGY	**UNIT – I** A) I) Cells of the immune system. i. Hematopoiesis- Characteristics and Types of stem cells. ii. Classification of cells of immune system- Lymphoid and myeloid cells. iii. Structure and functions of Lymphoid cells- T cells and T cell subsets, NK cells, B cells and dendritic cells. iv. Structure and functions of myeloid cells – Granulocytes, Monocytes and macrophages. **UNIT – II** A. i. General characters of cytokines ii. Cytokines produced by different TH cells and Macrophages. iii. Effects of cytokines
	DSE - E 51 FOOD AND INDUSTRIAL MICROBIOLOGY	**UNIT – I** 2) Industrial Microbiology A) Strain Improvement B) Scale up of fermentations C) Microbiological assays **UNIT – II** c. Penicillin: - Organisms used, Inoculum preparation, Fermentation media, Fermentation conditions, Extraction and Recovery. Concept of semi synthetic Penicillin.
	DSE - E 52 – AGRICULTURAL MICROBIOLOGY	**UNIT – I** 1) Soil Microbiology a. Physical characters. b. Chemical characters. c. Types of microorganisms in soil and their role in soil fertility. d. Microbiological interactions - Symbiosis, Commensalism, Amensalism, Parasitism, and Predation. 3) III) Standards of City Compost and Vermicompost as per Fertilizer Control Order. **UNIT – II** 1) B) c) *Beauveria bassiana* 2) b) Pesticides degradation
Sem VI	**DSE F49: MICROBIAL GENETICS**	**UNIT – I** 1) b) One cistron - one polypeptide hypothesis. 2) c) Genetic regulation in tryptophan operon 3) ii) Conditional expression of mutation.

		UNIT – II 1) Genetic complementation - Cis-trans test a) DNA sequencing (Sanger's method) 4) d) Applications of genetics engineering in iii) Industry iv) Environment
	DSE F50: MICROBIAL BIOCHEMISTRY	**UNIT – I** 3) Assay of enzymes - Based on substrate and product estimation. 4) Ribozymes and Isozymes **UNIT – II** 3)I) Basics in carbohydrate metabolism a) PP pathway, ED pathway, Phosphoketolase pathway b) Pyruvate as a key intermediate c) Glyoxylate by pass 4) Biosynthesis of - d) Peptidoglycan
	DSE F51: ENVIRONMENTAL MICROBIOLOGY	**UNIT – I** 1) General characteristics of waste a) Liquid waste - pH, electrical conductivity, COD, BOD, total solids, total dissolved solids,total suspended solids, total volatile solids, chlorides, sulphates, oil & grease. b) Solid waste- pH, electrical conductivity, total volatile solids, ash. c) Standards as per MPCB. 2) a) Physico-chemical and Biological characteristics **UNIT – II** 1) Biological safety in laboratory a) Good Laboratory Practices b) Bio safety levels (BSL) 3) Environmental Impact Assessment- Concept and Brief introduction
	DSE F52: MEDICAL MICROBIOLOGY	**UNIT – I** Bacterial Diseases :*vii)Leptospira interrogans viii) Klebsiella pneumoniae* **UNIT – II** A. ii) Rabies virus iii) Dengue virus 3) a) Bacitracin, cycloserine, trimethoprim c) Nystatin d) Mepacrine
	PRACTICAL COURSE Practical - I (Virology and Microbial Genetics)	**Major:** 4. Transfer of genetic material by transformation in E. coli **Minor:** 1. Electrophoretic separation of DNA. 3. Testing of carcinogenicity of a substance by Ame's test.
	Practical - II (Food and Industrial Microbiology)	**Minor:** 1. Production of wine and examination for pH, colour and alcohol content. 2. Citric acid fermentation and recovery (**Estimation**

		is not removed) 3. Amylase production by using Bacillus species. **Practical - III (Agricultural and Environmental Microbiology)** **Major:** 4. Isolation of phosphate solubilising bacteria from soil. **Minor:** 1. Estimation of Calcium and Magnesium from soil (EDTA method).
	Practical - IV Medical Microbiology	**Major:** 1. b) *Staphylococcus aureus* **Minor:** 2. b) Rapid Diagnostic Test for Malaria c) Demonstration of Enzyme Linked Immunosorbent Assay (ELISA) 3. b) Determination of ESR of the blood sample (Wintrobe method) c) Determination of PCV 4. Test for bile pigments.
	Practical Examination	• Candidates have to visit at least two (2) places of microbiological interest pharmaceutical /Industry / dairy / research institute etc.) and submit the report of their visit.(Requirement of Study Tour reduced) • 20 marks of tour report is cancelled and marks of major experiment are increased by 5 marks, in each of the practical course i.e. each major experiment will be of 25 marks.

B.Sc. Industrial Microbiology		
Program	**Sem/Paper**	**Syllabus not to be considered for examination**
B.Sc Part I	**Paper I DSC –27A: Introduction to Industrial Microbiology**	Unit 1. A) 2) a) Louis Pasteur b) Antony Van Leeuwenhoeck 3) c) Food products – i) Fermented milk products – Curd. ii) Pickles – Sauerkraut d) Other Industrial products – i) Enzymes – Amylase **B)** 3) c) Solid state and liquid state fermentation

Sem I	**Paper II DSC –28 A - Basics of Fermentations**	Unit 2) B. Validation of sterilization processes
Sem II	**Paper III DSC –27B: Introduction to Fermentation Technology**	Unit I -: B. Fermenter control system: 1. Introduction & Importance of control systems 2. Designs, principles and working of systems for control of – a) temperature b) pressure c) foam d) pH.
	Paper IV DSC- 28 B: Microbial Fermentations and Economics	Unit II -: B. Fermentation economics 1. Raw material 2. Process 3. Recovery process 4. Storage and Transport 5. Product economics 6. Waste management.
Part I	**Practical's** **Paper I and Paper II**	**Practical Course I: Introduction to Industrial Microbiology and Basics of Fermentations** Unit I -: **1. Biosafety in Microbiology Laboratory** a) Aseptic techniques: i)Table disinfection ii)Hand wash, iii) Use of aprons b) Proper disposal of used material c) Cleaning and sterilization of glassware.
	Practical's **Paper III and Paper IV**	**Practical Course II: Introduction to Fermentation Technology and Microbial Fermentations and Economics** Unit 1. 2) Study of growth curve of bacteria 4) Demonstration of antimicrobial activity of actinomycete by Giant colony techniques. Unit 2. 2) Chemical assay of Penicillin. 4) Separation of sugars by paper chromatography.
B. Sc Part II	**Paper V DSC C-27 Industrial Production of Fermented Food**	Unit I: - A) 3. Curd C) 2. Cucumber Unit II A) 3. Curd C) 2. Cucumber D) 1. Dairy product 3. Pickles

Sem III	**Paper VI DSC C-28 Quality Control of Food Products**	Unit I: - A) Need of microbiological quality control of food B) 2.ii) Mold Unit II: - E)2. ICMSF- Sampling plans
Sem IV	**Paper VII DSC D-27 Fermentation Technology**	Unit I: - A) 3. Rifampicin B) 1. Lactic acid Unit II: - B) 2. Lipase
	Paper VIII DSC D-28 Industrial Production of Biofertilizers	Unit I: - C) 4. Methods of application Unit II: - C) 4. Standard of biofertilizer 5. Biostability of product biofertilizer
B. Sc Part II	**Practical's**	**Course III** Credit I 1.Production of sauerkraut 2. SPC of sauerkraut 6. Isolation of bacteria from spoiled wine Credit II 5. Detection of the presence of mold from given food sample **Course IV** Credit III 4. Production of protease by submerged culture method Credit IV 5. Determination of heterocyst frequency of blue green bacteria 6. Microbial limit test for PSB market fertilizer product **Practical Examination** • Candidates have to visit at least one place of microbiological interest (pharmaceutical / Industry / dairy / research institute etc.) and submit the report of their visit. (Requirement of Study Tour reduced) • 10 marks of tour report are reduced and marks of Q.No. 4 and Q.No. 6 are increased by 5 marks, in each.
B. Sc Part III	**Paper IX DSCC 27 Environmental Microbiology**	Unit I B) a. Carbon cycle b. Role of microorganisms in elemental cycles Unit II A) c. Astromicrobiology B) b. 2) Conditions favoring the actions of microorganisms

Sem V	Paper X **DSCC 28 Basic Techniques in Biotechnology**	Unit I A) 2. BAC and YAC Unit II A) c. Gene editing B) a. Protein Engineering b. Gene mapping
	Paper XI DSCC 29 Quality Assurance and Quality Control in Industrial Products	Unit I A) a. Introduction b. Concept of pharmacopoeia B) b. Vitamin A Unit II B) b. Validation and in process monitoring of sterilization
	Paper XII DSCC 30 Microbial Production of Metabolites and Bioinsecticide	Unit I A) b. Vitamin C – c. Vitamin A B) c. Itaconic acid C) a. Bacitracin Unit II B) c. Botulism
Sem VI	**Paper XIII DSCC 27 Environmental Pollution and Control**	Unit I A) b. E.M.S B) b. Biosafety in laboratories Unit II C) c. Dairy industry
	Paper XIV DSCC 28 Applications of Biotechnology	Unit I A) b. Methods of raising transgenic animals C) a. Food Industry Unit II B) c. b) TB detection
	Paper XV DSCC 29 Industrial Management, Government laws and Regulations	Unit I B) b. Organizing - Meaning c. Communication - Meaning Unit II A) a. Geographical indications, design b. TRIPS B) Good and service tax 2017
	Paper XVI DSCC 30 Microbial Fermentations, Foods and Biofuels	Unit I A) b. Production-bacteria c. Product quality B) a. Types of mushroom D) Microbial production of Indian made foreign liquors-rum

		Unit II A) a. Ethanol c. Biodiesel production from algae
B. Sc Part III	**Practical's**	**Course V** Credit I **Major experiment** 5. Isolation of hydrocarbons degrading microorganisms 6. Isolation of plastic degrading microorganisms **Minor experiments** 4. Validation of autoclave as per IP 5. Validation of Laminar air flow Credit II **Major experiment** 7. Demonstration of DNA amplification by PCR 8. Identification of protein by Western blot **Course VI** Credit I **Major experiment** 6. Cultivation of edible mushroom 7. Production of biogas from organic waste 8. Production of alcohol from molasses **Minor experiments** 5. Estimation of alcohol **Practical Examination** ● Candidates have to visit at least two (2) places of microbiological interest pharmaceutical /Industry / dairy / research institute etc.) and submit the report of their visit. (Requirement of Study Tour reduced) ● 20 marks of tour report are reduced and marks of major experiment are increased by 5 marks, in each of the practical course i.e., each major experiment will be of 25 marks.

Microbiology, Pharmaceutical Microbiology		
Program	**Sem/Paper**	**Syllabus not to be considered for examination**
M.Sc Part I and II	all Semister	Unit No. IV in all papers

Electronics			
Programme	**Sem/Paper**		**Syllabus not to be considered for examination**
B. Sc. Part – I	SEM –I	Paper- I	Unit No.1 Part (C)
			Unit No. 2 Part (C)
		Paper- II	Unit No. 2 Part (C)
	SEM –II	Paper- III	Unit No.1 Part (C)
			Unit No. 2 Part (C)
		Paper- IV	Unit No.1 Part (C)
			Unit No. 2 Part (C)
B. Sc. Part – II	SEM –III	Papers V, & VI	Unit No. 4 from all Papers
	SEM -IV	Papers VII & VIII	Unit No. 4 from all Papers
B. Sc. Part – III	SEM – V	Papers IX, X, XI & XII	Unit No. 4 from all Papers
	SEM –VI	Papers XIII, XIV, XV & XVI	Unit No. 4 from all Papers

Electronics		
Program	**Sem/Paper**	**Syllabus not to be considered for examination**
M.Sc Part I and II	all Semister	Unit No. IV in all papers

Geography			
Program	**Sem/Paper**		**Syllabus not to be considered for examination**
B. A./ B. A. B. Ed. Part I	I	Physical Geography	Module / Unit IV: Denudation
	II	Human Geography	Module / Unit IV: Agriculture
	I	STD	Module / Unit IV: Science, Technology and Human Health
	II	STD	Module / Unit IV: Science Technology in India's Defence and Ocean Research
B. A. / B. A. B. Ed. Part II	III	Soil Geography	Module / Unit IV: Practical (Theory Only)
	IV	Resource Geography	Module / Unit IV: Practical (Theory Only)
	V	Oceanography	Module / Unit IV: Practical's (Theory Only)
	VI	Agricultural Geography	Module / Unit IV: Practical (Theory Only)
	IDS I	Concepts in Tourism Geography	Module / Unit IV: Impact of Tourism
		Cartography	Module / Unit IV: Representation of Earth's Surface
		Resource Geography of Maharashtra	Module / Unit IV: Water and Soil Resources in Maharashtra
	IDS II	Development and Planning of Tourism	Module / Unit IV: Tourism Centers in Maharashtra
		Cartography	Module / Unit IV: Introduction to Geographical Information System and Global Positioning System
		Resource Geography of Maharashtra	Module / Unit IV: Practical (Theory Only)
B. A. / B. A. B. Ed. Part- III	VII	Evolution of Geographical Thought	Module / Unit IV: Trends in Geography
	VIII	Geography of India	Module / Unit IV: Agriculture and Industry
	IX	Population Geography	Module / Unit IV: Population Composition
		Social Geography	Module / Unit IV: Geographies of Welfare, Well Being and Social Problems in India
	X	Economic Geography	Module / Unit IV: Transport and Trade
	XI	Urban Geography	Module / Unit IV: Urban Problems and Issues
		Regional Planning and Sustainable Development	Module / Unit IV: Sustainable Development
	XII	Political Geography	Module / Unit IV: Resource Dispute and Conflicts
		Geography of Health and Wellbeing	Module / Unit IV: Health and Disease Patterns

B. A. / B. A. B. Ed. Part-III	XIII (Practical)	Map work and Map interpretation	Module No. I	1.1.1 Classification of Maps: Based on Scale and Purpose 1.2.4/ iii) Diagonal Scale
			Module No. II	2.2 /ii) Zenithal Polar Equal Area Projection 2.2/v) Mercator's Projection and Reference to Universal Transverse Mercator (UTM) Projection
			Module No. III	3.2/ 3.5.3 Projected Profile 3.2/ 3.5.4 Longitudinal Profile
			Module No. IV	4.3 Any one Toposheet Interpretation of Plain, Plateau and Mountain
			Module No. V	5.1 Study of Weather Instruments with reference to Principle, Mechanism and Function (All Instruments) 5.4 Any one Season
			Module No. VI	b) Proportional Circle c) Proportional Square
	XIV (Practical)	Advanced Tools, Techniques & Field Work in Geography	Module No. I	1.3 Application of Excel for Data Analysis
			Module No. IV	Statistical Methods and Techniques

Geography			
Program	**Sem/Paper**		**Syllabus not to be considered for examination**
B. Com. Part I	I	Commercial Geography	Module / Unit IV
	II	Commercial Geography	Module / Unit IV

Geography				
Program	Sem/Paper		Syllabus not to be considered for examination	
B. Sc. Part- I	I and II	Physical Geography-I	Module / Unit I	1.3 Recent Trends in Physical Geography
			Module / Unit II	2.4 Indian Monsoon: Indian Monsoon and Tibet Plateau, Jet Stream and El-Nino. 2.5 Seasons in India: Summer, Rainy and winter
		Physical Geography-II	Module / Unit II	2.3 Temperature of Ocean Water: Factors Affecting on Horizontal Distribution of Temperature of Ocean Water, Vertical Distribution of Temperature of Ocean Water 2.4 Salinity of Ocean Water: Affecting Factors on Salinity of ocean water, Distribution of salinity- Horizontal and Regional
	I and II	Human Geography –I	Module / Unit I	1.5 Human Races – Major Racial Groups and Classification 1.6 Religious and Ethnic Groups in the World
			Module / Unit II	2.5 Demographic Transition Theory
		Human Geography – II	Module / Unit II	2.3 Urbanization and World Trend of Urbanization 2.5 Perroux's Growth Pole Theory
B. Sc. Part- I	Practical	General Cartography	Module / Unit I	1.3 Significance and uses of Maps and Globe
			Module / Unit II	2.4 Construction of Graphical Scale ii) Comparative Scale iv) Diagonal Scale
			Module / Unit III	3.2 Graphical Construction of the following Projections: ii) Zenithal polar Equidistance Projection iv) Cylindrical Equal-Area Projection vi) Mercator's Projection vii) Bonne's Projection
			Module / Unit IV	4.2 Two Dimensional Diagrams: a) Proportional Circle b) Proportional Sphere

Geography

Paper No.	Course Title	Syllabus not to be considered for examination
M.A./M.Sc. Geography Sem. I		
CC-101	Fundamentals of Geomorphology	**Unit-1:** Principle of Uniformitarian's. **Unit-2:** Theory of Plate Tectonics. **Unit-3:** Mass wasting. **Unit-4:** Geosynclinals theory of Kobber, Theory of Isostasy.
CC-102	Principles of Climatology	**Unit-4:** Tropical Cyclones, Anticyclones, Thunderstorms, Tornadoes, Hurricanes, Water spouts; Application of Synoptic Climatology in pollution studies and navigation.
CC-103	Economic Geography	**Unit-2:** Energy Resources: OPEC-energy crisis. **Unit-3:** Industrial Geography: World industries: locational patterns and problems; New industrial policies of India. **Unit-4:** Transportation & Trade: patterns of world trade, Regional Trade blocks EEC, EFTA, & WTO.
CC-104	Geography of Population and Human Resource Development	**Unit-1:** Population composition and change: Health **Unit-**3: Theories of population growth: Marx, Epidemiological Transition **Unit-4:** Limits to Growth
CCPr-105 (Annual)	105.1 Practicals in Geomorphology and Surveying	**Unit-1:** 5. Indexing of Topographical sheets. **Unit-2:** Drainage Basin Analysis D) Drainage Basin Morphometry: 17. Delineating Drainage Basin Perimeters, 18. Measurement of Drainage basin area, 19. Relief/Height (H), 20. Perimeter Length (P), 22. Calculation of Bifurcation Ratio, 23. Calculation of Drainage density, 24. Calculation of Stream Frequency, 25. Drainage Texture, 26. Elongation ratio, 27. Circularity Ratio. **Unit-3:** Field Surveying 30. Transit Thedolite: Concept of transiting, swinging, face left, face right and changing face. 31. Measurement of horizontal and vertical angles. 32. Determination of horizontal distance between two inaccessible points with Thedolite. 33. Theodolite Traverse Surveying and Stadia Survey.

		34. Tacheometry. Preparation of Contour map of small area. 35. Total Station: Components used in Total Station Surveying; 36. To plot a small area using measurements taken from a Total Station.
	105.2 Analysis of Climatic Data	**Unit-1:** Basics of Climatic Data Analysis Practical Exercise(s): 3: Measurement of meteorological elements- Temperature, Humidity of the air, Precipitation, Wind, Evaporation, Atmospheric pressure **Unit-3:** Analysis of Interrelationship: Meteorological Elements Practical Exercise(s): 28: Analysis of upper air data- Tephigram (Temperature Height diagram) 29: Ergographs (Crop Calendar) 30-31: Dispersion graphs: Temperature and rainfall dispersion Diagram
	105.3 Analysis of Socio-economic Data	**Unit-1:** Population Data Analysis Practical Exercise(s): 5: Maps with proportional spheres. 12-14: Measures of population Growth- rates, ratios- arithmetic & exponential 17: Human Development Index **Unit-2:** Agricultural Data analysis Practical Exercise(s): 23: Determination of Agricultural Productivity **Unit-3:** Economic Data analysis Practical Exercise(s): 27-28: Logarithmic & Semi-logarithmic graphs. 29: Location Quotient method
	CGPA - Total Credit (Cumulative)	
AEC-106	Ability Enhancement Course	
	Non-CGPA - Total Credit (Cumulative)	
M.A./M.Sc. Geography Sem. II		
CC-201	Applied Geomorphology	**Unit-1:** folding and faulting. **Unit-2:** Morphogenetic regions **Unit-3:** Hill Slope development, views of W.M. Davis, Walther Penck, Allen Wood and L.C. King. **Unit-4:** recent trends in Geomorphology.
CC-202	Applied Climatology and Climate Change	**Unit-1:** History and relevance of applied climatology and climate change studies; Impact of climate on soils. **Unit-2:** spatial and seasonal variation of humidity and wind. **Unit-3:** Causes and impacts of acid rain; El-nino and southern oscillation (ENSO). **Unit-4:** Significant climate anomalies - notable events of recent times, extreme weather and climate.
CCS-203	Advanced Cartography and Surveying	**Unit-2:** Digital Cartography: visualization **Unit-4:** Surveying Measurements - Angular measurement-types of measured angles, Compass, Meridian, Bearings and azimuths, Errors, Corrections and precautions, Vertical measurement-types and methods of leveling, Contouring definition, characteristics, methods and interpolation.

CCS-204	Social and Cultural Geography	**Unit-1:** Social Geography: housing space and society, and geography of poverty. **Unit-2:** Culture and Races: Griffith Taylor Theory, Basis of racial classification and their physical characteristics. **Unit-3:** Socio-cultural Diversity: Concept of Dialects and ethnicity. Concept of social areas **Unit-4:** Social Justice and Well-being: Social status of women in India.
CCPr-205 (Annual)	205.1 Computer Applications in Geography	**Unit-3:** Exercise No. 27: Co-relation and regression analysis using MS Excel. 28: Presentation and illustration of geographic data – preparation of maps with labeling. 29-30: Presentation and analysis of geographic data using Origin and SPSS.
	205.2 Statistical Techniques in Geography	**Unit-2:** Measures of Statistics: Practical Exercise(s): 23-25: Relative measurements: Coefficient of variations, Index variability and Relative variability. **Unit-3:** Analysis of Statistical Relationship Practical Exercise(s): 31-32: Regression analysis: Simple and Multiple Regression 33: Least square method.
	205.3 Quantitative Techniques in Geography	**Unit-2:** Hypothesis Testing 1. The Man–Whitney Utest 2. The Wilcoxon test for paired samples 3. Analysis of variance 4. Kruskal–wallis analysis of variance 5. Snedecor's variance ratio test (F test) 6. ANOVA-One way 7.ANOVA-Two ways (single entry and multiple entry)
	CGPA - Total Credit (Cumulative)	
SEC-206	Skill Enhancement Course	
	Non-CGPA - Total Credit (Cumulative)	
M.A./M.Sc. Geography Sem. III		

CC-301	Geohydrology and Oceanography	**Unit-2:** Problems related to water use; Conservation and planning for the development of water resources; Watersheds and Wetlands in India. **Unit-3:** Bottom relief of Pacific, Atlantic and Indian Ocean. **Unit-4:** Biological productivity in the Ocean; Major water masses of the World's Ocean; Thermohaline circulation and the oceanic conveyor belt; Marine pollution.
CCS-302	Fundamentals of Remote Sensing and DIP	**Unit-1:** Introduction & Principles of Remote Sensing: Principles and applications of thermal & microwave remote sensing; Introduction to hyper-spectral remote sensing. **Unit-4:** Digital Image Processing: Sources of Errors: Geometric and radiometric; Image rectification; Image enhancement: methods and techniques; Image classification: supervised and unsupervised; Image accuracy assessment.
DSE-303 (Optional)	Geography of Environment	**Unit-1:** Functioning of environmental systems: role of biotic and abiotic elements **Unit-2:** Biogeochemical cycles (carbon, nitrogen and oxygen). **Unit-3:** Disaster management in Maharashtra and India. **Unit-4:** Conservation and management of environment; Concept of sustainable development; Environment impact assessment; International programmes and Policies (Brundtland commission, Kyoto protocol, agenda 21, Sustainable development goals, Paris agreement.
	Biogeography	**Unit-1:** Concepts and Theories in Biogeography: Nature of Biogeography, History of Biogeography – Development of Concepts (Limnaeus, Humboldt, Darwin, Wallace, Wegner, Heming, Brudin, Croizat), Plate tectonic and biotic change, Communities and patterns in biogeography–Biomes, Hotspots, biodiversity, alpha beta diversity and niche. Importance to society,
DSE-304 (Optional)	Settlement Geography	**Unit-1:** Fundamentals of Settlement Geography- Spacing, dispersion and localization. **Unit-2:** Geography of Rural Settlements- Morphology of rural settlements; service interaction; Rural planning and challenges. **Unit-3:** Geography of Urban Settlements suburbanization, Functional classification of urban settlements; Conurbation, law of primate city, Garden city movement, Urban agriculture.
	Geography of India	**Unit-4:** Transport Communication and Trade of India: Major ports Information Technology and Communication Development in India, Trade in India-Import and Export.

	Political Geography	**Unit-2:** climate change; world resources and Indian ocean, Neopolitics of world natural resources **Unit-3:** Lectures Citizenship, Determinants of electoral behaviour, Electoral reforms in India, Electoral system in India
CCPr-305 (Annual)	305.1 Research Methodology and Geographical Excursion - 2 Credits	**Unit-1:** Research Methods Exercise(s): 5: Use of instruments and other data collection methods
	305.2 Dissertation/ Project – 6 Credits	
	CGPA - Total Credit (Cumulative)	
AEC-306	Ability Enhancement Course	
EC-307	Elective Course (SWAYAM MOOC)	
	Non-CGPA - Total Credit (Cumulative)	
M.A./M.Sc. Geography Sem. IV		
CC-401	Development of Modern Geographical Thought	**Unit-1**: Trends in development of geography as a discipline in India. **Unit-4**: Approaches: Post modernism
CCS-402	Regional Planning and Development	**Unit-3:** Policies and Experiences of Regional Planning : Institutional framework from national planning level to regional development plans, Tennessee valley authority (USA), Damodar valley corporation (India), **Unit-4:** Regional planning in India : Planning for tribal area, Hilly area, Command area, and Drought-prone area development.
DSE-403 (Optional)	Fundamentals and Applications of GIS and GPS	**Unit-2:** GIS Analysis-DBMS **Unit-4:** Applications of Geospatial Technology: Soil resource Management, Agricultural Management, Forestry and Environment, Land use/ and Land cover mapping, Natural hazards assessment.
	Fundamentals of Soil Geography	**Unit-1:** Origin, Soil as a medium for plant growth **Unit-2:** Effects of tillage on structure and porosity. **Unit-3:** Ion exchange, Cation exchange, **Unit-4:** Nature and management of saline and sodic soils.
DSE-404 (Optional)	Agricultural Geography	**Unit-1:** Origin and dispersion of agriculture; **Unit-3:** spatial diffusion Process **Unit-4:** Land use survey, Land classification and land capability, Organic farming.
	Tourism Geography	**Unit-4:** assessment of tourist demand and supply -basic infrastructure planning for finance, human resources & environment maintance of tourist centres- time factor-regional planning consideration- tourism promotional planning advertisement, media, public relations & publicity. Tourism Policy Issues; strategic tourism planning; planning for tourism growth in India
	Geography of Health and Nutrition	**Unit-2:** Classification of Diseases, Occupational and nutritional deficiency diseases; WHO classification of diseases **Unit-4:** Health Care: Health Care - International level, with special reference to WHO, UNICEF and National level, with special reference to Government and NGOs; national disease eradication, and Health for All

		programmes, Health care response to COVID-19.
CCPr-405 (Annual)	405.1 CCPr-405.1: Photogrammetry, Remote Sensing and DIP – 4 Credits	**Unit-3**: Practicals in DIP Exercise-13: Supervised Classification Exercise-14: Unsupervised classification Exercise-15: Accuracy assessment
	405.2 Introduction to GIS Software and GPS (Optional)	**Unit-4:** Introduction to GPS instrument: Exercise 13: GPS surveying: Setting of GPS coordinates, Waypoints demarcation, Area Calculation through GPS, Navigation by Mobile GPS application. Exercise 14: Transfer of data in GIS software.
	405.2 Soil and Water Analysis (Optional) – 4 Credits	**Unit-1:** Soil survey Field-Moist preparation and Air-Dry preparation. **Unit-2:** Physical analyses of soil: Analysis of Soil colour, **Unit-3 :** Chemical extractions and analyses of soils: Determination of sodium, calcium and magnesium. **Unit-4:** Analysis of Water samples: Determination of carbonates and bicarbonates;
	CGPA - Total Credit (Cumulative)	
SEC-406	Skill Enhancement Course	
GE-407	Generic Elective Course	
	Non-CGPA - Total Credit (Cumulative)	

Geology		
Program	**Sem/Paper**	**Syllabus not to be considered for examination**
B.Sc Part I Sem I	**DSC 21A: Physical Geology**	Unit II- -Earthquake Scales -Volcano
	DSC 22A: Structural Geology	Unit II- -Joints -Unconformities
	DSC A: Lab Course	-Reading of Toposheet -Study of Clino-meter and Brunton Compass.
Sem II	**DSC 21B: Crystallography**	Unit II- -Monoclinic System -Triclinic System

	DSC 22B: Mineralogy	Unit II -Optical properties of Minerals
	DSC B: Lab Course	Section I -Monoclinic System -Triclinic System Section II -Optical properties of Minerals
B.Sc. Part II Sem III	**DSC 21C: Igneous Petrology**	Unit II -Crystallization of Ternary Magma
	DSC 22C: Sedimentary and Metamorphic Petrology	Unit I -Depositional Environments -Provenance Unit II -Outline of Facies of Metamorphism
	DSC C: Lab Course	-Microscopic Textures and Structures of Igneous Rocks -Microscopic Textures and Structures of Sedimentary and Metamorphic Rocks
Sem IV	**DSC 21D: Stratigraphy**	Unit I -Physiographic Divisions of India Unit II -Brief idea of Palaeozoic succession of Northwestern Himalaya
	DSC 22D: Palaeontology	Unit II -Vertebrate Palaeontology -Plant Fossils **DSC D: Lab Course** -Pelecypods -Echinoidea
B.Sc. Part III Sem V	**DSE 41E: Economic Geology**	Unit II -Study of Important Metallic and Non-metallic Minerals
	DSE 42E: Hydrogeology	Unit II -Surface and Sub-surface Geophysical and Geological Methods of Groundwater Exploration. -Darcy's Law.
	DSE 43E: Applied Geology-Engineering Geology	Unit I -Geology of Bridge Sites, Types of Bridges.

	DSE 44E: Applied Geology- Prospecting and Mining Geology	Unit I -Gravity Methods Unit II -Environmental Considerations for Mining.
	DSE E: Lab Course	Section IV- Complete
Sem VI	**DSE 41F: Photogeology and Remote Sensing**	Unit II -Introduction to GIS, Components of GIS, Integration of GIS with Remote Sensing
	DSE 42F: Geomorphology and Geotectonic	Unit I -Concepts of Geomorphology -Slope- Geometric Properties and Classification
	DSE 43F: Environmental Geology	Unit II -Watershed Management, -Land use Planning, -Management of Water Resources, Land Reclamation.
	DSE 44F: Geochemistry	Unit I -Geochemical Evolution of Earth and Geochemical Cycles. Unit II -Isotope Geochemistry
	DSE F: Lab Course	Section III- Complete

Geology		
Program	**Sem/Paper**	**Syllabus not to be considered for examination**
M.Sc Part I and II	all Semister	Unit No. IV in all Papers and Practical's related to those Units.

B. Sc. Information Technology (Entire)		
Program	**Sem/Paper**	**Syllabus not to be considered for examination**
B.Sc Part I Sem I	DSC-105 : Mathematics Paper-I Semester – I (Matrices & Calculus)	**Unit 4 – Partial Differentiation** 4.1. Introduction 4.2. Partial derivative of first order. 4.3. Partial derivative of Higher orders. 4.4. Homogeneous functions. 4.5. Euler's on homogeneous functions.
Sem II	DSC-205 : Mathematics Paper-II Semester – II (Numerical Methods)	**Unit-8. Numerical Solution of Ordinary Differential Equations &Numerical Integration** 8.2. Numerical Integration. 8.2.1. Trapezoidal Rule. 8.2.2. Simpson's 1/3 Rule. 8.2.3. Simpson's 3/8 Rule
	Mathematics Lab Practical Second Term	9 Numerical Integration (a) Trapezoidal Rule. (b) Simpson's 7 Rule (c) Simpson's 3/8 Rule
B.Sc Part II Sem III	DSC-306: Mathematics Paper-III (Algebra and Discrete Mathematics)	**Unit – 2 Graph Theory &Introduction to Finite Automata** 2.6 Finite automata 2.6.1 Acceptors, Deterministic and non-deterministic automata 2.6.2 Moore - Mealy machines and their equivalence 2.7 Definition of a Grammar , Derivations sentential forms, types of Grammars 2.8 Languages generated by Grammar 2.8.1 Grammars and Languages
	DSC-406: Mathematics Paper-IV (Operations Research)	**Unit – 2 Theory of Games** 2.3 Principle of dominance and solving some simple games 2.4 Sub game method 2.5 Graphical method for 2 x m and m x 2 game
	Lab course-VIII based on CC-306, CC-406 B. Sc. Part II (I.T.) (Entire) MATHEMATICS	**3 Graph Theory & Finite Automata** Finite Automata Languages generated by Grammar

	(Practical) (Based on CC-306: Discrete Mathematics and Linear Algebra)	
	DSC-406: Mathematics Paper-IV LAB COURSE – VIII (Second Term) (Based on CC-406:Operations Research Techniques)	**3 Theory of Games** Games without saddle point : Graphical method

B.Sc Environmental Science(Entire)

B. Sc.: Environment Science (Entire)
Semester I
Ecology and Ecosystem – Paper I
DSC-A1 – Ecology and Ecosystem
Credits 2 (Marks 50) Hours 30, 37.5 Lectures of 48 minutes

Unit	Lecture Hours
B: Succession Succession: Concepts of succession, Types of Succession. Trends in succession. Climax and stability. Major biomes of the world. Characteristics of terrestrial fresh water and marine ecosystems. Forests, grasslands, lake, river and marine ecosystems of India.	**7**

Natural Resources – Paper II
(DSC-A2 – Natural Resources)
Credits 2 (Marks 50) Hours 30, 37.5 Lectures of 48 minutes

Unit	Lecture Hours
B:Conventional and Non-conventional Resources Eenergy demand analysis Fundamental of Energy: Energy; work and power; different forms of energy.Conventional Energy Sources and Technology: Coal, petroleum; natural gas, nuclear energy, Non conventional resources; solar, water, wind, tidal, geothermal resources, biomass energy	**8**

Semester I
Fundamentals of Geoscience – Paper III
(DSC-A3 – Fundamentals of Geoscience)
Credits 2 (Marks 50) Hours 30, 37.5 Lectures of 48 minutes

Unit	Lecture Hours
B:Energy Budget and Temperature Inversion Energy budget of earth, Albedo, Heat island Lapse rate, Types-ELR, DALR & WALR Temperature inversion; Types-radiation, advection, frontal, subsidence, turbulence Types of interaction of solar rays with atmosphere	**7**

Semester I
Fundamentals of Environmental Pollution I (Water) – Paper IV
(DSC-A4 – Fundamentals of Environmental Pollution I (Water))
Credits 2 (Marks 50) Hours 30, 37.5 Lectures of 48 minutes

Unit	Lecture Hours
B: Treatments Provided to Water	**8**

Drinking water standards, effluent standards, Characteristics of domestic waste, characteristics of agricultural waste, Characteristics of industrial waste Water and waste water treatments i.e. Primary Treatment to waste water, Secondary Treatment, Tertiary / advanced treatment	

Semester I

Fundamentals of Environmental Science– Paper V

(DSC-A5 – Fundamentals of Environmental Science)

Credits 2 (Marks 50) Hours 30, 37.5 Lectures of 48 minutes

Unit	Lecture Hours
D: Biogeographic Provinces and Environmental Issues Biogeographic provinces of world Agroclimatic zones of India Major Environmental Issues in India- green house gas emission, ozone depletion, deforestation, depletion of fossil fuels and its impacts on mankind and animals	**8**

Semester I

Soil Science– Paper VI

(DSC-A6– Soil Science)

Credits 2 (Marks 50) Hours 30, 37.5 Lectures of 48 minutes

Unit	Lecture Hours
B: Soil Conservation Soil conservation : methods, practices, land treatment Need & practices for agricultural lands, physical, mechanical & biological practices Points to be considered for choice of conservation practice Bunding, terracing, plantations and other practices, it's advantages	**8**

Semester I

Fundamentals of Environmental Chemistry– Paper VII

(DSC-A7 – Fundamentals of Environmental Chemistry)

Credits 2 (Marks 50) Hours 30, 37.5 Lectures of 48 minutes

Unit	Lecture Hours

B: Environmental Analysis and Instrumentation Environmental Analysis – Solution Concentration, (Normality, Molarity, ppm, equivalent weight etc.) Titrimetric methods. Instrumentation Principle & working pH meter, conductivity meter, spectrophotometer, flame photometer	**7**

Semester I

Fundamentals of Environmental Biology– Paper VIII

(DSC-A8 – Fundamentals of Environmental Biology)

Credits 2 (Marks 50) Hours 30, 37.5 Lectures of 48 minutes

Unit	Lecture Hours
B: Ecological adaptations and Bioresources Ecological adaptations under various environmental conditions. Bio-resources – Forest, Agricultural crops, livestock, fisheries. Use of bio-resources, threats – over exploitation, habitat loss, invasive spp. etc.	**7**

B.Sc. Part - II

Environment Science (Entire)

Semester III

Disaster Management I (Natural) – Paper I

(DSC-C1 – Disaster Management-1 (Natural))

Credits 2 (Marks 50) Hours 30, 37.5 Lectures of 48 minutes

Unit	Lecture Hours
B: Natural disaster mitigation and legal aspects Community health and awareness, safety and preparedness for emergencies, Practical and sustainable approaches to disaster recovery National Calamity Management Act, State Disaster Management Act Natural disaster management in national development Disaster management in India Disaster Management ethics	**7**

Semester III
Biostatistics – Paper II
(DSC-C2 – Biostatistics)
Credits 2 (Marks 50) Hours 30, 37.5 Lectures of 48 minutes

Unit	Lecture Hours
B: Sampling, Coerrelation and regression Introduction to sampling, steps involved in sampling, types and methods of sampling Correlation and regression: relation between variables, linear regression analysis, regression analysis of grouped data, correlation analysis, Karl Pearson's coefficient of correlation	**8**

Semester III
Environmental Ethics and Environmental Issues – Paper III
(DSC-C3 – Environmental Ethics and Environmental Issues)
Credits 2 (Marks 50) Hours 30, 37.5 Lectures of 48 minutes

Unit	Lecture Hours
B: Environmental ethics from Indian perspectives: Significance of Indian traditions for environmental ethics, Women in forest, Indian heritage of conservation ethics, environment protection in Indian culture: cultural evolution, nature worship, tribal tradition, reservation of forest, movements for environmental protection Population control in the light of environmental protection	**7**

Semester III
Environmental Engineering-1 (Water) – Paper IV
(DSC-C4 – Environmental Engineering-I (Water))
Credits 2 (Marks 50) Hours 30, 37.5 Lectures of 48 minutes

Unit	Lecture Hours
B: Other Methods of Water Treatment: Flow diagram of general water treatment plant Colour, odour and taste removal: aeration, treatment by activated	**8**

carbon, use of copper sulphate Iron and manganese removal, fluoridation	

Semester III

Environmental Impact Assessment– Paper V

(DSC-C5 – Environmental Impact Assessment)

Credits 2 (Marks 50) Hours 30, 37.5 Lectures of 48 minutes

Unit	Lecture Hours
Prediction and identification of socio-economic impacts, education service impacts, traffic and transportation system impacts, Human health impacts EIA report writing	**8**

Semester III

Environmental Biotechnology– Paper VI

(DSC-C6– Environmental Biotechnology)

Credits 2 (Marks 50) Hours 30, 37.5 Lectures of 48 minutes

Unit	Lecture Hours
B: Genetically Modified Organisms and IPR: Genetically Modified Organisms in environment, effects of GMO's on environment, effects on human health, biosafety management Environmental biotechnology and Intellectual Property Rights Genetic engineering, concept of bio-safety, role of biotechnology in conservation of species	**8**

Environmental Studies Part II

as a Compulsory Paper for all Undergraduate Courses

1. **Nature of Environmental Studies :**
2. Definition, scope and importance.
   Multidisciplinary nature of environmental studies
   Need for public awareness.

3. Natural Resources and Associated Problems :

a) Forest resources: Use and over-exploitation, deforestation, dams and their effects on forests and tribal people.

b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and

problems.

c) Minral resources: Usage and explolitation. Environmental effects of extracting and using mineral resources.

d) Food resources: World food problem, changes caused by agriculture effect of modern agriculture, fertilizer-pesticide problems.

e) Energy resources: Growing energy needs, renewable and non-renewable energy resources, use of alternate energy sources. Solar energy , Biomass energy, Nuclear energy,

e) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Role of an individuals in conservation of natural resources.

Ecosystems :

Concept of an ecosystem.

Structure and function of an ecosystem.

Producers, consumers and decomposers.

Energy flow in the ecosystem.

Ecological succession.

Food chains, food webs and ecological pyramids.

Introduction, types, characteristics features, structure and function of the following ecosystem :-

a) Forest ecosystem, b) Grassland ecosystem, c) Desert ecosystem, d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and its conservation :

Introduction- Definition: genetic, species and ecosystem diversity.

Bio-geographical classification of India.

Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.

India as a mega- diversity nation.

Western Ghat as a biodiversity region.

Hot-spots of biodiversity.

Threats to biodiversity habitat loss, poaching of wildlife, man- wildlife conflicts.

Endangered and endemic species of India.

Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Environmental Pollution :

Definition: Causes, effects and control measures of: Air pollution,

Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards.

Solid waste Management: Causes, effects and control measures of urban and industrial wastes.

Role of a individual in prevention of pollution.

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4) Clank R.S. Marine Pollution, Clanderson Press Oxford (TB)
5) Cunningham, W.P. Cooper, T.H.Gorhani, E. & Hepworth, M.T.2001, Environmental Encyclopedia, Jaico Publ. Hpise, Mumbai, 1196p
6) De A.K., Environmental Chemistry, Wiley Wastern Ltd.
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8) Gleick, H.,1993, Water in crisis, Pacific Institute for studies in Dev., Environment & Security. Stockholm Env. Institute. Oxford Univ. Press 473p
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15) Odum, E.P.1971, Fundamentals of Ecology, W.B.Saunders Co. USA, 574p.
16) Rao M.N.& Datta, A.K.1987, Waste Water Treatment, Oxford & IBH Publ. Co. Pvt. Ltd., 345p
17) Sharma B.K., 2001, Environmental Chemistry, Gokel Publ. Hkouse, Meerut
18) Survey of the Environment, The Hindu (M)
19) Townsend C., Harper, J. and Michael Begon, Essentials of Ecology, Blackwell Science (TB)
20) Trivedi R.K. Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, vol. I anfd II, Environmental Media (R)
21) Trivedi R.K. and P.K. Gokel, Intriduction to air pollution, Tecgbi-Science Publications (TB)
22) Wagner K.D.,1998, Environmental management, W.B. Saunders Co. Philadelphia, USA 499p.
23) Paryavaran shastra – Gholap T.N.
24) Paryavaran Sahastra – Gharapure\

(M) Magazine (R) Reference (TB) Textbook

Pollution		
Program	**Sem/Paper**	**Syllabus not to be considered for examination**
B.Sc.Part - II Sem III	**DSC IC47: Ecology and Environment**	**Unit 5. Biogeochemical cycle**– General concept of Biogeochemical cycles, Global Biogeochemical cycles – Oxygen cycle, Carbon cycle, Nitrogen cycle and Phosphorous cycle. **5**
	DSC IC48: Environmental Pollution	**Unit 1. Pollution –** Introduction, Definition, Concept and Origin **4**
B.Sc.Part - III Sem V	**DSE E 85: Pollution V: Biomedical Aspects of Pollution**	**Unit 6. Food and safety** – Definition, Quality of food, Impact of additives, preservatives and chemicals on human health. (5)
	DSE E 86: Pollution VI: Environmental Legislation	**Unit 6. Maharashtra Pollution Control Board:** Activities and Achievements (5)

Environmental Science		
Program	**Sem/Paper**	**Syllabus not to be considered for examination**
M.Sc Part I and II	all Semister	Unit No. IV in all Papers

Biotechnology		
Program	**Sem/Paper**	**Syllabus not to be considered for examination**
B.Sc. Part - I **Sem I**	DSC-17-A Basics of Biotechnology-I	Credit- II Enzyme (basic concepts):- definition , concept of Holo enzyme, Apoenzyme, Coenzyme, Cofactor, Prosthetic group, Active site, Types - extracellular, intracellular, constitutive, inducible.
	DSC-18-A Basics of Biotechnology-II	Credit - II A. Ray diagram, principle and applications of – i) Compound Microscope ii) Electron Microscope- Scanning electron Microscope, Transmission Electron Microscope.
Sem II	DSC-17-B Basics of Cell biology and Microbiology	Credit- II Beneficial and harmful activities of microorganisms, Applied branchesof Microbiology Morphology and cytology of Bacteria A. Morphology of Bacteria – i) Size, ii) Shape, iii) Arrangements B. Cytology of Bacteria – Structure of Typical Bacterial Cell.
	DSC-18 B Basics of Microbiology	Credit- II Stains and staining procedures - A. Definition of dye and stain B. Classification of stains – Acidic, Basic and Neutral C. Principle, Procedure, Mechanism and application of staining procedures i) Simple staining ii) Negative staining Differential staining : Gram staining and Acid fast staining
	Practical -	**I) Lab. Exercises in Cell Biology and Microbiology.** 2. Demonstration of some lab equipments:- Autoclave, Hot air Oven, Incubator, LAF, Centrifuge, Colorimeter, Water bath, Colony Counter, Water distillation unit. 6. Enumeration of Bacteria from soil by total viable count- Pour plate technique.

		II) Lab. Exercises in Biochemistry 10. Estimation of RNA by Orcinol Method. (by calculation)
B.Sc Part II Sem III	**Paper V- Biophysics and enzyme technology**	Credit –II 2.1 Spectroscopy :- Principle, working and applications of- a) Principle, working and applications of-Florescence spectroscopy b) Principle, working and applications of-Infra red spectroscopy c) Principle, working and applications of-Atomic absorption spectroscopy
	Paper-VI Molecular Biology	2.3 Insertion elements and transposons- Properties and uses. 2.4Modes of gene transfer in bacteria – a)Transformation b) Transduction c) Conjugation
Sem IV	**Paper – VII (Immunology)**	Credit –II 2.5 Hypersensitivity – definition, types – a) Immediate - Anaphylaxis b) Delayed – homograft rejection
	Paper VIII - r-DNA technology	Credit II 2.4 Safety measures and biological risk for r-DNA work – Hazards in genetic engineering. 2.5. Gene Silencing- Introduction, Principle of Si-RNA and Si- RNA technology
	Laboratory exercise Techniques in enzymology	3.Effect of temperature on amylase
	Techniques in immunology	3.Radial immunodiffusion-double diffusion
	Techniques in r-DNA technology	4.Separation of plasmid DNA by Agarose Gel electrophoresis 5. Ligation
B.Sc Part III Sem V	**Paper No-IX- Biochemical Techniques.**	**Credit II** 2.2.1Agarose gel electrophoresis of DNA 2.4 Tracer technique. 2.4.1 Introduction – Radioactivity, radioisotopes, types of radiation (α, β, γ), half-life period of radioisotope 2.5 Methods of measurement of radioactivity Gas ionization Solvent excitation- Liquid scintillation counter
	Paper X–Animal Cell Culture	**Credit II** 2.3 Applications of Animal cell culture 2.3.5 Cloning.

		2.3.6 Cell synchronization 2.5 Selection of Transfected cells- Using selective markers- NPT-II,TK, DHFR, XGPRT 2.7 Transgenic Animals 2.7.1Production of Transgenic Animals- sheep, mice. 2.7.2Applications of Transgenic Animals 2.8 Bioethics of Animal Genetic Engineering
	Paper XI: Bioprocess Engineering	1.5 Downstream processing- Centrifugation, Precipitation ,Gel filtration, Affinity chromatography, Ion exchange chromatography 2.6.1 Physico-chemical assays- Gravimetric, Spectrophotometric, Chromatographic
	Paper XII: Fermentation Technology	**Credit II** 2.5 Lactic acid fermentation 2.6 Fermentation economics 2.7 IPR- introduction 2.7.1-Patents- Introduction, Criteria and process for patenting. 2.7.2Trademarks 2.7.3Trade secrets- 2.7.4. Copyrights.
Sem VI	**Paper XIII: Plant Biotechnology**	**Credit II** 2.6 Genetic transformation - micro projectile, pollen mediated, marker genes, expression of transferred genes. . 2.7 Practical applications of tissue and organ culture - Application in agriculture, application in horticulture and forestry, applications in industries, transgenic plants.
	Paper XIV: Environmental Biotechnology	**Credit II** 2.8 Biofertilizers- 2.8.1Rhizobial inoculants 2.8.2Azotobacter inoculants 2.8.3Azospirillum inoculants 2.8.4Cyanobacterial inoculants 2.8.5Phosphate solubilizing bacteria 2.8.6VAM 2.8.7Frankia 2.8.8Azolla 2.9Methods of Field applications
	Paper XV : Cell Metabolism and	2.6- Reproduction of Viruses- 4.4.1- Adeno virus 4.4.2- Bacteriophages- T4,

	Virology	λ- Phage 2.7 Isolation & Cultivation of Plant & Animal Viruses- Tissue culture & Embryonated Eggs
	Paper XVI: Gene biotechnology and Bioinformatics	**Credit II** 2.4.2 Secondary protein sequence databases:- PROSITE, PROFILE, PRINT, pfam, BLOCK, IDENTIFY 2.5 Other databases: -Literature database, PubMed, PubMed central 2.6Structural databases:-Introduction, Difference between Primary structure and 3D structure, Protein databank(PDB), -Molecular modeling databank (MMDB). CATH, SCOP, PdbSum
	Practical- I: Techniques in Plant and Environmental Biotechnology	9. Isolation of PSB from soil
	Practical- II: Techniques in Microbial, Biochemical Technology and Bioinformatics	8.Determination of molecular weight of DNA 13. Purification of Proteins by Ion exchange chromatography 16. Polymerase chain reaction (Demonstration) 17. Southern Blotting (Demonstration) 18. SDS-PAGE (Demonstration)
	Practical IV:	Study Tour Report

Biotechnology (Entire)		
Program	**Sem/Paper**	**Syllabus not to be considered for examination**
B.Sc Part I **Sem I**	**DSC BT1 : Chemistry- I**	Coordination Complexes Definition and formation of Co-ordinate bond in BF3← NH3 & NH4+ Distinction between double salt and complex salt Description of terms Ligand, Co-ordination number (CN), Co-ordination sphere. Essential and trace elements in biological process, Metallo porphyrins w.r.t. Hemoglobin and Myoglobin.
	DSC BT2 : Physics – I	Sound waves:

		Introduction, mechanical and electromagnetic waves, transverse and longitudinal waves with characteristics, principle of superposition of waves (Statement only), phenomenon of beats and expression for frequency of beats, application of beats, audible, ultrasonic and infrasonic waves, properties of ultrasonic waves and their applications, Doppler effect and its applications
	DSC BT3 : Plant Science	**Credit – II** **Seed and Plant Anatomy** **Seed** –Definition, Formation, structure of Monocot and Dicot seed Dormancy of seed- Definition, Causes and Breaking of seed dormancy. Seed germination- Concept, Types-Epigeal and Hypogeal, factors affecting seed germination. **Plant Anatomy** Tissues- Simple and complex (Xylem and Phloem) Primary structure of Dicot stem and root(Sunflower) Primary structure of Monocot stem and root(Maize) Normal secondary growth in Dicot stem(Sunflower)
	DSC BT4 : Mathematical Methods	**Credit - II** **Partial differentiation** Introduction Simple examples on evaluation of partial derivatives Composite function with examples Homogenous function (Definition) Euler's theorem for first and second order. Simple examples on above theorems. Maxima and Minima (Two variables)
	DSC BT 5: biomolecules	**Credit – II** **Carbohydrates:** Classification, glyceraldehydes, simple aldoses & ketoses, confirmation of D-glucose, biological importance of carbohydrates, reactions of monosaccharide (Oxidation, reduction, osazone), glycosidic bond, disaccharides (Sucrose, maltose, lactose), polysaccharides- homo polysaccharides- (Starch, glycogen, Cellulose.)
	DSC BT6 : Biotechniques and Instrumentation	**Credit – II**

		Centrifugation- Basic principles, RCF, Sedimentation coefficient, Svedberg's constant. Types of centrifuge: Desktop, High speed and Ultracentrifuge, Preparative centrifugation: Differential and density gradient centrifugation, applications **Basic Laboratory Instruments:** Principle, working and application of pH meter, Conductometer, Colorimeter, Refractometer, Autoclave, Laminar Air Flow.
	DSC BT7 : Microbiology – I	**Credit – II** **Stains and staining procedures -** A. Definition of dye and stain B. Classification of stains – Acidic, Basic and Neutral C. Principles, Procedure, Mechanism and application of staining procedures i) Simple staining ii) Negative staining iii) Differential staining : Gram staining and Acid fast staining iv)Special staining: Capsule staining, cell wall staining, endospore staining
	DSC BT8 : Computer Basics and Bioinformatics	**Basics of Bioinformatics:** Internet, world wide web, web browser, search engine (Google), searching data from search engine. **Bioinformatics-**Introduction, Nature of Biological data, characteristics of data, Tools for Protein function analysis, Homology and similarity, structure analysis, sequence analysis, BLAST, FASTA, EMBOSS, Clustalw, Applications & scope of Bioinformatics.
Sem II	**DSC BT9 : Chemistry – II**	**Credit – II** **Radioactivity :** **Introduction**, properties of alpha, beta and gamma radiation, Neutron-proton ratio and nuclear Stability, Process of radioactive decay, radioactive decay energy, rate of radioactive decay, units of radioactivity, Dosimeter: Absorbed dose(D), Dose equivalent(H) and effective dose equivalent **Radioactivity detecting techniques**: Ionization chamber, Geiger Muller counter, Scintillation counter, Hazards biological effect of radiation, Biological Applications of Radioisotope.
	DSC BT10 : Physics – II	**Credit – II**

		Atomic structures and X-rays Introduction, J. J. Thomson atomic model, Rutheford atomic model and Bohr model, Limitations of Bohr atomic model, Energy level diagram of Hydrogen atom,, Quantum numbers, Nuclear models and forces(Liquid drop modem and shell model), production of x-rays and its properties, Continuous and characteristics X- ray spectrum, Brags law, Applications of X-rays
	DSC BT 11 : Animal Science	Credit – II **Applied zoology** **Vermiculture** :Systematic position of species/types, stages of vermiculture, various models/methods, economic importance **Apiculture**: Types/ species of Honey bees, castes of Honey bees, economic Importance **Sericulture** : Types of Silkworms, Life cycle, economic importance **Pearl culture** :Systematic position ,various species, Stages in commercial Pearl culture, economic importance
	SC BT12 : Statistical Methods	**Credit – II** **Correlation and Regression** Concept of correlation between two variables and types of correlation. Method of obtaining correlation (i) by scattar diagram method ii) By Karl Pearson Correlation coefficient Properties of correlation coefficient. Examples on ungrouped data Concept of regression, Lines of regression Regression coefficients and properties without proof. Examples on ungrouped data.
	DSC BT13 : Proteins and Enzymes	**Credit – II** **Enzymes:** M-M equation, Line weaver- Burk plot, Eadie-Hofstee plot. **Co-enzymes:** Thiamine, riboflavin, niacin, pyridoxol phosphate, (Introduction, structure, sources, daily requirement, biological functions, deficiency,)
	DSC BT14: Basics in Cell Biology	**Credit – II** **Cytoskeletal assembly** Introduction Cytoskeletal elements Microtubules-ccurrence, structure, chemical composition, microtubule associated proteins, HMW proteins, DAU proteins MTOC , assembly and disassembly of microtubules, functions Microfilaments-occurrence, structure, chemical composition, functions

		Intermediate filaments(IF)- -occurrence, structure, chemical composition, types of IF, functions Organization of cilia and flagella
	DSC BT16 : Computer Programming	**Credit – II** Control Structures & Array If, if..else, nested if, switch statement, while loop , do.. while loop , for loop, continue & break statement Array- declaration, initialization of One dimensional & two dimensional array, character array, strlen(), strcpy(), strcmp(), strcat().
	Practical **DSC BTP1 : Techniques in Chemistry and Biochemistry**	**Sr. No.** **Name of the Practicals** **9** Preparation of standard potassium dichromate solution and determination of strength of ferrous ammonium sulphate solution **10** Preparation of dilute solution from given stock solution. **11** Inorganic preparations 1. Ferrous ammonium sulphate 2. Hexammine Nickel (II) Chloride **12** Inorganic Estimation :- Estimation of amount of magnesium from talcum powder by complexometric titration.
	DSC BTP2 : Laboratory Exercises in Microbiology and Instrumentation	**Sr. No.** **Name of the Practical Practicals** **1** Use, care and study of compound microscopy. **4** Demonstration (Principle, working, construction) of Autoclave & Centrifuge **5** Demonstration (Principle, working, construction) of Hot air oven & Incubator **6** Demonstration (Principle, working, construction) of Laminar Air Flow & Refractometer. **13** Isolation, mounting and identification of Mold. c. *Mucor* d. *Rhizopus*
	DSC BTP3 : Laboratory Exercises in Plant Science and Animal Science	**Sr. No.** **Name of the Practical** **3** Study of Pteridophyte (*Selaginella*) **4** Study of gymnosperms (*Pinus*)

		5 Study of Angiosperms (Sunflower,Maize) **6** Plant anatomy –, leaf **8** Study of typical flower **9** Study of types of inflorescence **10** Study of fruit types as per theory **16** Dissection of Labeo – Visceral organ like Gill, Digestive track, Heart, Kidney and Air bladder **23** Histology of Skin, Tooth, Liver, Kidney, Uterus. **24** Demonstration of – ii) Bee Keeping- Study of Instruments iii) Sericulture - Study of different Stages.
	SC BTP4 : Methods in Mathematics, Statistics and Computer Applications in Biology	**Sr. No.** **Name of the Practical** **1** 1. Applications of differential equation i) Growth & decay ii) Newton's law of cooling **4** Frequency distribution – Graphical, Histogram, ogive curve [less & greater than]. **19** Write program to display number, square & cube upto given number. **20** Write program to sort elements of array **21** Write program for addition of two matrix **22** Introduction to biological database
B.Sc Part II Sem III and IV	**DSC BT17- Genetics**	**Credit II** **2. Mechanism of recombination**-The Holliday model, Messelson and Radding model, Double strand break repair model, Fox model for non reciprocal recombination.
	DSC BT18- Fundamentals of Biophysics	**Topic No.** **Lectures 30** Credit-II **2.** . **Chromatography:** Introduction, Theory, Principle and applications of column chromatography, size exclusion chromatography, Ion exchange chromatography, Affinity chromatography, HPLC, GLC. **Tracer technique:** Introduction, α, β, γ radiations, measurement (scintillation counting, Geiger-Muller counting), radioactive isotopes, half life of isotopes, autoradiography.
	DSC BT19 - Metabolic Pathways	**Topic No.** 2. Credit-II

		Respiration:- Aerobic:-Flow of electrons in ETC, Redox potential components of ETC, Mechanism of ATP generation- Chemiosmotic hypothesis, ATP synthase complex. Anaerobic Respiration:- Alcoholic and Lactic acid fermentation**.**
	DSC BT20 - Ecology	**Topic No.** Credit-II **2. Population Ecology-** Introduction, population characteristics, Natality, Mortality, survivor ship curves, age structure, age pyramid. **Population growth-** Exponential and logistic, r and k strategists.
	DSC BT21 - Molecular Biology- I	**Topic No.** **Credit II** **2. DNA Repair** DNA repair- Direct repair, Excision repair (Nucleotide and Base), Mismatch repair, SOS repair, Recombination repair, Repair of double strand DNA break.
	DSC BT22 - Plant Tissue Culture	**Topic No.** Credit-II **2. Anther & Pollen Culture Technique-** Introduction, principle, protocol, factors affecting and applications. **Somaclonal Variation-** Introduction, terminology, origin, selection at plant level, selection at cell level, mechanism, assessment, applications and limitations.
	DSC BT23-Immunology	**Topic No.** Credit-II **2. Immune response**-primary and secondary immune response, theories of antibody production. **Hypersensitivity-** Concept and types with example.
	DSE BT24- Advances in Cell Biology	**Topic No.** **Credit II** **2. Cell division** Introduction and types of cell division- amitosis, mitosis and meiosis. Mitosis- history, phases in mitosis, significance. Meiosis -history, phases in meiosis, significance. Role of spindle fibers in chromosome

		separation. Condensation of chromosome. Synaptonemal complex.
	DSC BT25 -Plant Biochemistry	**Topic No.** 2. Credit-II **Introduction to Plant Hormones** Biosynthesis of plant hormones- Auxin, Cytokinin, Gibberellin. **Growth:-** Definition, phases of growth curve, Photoperiodism, Vernalisation.
	DSC BT26 Environmental Biotechnology	**Topic No.** **Credit II** **2. Environmental quality Assessment and Monitoring** Definition, Quality of environment for life on earth and man. Deterioration of environment quality, short term studies, rapid assessment, continuous-short and long term monitoring, Basic Concept of Environment Impact Assessment.
	DSC BT27 - Molecular Biology-II	**Topic No.** **2. Regulation of gene expression in prokaryote and eukaryote.** Regulation of gene expression in prokaryote a) Lac operon b) Tryptophan operon c) Arabinose operon. Regulation of gene expression in eukaryote a) Promoter b) Enhancers c) Activators d) Repressor e) Co-Repressors. Regulation of gene expression at transcriptional and translation level.
	DSC BT28 Animal Tissue Culture	**Topic No.** **Credit II** **2. Contamination-** Concept and Sources of contamination, types of microbial contamination, eradication of contamination. **Applications of cell culture-**In transplantation, and tissue engineering, monoclonal antibodies, culture based vaccine, valuable recombinant product, cloning, ethics and morality. **Stem Cell technology:** General introduction and applications.

	DSC BT P5 Techniques in Genetics, Immunology and Cell Biology **Techniques in Genetics, Immunology** **Sr. No. Name of the Practical**	**Sr. No. Name of the Practical** **Major Experiments** **4** Transformation in *E. coli*. **Minor Experiments** **7** Study of meiotic abnormality in *Rhoeo.*
	Techniques in Cell Biology **Sr. No. Name of the Practical**	**Major Experiments** **3** Isolation of mitochondria. **5** Isolation of giant chromosomes using Drosophila / Chironomous larvae. **Minor Experiments** **7** Study of plasmolysis.
	DSC BT P6 Techniques in Molecular Biology and Metabolic Pathways **Techniques in Molecular Biology** **Sr. No. Name of the Practical**	**Major Experiments** **2** DNA isolation from fungi. **5** Determination of Tm of DNA.
	Techniques in Metabolic Pathways **Sr. No. Name of the Practical**	**Major Experiments** **5** Paper electrophoresis of Amino Acids. **Minor Experiments** **5** Estimation of Indole-3 Acetic Acid by (Salkowaski reagent) Colorimetric method.
	DSC BT P7 Techniques in Plant Tissue Culture and Environmental Biotechnology **Techniques in Plant Tissue Culture** **Sr. No. Name of the Practical**	**Minor Experiments** **4** Anther Culture technique. **6** Micropropagation stage III-Rooting *(nvitro)* **7** Micropropagation stage IV-Acclimatization & hardening.
	Visit to commercial Plant Tissue Culture Laboratory **Techniques in Environmental Biotechnology** **Sr. No. Name of the Practical**	**Major Experiments** **5** Study of effect of pesticide on *Azotobater* population by viable count method. **Minor Experiments** **4** Isolation of microorganism from air by solid impaction technique. **Visit to ETP plant**
B.Sc. Part III Sem V & VI	**DSC BT- 29 Basics in Genetic Engineering**	**Topic No.** **Credit II** **2. DNA Sequencing and blotting technique** Maxam Gilbert method , Sanger Coulson method, Automated DNA sequencing, Southern Blotting, Northern Blotting, Western blotting ,

		Dot blotting.
	DSC BT – 30 Industrial Biotechnology	**Topic No.** **Credit II** **2** Downstream Process and Product Recovery Downstream Processes in fermentation and bioprocess technology Solid and liquid separation, Flocculation and Flotation, filtration and centrifugation, Cell disruption by solid and liquid shear, ultrasonication, enzyme action and mechanical disruption. Product recovery and purification- principle, Precipitation, Crystallization, Liquid-Liquid extraction, Distillation (Fractional and Steam), evaporation, Chromatographic separation (Principles), Adsorption and concentration, Membrane filtration, drying and packing.
	DSC BT -31 Application of Biotechnology in Agriculture	**Topic No.** **Credit II** **2** Biofertilizers – Definition ,Principle , Mass production and field application – *Rhizobium, Azotobacter, Azospirillum, Acetobacter, Azolla, Cyanobacteria,* PSB, VAM. Biopesticide – Definition, production and applications of Bacterial, fungal, viral and Plant origin Biopesticides.
	DSC BT -32 Developmental Biology (Plant and Animal)	**Topic Lectures 30** **No.** **Credit II** **2** **Differentiation and Regeneration :** Cell lineages, Determination, Commitment - specification and determination, Differentiation, Dedifferentiation, Rediffrentitation, Transdifferentiation, Developmental Plasticity. **French flag anatomy** Role of gene/s in patterning and development(anterior , posterior and dorsal ventral axis) of *Drosophila.*
	DSC BT -33 Advances in Genetic Engineering	**Topic No.** **Credit II**

		2 Application of r-DNA technology Production of transgenics- knock out mice, In medicines –Insulin and Somatostatin, Gene Silencing- Introduction, Principle of Si-RNA and Si- RNA technology **Molecular Markers** Introduction – Morphological , Biochemical, Molecular Markers- RFLP, RAPD, AFLP, STRS, QTL, SSR.
	DSC BT -34 Food and Microbial Biotechnology	**Topic No.** **Credit II** **2** Impact of GM food on human health Principle, Risk analysis and Regulations, Multidisciplinary perspectives of GM foods and impact, Public health principles Characteristics of food supply for public health, Food Safety, Capacity to supply nutritional adequacy, Sustainability, Capacity for Consumer choice, Accessibly and affordability to all.
	DSC BT -35 Application of Biotechnology in Health	**Topic** **No.** **Credit II** **2** **Biosensors-** Introduction, Principle, Types (Amperometric, Thermometric, Optical biosensor, Immuno biosensor), Applications **Public health** Introduction, DNA sample preparation, Methods of Diagnosis – Nucleic acid hybridization (Radioactive and Non radio detection). Detection of infectious disease (Tuberculosis, Malaria, AIDS, Chaga's) Detection of genetic diseases (cystic fibrosis, Sickle cell Anemia, Huntington's, DMD).
	DSC BT -36 Bioinformatics	**Topic No.** **Credit II** **2** **Drug designing** **Structure-based drug designing:** Introduction; Structure-based drug designing approaches, Target Identification and Validation, homology modeling and protein folding, receptor mapping, active site analysis and pharmacophore mapping, Grid maps. **Ligand-based drug designing and Docking:** Introduction; Ligand-based drug designing approaches, Lead Designing, combinatorial chemistry, High Throughput Screening (HTS), QSAR, Database generation and Chemical libraries, ADME property.

	DSC BT P8 Practical Techniques in Genetic Engineering and Bioinformatics **Sr. No.** **Techniques in Genetic engineering**	**1.** Calculation of molecular size of digested DNA	01	Minor
		2. Construction of restriction map of plasmid DNA	01	Minor
		6 cDNA cloning by Reverse Transcription PCR	01	Major
		Techniques in Bioinformatics		
		18 Energy calculation of the biomolecules using molecular mechanics and quantum mechanics. (Argus lab)	02	Minor
	DSC BT P9 Techniques in Industrial Biotechnology Practicals	**6** Production of sauerkraut.	01	Minor
		7 Mushroom Cultivation.	01	Minor
		10 Production, Recovery (Filtration, Solvent extraction) and estimation (Bioassay) a of Secondary metabolite (Antibiotic)	01	Major
		15 Preparation of fermented food (Bread/ Idli)	01	Minor
	DSC BT P10 Techniques in Agricultural and Health Biotechnology	**Practicals**	15	
		12 RAPD analysis demonstration experiment.	01	Major
		13 RFLP analysis demonstration experiment.	01	Major
		14 Study of Protoplast fusion and regeneration	01	Minor
		15 DPPH assay for antioxidant plant extract.	01	Minor

Biochemistry, Environmental Biotechnology, Biotechnology		
Program	**Sem/Paper**	**Syllabus not to be considered for examination**
M.Sc Part I and II	all Semester	Unit No. IV in all Papers

English			
B.Sc I	**AECC- Paper A**	ENGLISH FOR COMMUNICATION	**Module IV** A) The Auspicious Vision- Tagore B. The Book - Iftikar Rizvi
	AECC- Paper B	ENGLISH FOR COMMUNICATION	**Module VIII** A)The Golden Touch -Nathaniel Howthone B) Offering in the Temple -Desika Vinayakam Pillai
B.Sc III	**AECC**	ENGLISH FOR COMMUNICATION	**Module IV**
		ENGLISH FOR COMMUNICATION	**Module VIII**