University of Mumbai

No. UG/ 17 of 2020-21

CIRCULAR:-

Attention of the Principals of the Affiliated Colleges and Directors of the recognized Institutions in Humanities, Science & Technology Faculty is invited to this office circular No.UG/57 of 2018-19, dated 6th July, 2018 relating to the revised syllabus for the F.Y.B.Sc/F.Y.B.A. in Mathematics (Sem. I & II).

They are hereby informed that the recommendations made by the Board of Studies in Mathematics at its meeting held on 11th March, 2020 vide item No.1 and subsequently made by the Board of Deans at its meeting held on 20th July, 2020 vide item No.54 have been accepted by the Academic Council at its meeting held on 23rd July, 2020 vide item No. 4.106 and that in accordance therewith, the revised syllabus practical book of F.Y. B.Sc./ F.Y.B.A. in Mathematics under the (CBCS) in 75:25 pattern has been brought into force with effect from the academic year 2020 -21 accordingly. (The same is available on the University's website www.mu.ac.in).

MUMBAI – 400 032
17th November, 2020

(Dr. Vinod Patil)
I/c REGISTRAR

To

The Principals of the affiliated Colleges and Directors of the recognized Institutions in Humanities, Science &Technology Faculty.(Circular No.UG/334 of 2017-18 dated 9th January, 2018.)

A.C/4.106/23/07/2020

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No. UG/ 17 -A of 2020-21   MUMBAI-400 032   17th November, 2020
Copy forwarded with Compliments for information to:-

1) The Dean, Faculty of Humanities, Science & Technology,
2) The Chairman, Board of Studies in Mathematics,
3) The Director, Board of Examinations and Evaluation,
4) The Director, Board of Students Development,
5) The Co-ordinator, University Computerization Centre,

(Dr. Vinod Patil)
I/c REGISTRAR

Copy to :-

1. The Director of Board of Student Development.,
2. The Deputy Registrar (Eligibility and Migration Section)
3. The Director of Students Welfare,
4. The Executive Secretary to the to the Vice-Chancellor,
5. The Pro-Vice-Chancellor
6. The Registrar and
7 The Assistant Registrar, Administrative sub-centers, Ratnagiri,
   Thane & Kalyan, for information.

1. The Director of Board of Examinations and Evaluation
2. The Finance and Accounts Officers
3. Record Section
4. Publications Section
5. The Deputy Registrar, Enrolment, Eligibility and Migration Section
6. The Deputy Registrar (Accounts Section), Vidyanagari
7. The Deputy Registrar, Affiliation Section
8. The Professor-cum- Director, Institute of Distance and Open Learning
   Education,
9. The Director University Computer Center (IDE Building), Vidyanagari,
10. The Deputy Registrar (Special Cell),
11. The Deputy Registrar, (PRO)
12. The Deputy Registrar, Academic Authorities Unit (1 copies) and
13. The Assistant Registrar, Executive Authorities Unit

They are requested to treat this as action taken report on the concerned resolution adopted by the Academic Council referred to in the above circular and that on separate Action Taken Report will be sent in this connection.

1. The Assistant Registrar Constituent Colleges Unit
2. BUCTU
3. The Deputy Accountant, Unit V
4. The In-charge Director, Centralize Computing Facility
5. The Receptionist
6. The Telephone Operator
7. The Secretary MUASA
8. The Superintendent, Post-Graduate Section
9. The Superintendent, Thesis Section

   for information.

AC_____

Item No. _____

UNIVERSITY OF MUMBAI

Sr. No.	Heading	Particulars
1	Title of the Course	Mathematics (F.Y.B.Sc /F.Y.B.A)
2	Eligibility for Admission	XIIth Science with Maths
3	Passing Marks	40/100
4	Ordinances / Regulations (if any)	—
5	No. of Years / Semesters	Two Semesters
6	Level	P.G. / U.G./ Diploma / Certificate (Strike out which is not applicable)
7	Pattern	Yearly / Semester (Strike out which is not applicable)
8	Status	New / Revised (Strike out which is not applicable)
9	To be implemented from Academic Year	From Academic Year 2020-2021

Date: 20/03/2020

Signature:

Name of BOS Chairperson / Dean: Prof. Dr. R.P. Deore

UNIVERSITY OF MUMBAI

Syllabus

for F. Y. B. Sc. / F. Y. B. A. Semester I & II (CBCS)

Program: B. Sc. / B. A.

Course: Mathematics

with effect from the academic year 2020-2021

F. Y. B. Sc. (CBCS) SEMESTER I

CALCULUS I				
Course Code	UNIT	TOPICS	Credits	L/Week
USMT 101	I	Real Number System	2	3
	II	Sequences in $\mathbb{R}$		
	III	First Order First Degree Differential Equations		
ALGEBRA I				
USMT 102	I	Integers and Divisibility	2	3
	II	Functions, Relations and Binary Operations		
	III	Polynomials		
PRACTICALS				
USMTP01	-	Practicals based on USMT101, USMT102	2	2

F. Y. B. A. (CBCS) SEMESTER I

CALCULUS I				
Course Code	UNIT	TOPICS	Credits	L/Week
UAMT 101	I	Real Number System	3	3
	II	Real Sequences		
	III	First Order First Degree Differential Equations		
Tutorials				
	-	Tutorials based on UAMT101		

F. Y. B. Sc. (CBCS) SEMESTER II

CALCULUS II				
Course Code	UNIT	TOPICS	Credits	L/Week
USMT 201	I	Limits and Continuity	2	3
	II	Differentiability of functions		
	III	Applications of Differentiability		
DISCRETE MATHEMATICS				
USMT 202	I	Preliminary Counting	2	3
	II	Advanced Counting		
	III	Permutations and Recurrence Relation		
PRACTICALS				
USMTP02	-	Practicals based on USMT201, USMT202	2	2

F. Y. B. A. (CBCS) SEMESTER II

CALCULUS II				
Course Code	UNIT	TOPICS	Credits	L/Week
	I	Limits and Continuity		
	II	Differentiability of functions		
UAMT 201	III	Applications of Differentiability	3	3
TUTORIALS				
	-	Tutorials based on UAMT201		

Revised Syllabus in Mathematics
Choice Based Credit System
F. Y. B. Sc. / B. A. 2020-2021

Preamble:

The University of Mumbai has brought into force the revised syllabi as per the Choice Based Credit System (CBCS) for the First year B. Sc/ B. A. Programme in Mathematics from the academic year 2020-2021.

Mathematics has been fundamental to the development of science and technology. In recent decades, the extent of application of Mathematics to real world problems has increased by leaps and bounds. Taking into consideration the rapid changes in science and technology and new approaches in different areas of mathematics and related subjects like Physics, Statistics and Computer Sciences, the board of studies in Mathematics with concern of teachers of Mathematics from different colleges affiliated to University of Mumbai has prepared the syllabus of F.Y.B. Sc. / F. Y. B. A. Mathematics. The present syllabi of F. Y. B. Sc. for Semester I and Semester II has been designed as per U. G. C. Model curriculum so that the students learn Mathematics needed for these branches, learn basic concepts of Mathematics and are exposed to rigorous methods gently and slowly. The syllabi of F. Y. B. Sc. / F. Y. B. A. would consist of two semesters and each semester would comprise of two courses for F. Y. B. Sc. Mathematics and one course for each semester for F. Y. B. A. Mathematics. Course I is 'Calculus I and Calculus II'. Calculus is applied and needed in every conceivable branch of science. Course II, 'Algebra I and Discrete Mathematics' develops mathematical reasoning and logical thinking and has applications in science and technology.

Aims:

(1) Give the students a sufficient knowledge of fundamental principles, methods and a clear perception of innumerous power of mathematical ideas and tools and know how to use them by modeling, solving and interpreting.

(2) Reflecting the broad nature of the subject and developing mathematical tools for continuing further study in various fields of science.

(3) Enhancing students' overall development and to equip them with mathematical modeling abilities, problem solving skills, creative talent and power of communication necessary for various kinds of employment.

(4) A student should get adequate exposure to global and local concerns that explore them many aspects of Mathematical Sciences

Course outcomes:

1. Calculus (Sem I & II): This course gives introduction to basic concepts of Analysis with rigor and prepares students to study further courses in Analysis. Formal proofs are given lot of emphasis in this course which also enhances understanding of the subject of Mathematics as a whole. The portion on first order, first degree differentials prepares learner to get solutions of so many kinds of problems in all subjects of Science and also prepares learner for further studies of differential equations and related fields.

2. Algebra I (Sem I) & Discrete Mathematics (Sem II): This course gives expositions to number systems (Natural Numbers & Integers), like divisibility and prime numbers and

their properties. These topics later find use in advanced subjects like cryptography and its uses in cyber security and such related fields.

Teaching Pattern for Semester I

[1.] Three lectures per week per course.

[2.] One Practical per week per batch for each of the courses USMT101, USMT 102 (the batches to be formed as prescribed by the University).

[3.] One Tutorial per week per batch for course UAMT101 (the batches to be formed as prescribed by the University).

Teaching Pattern for Semester II

[1.] Three lectures per week per course.

[2.] One Practical per week per batch for each of the courses USMT201, USMT 202. (the batches to be formed as prescribed by the University).

[3.] One Tutorial per week per batch for the course UAMT201 (the batches to be formed as prescribed by the University).

F.Y.B.Sc. / F.Y.B.A. Mathematics

SEMESTER I

USMT 101 / UAMT 101: CALCULUS I

Note: All topics have to be covered with proof in details (unless mentioned otherwise) and examples.

Unit 1 : Real Number System (15 Lectures)

(1) Real number system $\mathbb{R}$ and order properties of $\mathbb{R}$, absolute value $|\,|$ and its properties.

(2) AM-GM inequality, Cauchy-Schwarz inequality, Intervals and neighbourhoods, interior points, limit point, Hausdorff property.

(3) Bounded sets, statements of l.u.b. axiom and its consequences, supremum and infimum, maximum and minimum, Archimedean property and its applications, density of rationals.

Unit II: Sequences in $\mathbb{R}$ (15 Lectures)

(1) Definition of a sequence and examples, Convergence of sequences, every convergent sequences is bounded. Limit of a convergent sequence and uniqueness of limit, Divergent sequences.

(2) Convergence of standard sequences like $\left(\dfrac{1}{1+na}\right)\ \forall a > 0,\ \ (b^n)\ \forall b,\ 0 < b < 1,\ \ (c^{\frac{1}{n}})\ \forall c > 0,\ \ \&\ \ (n^{\frac{1}{n}})$.

(3) Algebra of convergent sequences, sandwich theorem, monotone sequences, monotone convergence theorem and consequences as convergence of $\left(\left(1+\dfrac{1}{n}\right)^n\right)$.

(4) Definition of subsequence, subsequence of a convergent sequence is convergent and converges to the same limit, definition of a Cauchy sequences, every convergent sequences s a Cauchy sequence and converse.

Unit III: First order First degree Differential equations (15 Lectures)
Review of Definition of a differential equation, order, degree, ordinary differential equation and partial differential equation, linear and non linear ODE. Solution of homogeneous and non-homogeneous differential equations of first order and first degree. Notion of partial derivatives.

(1) Exact Equations: General solution of Exact equations of first order and first degree. Necessary and sufficient condition for $Mdx + Ndy = 0$ to be exact. Non-exact equations: Rules for finding integrating factors (without proof) for non exact equations, such as :

   i) $\dfrac{1}{M\ x + N\ y}$ is an I.F. if $M\ x + N\ y \neq 0$ and $Mdx + Ndy = 0$ is homogeneous.

   ii) $\dfrac{1}{M\ x - N\ y}$ is an I.F. if $M\ x - N\ y \neq 0$ and $Mdx + Ndy = 0$ is of the form $f_1(x,y)\ y\ dx + f_2(x,y)\ x\ dy = 0$.

iii) $e^{\int f(x)\ dx}$ (resp $e^{\int g(y)\ dy}$) is an I.F. if $N \neq 0$ (resp $M \neq 0$) and $\dfrac{1}{N}\left(\dfrac{\partial M}{\partial y} - \dfrac{\partial N}{\partial x}\right)$ $\left(\text{resp}\dfrac{1}{M}\left(\dfrac{\partial M}{\partial y} - \dfrac{\partial N}{\partial x}\right)\right)$ is a function of x (resp y) alone, say $f(x)$ (resp $g(y)$).

iv) Linear and reducible linear equations of first order, finding solutions of first order differential equations of the type for applications to orthogonal trajectories, population growth, and finding the current at a given time.

(2) Reduction of order :

(i) If the differential equation does not contain only the original function y, that is equations of Type $F(x, y', y'') = 0$.

(ii) If the differential equation does not contain the independent variable x that is, equations of Type $F(y, y', y'') = 0$.

Reference Books:

1. R. R. Goldberg, Methods of Real Analysis, Oxford and IBH, 1964.

2. K. G. Binmore, Mathematical Analysis, Cambridge University Press, 1982.

3. R. G. Bartle- D. R. Sherbert, Introduction to Real Analysis, John Wiley & Sons, 1994.

4. Sudhir Ghorpade and Balmohan Limaye, A course in Calculus and Real Analysis, Springer International Ltd, 2000.

5. G. F. Simmons, Differential Equations with Applications and Historical Notes, McGraw Hill, 1972.

6. E. A. Coddington , An Introduction to Ordinary Differential Equations.Prentice Hall, 1961.

7. W. E. Boyce, R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, Wiely, 2013.

Additional Reference Books

1. T. M. Apostol, Calculus Volume I, Wiley & Sons (Asia) Pte, Ltd.

2. Richard Courant-Fritz John, A Introduction to Calculus and Analysis, Volume I, Springer.

3. Ajit kumar and S. Kumaresan, A Basic Course in Real Analysis, CRC Press, 2014.

4. James Stewart, Calculus, Third Edition, Brooks/ cole Publishing Company, 1994.

5. D. A. Murray, Introductory Course in Differential Equations, Longmans, Green and Co., 1897.

6. A. R. Forsyth, A Treatise on Differential Equations, MacMillan and Co.,1956.

ALGEBRA I
USMT 102

Prerequisite :
Set Theory: Set, subset, union and intersection of two sets, empty set, universal set, complement of a set, De Morgan's laws, Cartesian product of two sets, Relations, Permutations ^nP_r and Combinations ^nC_r.

Complex numbers: Addition and multiplication of complex numbers, modulus, amplitude and conjugate of a complex number.

Unit I : Integers & Divisibility (15 Lectures)

(1) Statements of well-ordering property of non-negative integers, Principle of finite induction (first and second) as a consequence of Well-Ordering Principle.

(2) Divisibility in integers, division algorithm, greatest common divisor (g.c.d.) and least common multiple (l.c.m.) of two non zero integers, basic properties of g.c.d. such as existence and uniqueness of g.c.d. of two non zero integers $a\&b$ and that the g.c.d. can be expressed as $ma + nb$ for some $m, n \in \mathbb{Z}$, Euclidean algorithm.

(3) Primes, Euclid's lemma, Fundamental Theorem of arithmetic, The set of primes is infinite, there are arbitrarily large gaps between primes, there exists infinitely many primes of the form $4n - 1$ or of the form $6n - 1$.

(4) Congruence, definition and elementary properties, Results about linear congruence equations. Examples.

Unit II : Functions, Relations and Binary Operations (15 Lectures)

(1) Definition of relation and function, domain, co-domain and range of a function, composite functions, examples, Direct image $f(A)$ and inverse image $f^{-1}(B)$ for a function f, injective, surjective, bijective functions, Composite of injective, surjective, bijective functions when defined, invertible functions, bijective functions are invertible and conversely, examples of functions including constant, identity, projection, inclusion, Binary operation as a function, properties, examples.

(2) Equivalence relation, Equivalence classes, properties such as two equivalences classes are either identical or disjoint, Definition of partition, every partition gives an equivalence relation and vice versa.

(3) Congruence is an equivalence relation on $\mathbb{Z}$, Residue classes and partition of $\mathbb{Z}$, Addition modulo$n$, Multiplication modulo n, examples.

Unit III: Polynomials (15 Lectures)

(1) Definition of a polynomial, polynomials over F where $F = \mathbb{Q}, \mathbb{R}$ or $\mathbb{C}$, Algebra of polynomials, degree of polynomial, basic properties.

(2) Division algorithm in $F[X]$ (without proof), and g.c.d of two polynomials and its basic properties, Euclidean algorithm (proof of the above results may be given only in the case of $\mathbb{Q}[X]$ with a remark that the results as well as the proofs remain valid in the case of $\mathbb{R}[X]$ or $\mathbb{C}[X]$).

(3) Roots of a polynomial, relation between roots and coefficients, multiplicity of a root. Elementary consequences such as the following.

   (i) Remainder theorem, Factor theorem.

   (ii) A polynomial of degree n has at most n roots.

   (iii) Complex and non-real roots of a polynomials in $\mathbb{R}[X]$ occur in conjugate pairs.

   (Emphasis on examples and problems in polynomials with real coefficients).

(4) Necessary condition for a rational number $\frac{p}{q}$ to be a root of a polynomial with integer coefficients (viz. p divides the constant coefficient and q divides the leading coefficient), corollary for monic polynomials (viz. a rational root of monic polynomial with integer coefficients is necessarily an integer). Simple consequence such as the irrationality is necessarily of $\sqrt{p}$ for any prime number p. Irreducible polynomials in $\mathbb{Q}[x]$, Unique Factorisation Theorem. Examples.

Reference Books:

1. David M. Burton, Elementary Number Theory, Seventh Edition, McGraw Hill Education (India) Private Ltd.

2. 2. Norman L. Biggs, Discrete Mathematics, Revised Edition, Clarendon Press, Oxford 1989.

Additional Reference Books

1. I. Niven and S. Zuckerman, Introduction to the theory of numbers, Third Edition, Wiley Eastern, New Delhi, 1972.

2. G. Birkoff and S. Maclane, A Survey of Modern Algebra, Third Edition, Mac Millan, New York, 1965.

3. N. S. Gopalkrishnan, University Algebra, Ne Age International Ltd, Reprint 2013.

4. I .N. Herstein, Topics in Algebra, John Wiley, 2006.

5. P. B. Bhattacharya S. K. Jain and S. R. Nagpaul, Basic Abstract Algebra, New Age International, 1994.

6. Kenneth Rosen, Discrete Mathematics and its applications, Mc-Graw Hill, International Edition, Mathematics Series.

PRACTICALS FOR F.Y.B.Sc
USMTP01 – Practicals

A. **Practicals for USMT101/ UAMT 101:**

  (1) Algebraic and Order Properties of Real Numbers and Inequalities

  (2) Hausdorff Property and LUB Axiom of $\mathbb{R}$, Archimedian Property.

  (3) Convergence and divergence of sequences, bounded sequences, Sandwich Theorem.

  (4) Cauchy sequences, monotonic sequences, non-monotonic sequences.

  (5) Solving exact and non-exact, linear, reducible to linear differential equations.

  (6) Reduction of order of Differential Equations, Applications of Differential Equations.

  (7) Miscellaneous Theoretical Questions based on full paper.

B. **Practicals for USMT102:**

  (1) Mathematical induction ,Division Algorithm, Euclidean algorithm in $\mathbb{Z}$, Examples on expressing the gcd. of two non zero integers $a\&b$ as $ma + nb$ for some $m, n \in \mathbb{Z}$,

  (2) Primes and the Fundamental theorem of Arithmetic, Euclid's lemma, there exists infinitely many primes of the form $4n - 1$ or of the form $6n - 1$.

  (3) Functions, Bijective and Invertible functions, Compositions of functions.

  (4) Binary Operation, Equivalence Relations, Partition and Equivalence classes.

  (5) Polynomial (I)

  (6) Polynomial (II)

  (7) Miscellaneous Theoretical Questions based on full paper.

TUTORIALS FOR F.Y.B.A

Tutorials for UAMT101 :

 (1) Algebraic and Order Properties of Real Numbers and Inequalities

 (2) Hausdorff Property and LUB Axiom of $\mathbb{R}$, Archimedian Property.

 (3) Convergence and divergence of sequences, bounded sequences, Sandwich Theorem.

 (4) Cauchy sequences, monotonic sequences, non-monotonic sequences.

 (5) Solving exact and non-exact, linear, reducible to linear differential equations.

 (6) Reduction of order of Differential Equations, Applications of Differential Equations.

 (7) Miscellaneous Theoretical Questions based on full paper.

Semester II
USMT 201 / UAMT201: CALCULUS II

Unit-I: Limits and Continuity (15 Lectures)

{Brief review: Domain and range of a function, injective function, surjective function, bijective function, composite of two functions (when defined), Inverse of a bijective function. Graphs of some standard functions such as $|x|$, e^x, $\log x$, ax^2+bx+c, $\frac{1}{x}$, x^n $n \geq 3$), $\sin x$, $\cos x$, $\tan x$, $\sin\left(\frac{1}{x}\right)$, $x^2 \sin\left(\frac{1}{x}\right)$ over suitable intervals of $\mathbb{R}$. No direct questions to be added.}

(1) $\varepsilon - \delta$ definition of Limit of a function, uniqueness of limit if it exists, algebra of limits, limits of composite function, sandwich theorem, left-hand-limit $\lim\limits_{x \longrightarrow a^-} f(x)$, right-hand-limit $\lim\limits_{x \longrightarrow a^+} f(x)$, non-existence of limits, $\lim\limits_{x \longrightarrow -\infty} f(x)$, $\lim\limits_{x \longrightarrow \infty} f(x)$ and $\lim\limits_{x \longrightarrow a} f(x) = \pm\infty$.

(2) Continuous functions: Continuity of a real valued function at a point and on a set using $\epsilon - \delta$ definition, examples, Continuity of a real valued function at end points of domain using $\epsilon - \delta$ definition, f is continuous at a if and only if $\lim\limits_{x \longrightarrow a} f(x)$ exists and equals to $f(a)$, Sequential continuity, Algebra of continuous functions, discontinuous functions, examples of removable and essential discontinuity.

(3) Intermediate Value theorem and its applications, Bolzano-Weierstrass theorem (statement only): A continuous function on a closed and bounded interval is bounded and attains its bounds.

Unit-II: Differentiability of functions (15 Lectures)

(1) Differentiation of real valued function of one variable: Definition of differentiability of a function at a point of an open interval, examples of differentiable and non differentiable functions, differentiable functions are continuous but not conversely, algebra of differentiable functions.

(2) Chain rule, Higher order derivatives, Leibniz rule, Derivative of inverse functions, Implicit differentiation (only examples)

Unit-III: Applications of differentiability (15 Lectures)

(1) Rolle's Theorem, Lagrange's and Cauchy's Mean Value Theorems, applications and examples, Monotone increasing and decreasing functions, examples.

(2) L-Hospital rule (without proof), examples of indeterminate forms, Taylor's theorem with Lagrange's form of remainder with proof, Taylor polynomial and applications.

(3) Definition of critical point, local maximum/minimum, necessary condition, stationary points, second derivative test, examples, concave/convex functions, point of inflection.

(4) Sketching of graphs of functions using properties.

Reference books:

1. R. R. Goldberg, Methods of Real Analysis, Oxford and IBH, 1964.

2. James Stewart, Calculus, Third Edition, Brooks/ Cole Publishing company, 1994.

3. T. M. Apostol, Calculus, Vol I, Wiley And Sons (Asia) Pte. Ltd.

4. Sudhir Ghorpade and Balmohan Limaye, A course in Calculus and Real Analysis, Springer International Ltd, 2000.

Additional Reference:

1. Richard Courant and Fritz John, A Introduction to Calculus and Analysis, Volume-I, Springer.

2. Ajit Kumar and S. Kumaresan, A Basic course in Real Analysis, CRC Press, 2014.

3. K. G. Binmore, Mathematical Analysis, Cambridge University Press, 1982.

4. G. B. Thomas, Calculus, 12th Edition 2009

USMT 202: DISCRETE MATHEMATICS

Unit I: Preliminary Counting (15 Lectures)

(1) Finite and infinite sets, countable and uncountable sets examples such as $\mathbb{N}$, $\mathbb{Z}$, $\mathbb{N} \times \mathbb{N}$, $\mathbb{Q}$ $(0, 1)$, $\mathbb{R}$.

(2) Addition and multiplication Principle, counting sets of pairs, two ways counting.

(3) Stirling numbers of second kind. Simple recursion formulae satisfied by $S(n, k)$ for $k = 1, 2, \cdots, n-1, n$.

(4) Pigeonhole principle simple and strong form and examples, its applications to geometry.

Unit II: Advanced Counting (15 Lectures)

(1) Permutation and combination of sets and multi-sets, circular permutations, emphasis on solving problems.

(2) Binomial and Multinomial Theorem, Pascal identity, examples of standard identities such as the following with emphasis on combinatorial proofs.

- $\displaystyle\sum_{k=0}^{r} \binom{m}{k} \binom{n}{r-k} = \binom{m+n}{r}$ $\displaystyle\sum_{i=0}^{k} \binom{k}{i}^2 = \binom{2k}{k}$

- $\displaystyle\sum_{i=r}^{n} \binom{i}{r} = \binom{n+1}{r+1}$ $\displaystyle\sum_{i=0}^{n} \binom{n}{i} = 2^n$

(3) Non-negative integer solutions of equation $x_1 + x_2 + \cdots + x_k = n$.

(4) Principal of inclusion and exclusion, its applications, derangements, explicit formula for d_n, deriving formula for Euler's function $\phi(n)$.

Unit III: Permutations and Recurrence relation (15 lectures)

(1) Permutation of objects, S_n, composition of permutations, results such as every permutation is a product of disjoint cycles, every cycle is a product of transpositions, signature of a permutation, even and odd permutations, cardinality of S_n, A_n.

(2) Recurrence Relations, definition of homogeneous, non-homogeneous, linear, non-linear recurrence relation, obtaining recurrence relations of Tower of Hanoi, Fibonacci sequence, etc. in counting problems, solving homogeneous as well as non homogeneous recurrence relations by using iterative methods, solving a homogeneous recurrence relation of second degree using algebraic method proving the necessary result.

Recommended Books:

1. Norman Biggs, Discrete Mathematics, Oxford University Press.

2. Richard Brualdi, Introductory Combinatorics, John Wiley and sons.

3. V. Krishnamurthy, Combinatorics-Theory and Applications, Affiliated East West Press.

4. Discrete Mathematics and its Applications, Tata McGraw Hills.

5. Schaum's outline series, Discrete mathematics,

6. Allen Tucker, Applied Combinatorics, John Wiley and Sons.

7. Sharad Sane, Combinatorial Techniques, Springer.

PRACTICALS FOR F.Y.B.Sc
USMTP02-Practicals

A. **Practicals for USMT201 :**

   (1) Limit of a function and Sandwich theorem, Continuous and discontinuous function.
   (2) Algebra of limits and continuous functions, Intermediate Value theorem, Bolzano-Weierstrass theorem.
   (3) Properties of differentiable functions, derivatives of inverse functions and implicit functions.
   (4) Higher order derivatives, Leibnitz Rule.
   (5) Mean value theorems and its applications, L'Hospital's Rule, Increasing and Decreasing functions.
   (6) Extreme values, Taylor's Theorem and Curve Sketching.
   (7) Miscellaneous Theoretical Questions based on full paper.

B. **Practicals for USMT202:**

   (1) Counting principles, Two way counting.
   (2) Stirling numbers of second kind, Pigeon hole principle.
   (3) Multinomial theorem, identities, permutation and combination of multi-set.
   (4) Inclusion-Exclusion principle. Euler phi function.
   (5) Composition of permutations, signature of permutation, inverse of permutation.
   (6) Recurrence relation.
   (7) Miscellaneous Theoretical Questions based on full paper.

TUTORIALS FOR F.Y.B.A

Tutorials for UAMT201 :

(1) Limit of a function and Sandwich theorem, Continuous and discontinuous function.

(2) Algebra of limits and continuous functions, Intermediate Value theorem, Bolzano-Weierstrass theorem.

(3) Properties of differentiable functions, derivatives of inverse functions and implicit functions.

(4) Higher order derivatives, Leibnitz Rule.

(5) Mean value theorems and its applications, L'Hospital's Rule, Increasing and Decreasing functions.

(6) Extreme values, Taylor's Theorem and Curve Sketching.

(7) Miscellaneous Theoretical Questions based on full paper.

Scheme of Examination (75:25)

The performance of the learners shall be evaluated into two parts. The learner's performance shall be assessed by Internal Assessment with 25 percent marks in the first part and by conducting the Semester End Examinations with 75 percent marks in the second part. The allocation of marks for the Internal Assessment and Semester End Examinations are as shown below:-

  I. **Internal Evaluation of 25 Marks:**

   F.Y.B.Sc. :

   (i) One class Test of 20 marks to be conducted during Practical session.
   Paper pattern of the Test:
   Q1: Definitions/ Fill in the blanks/ True or False with Justification (04 Marks).
   Q2: Multiple choice 5 questions. (10 Marks: 5×2)
   Q3: Attempt any 2 from 3 descriptive questions. (06 marks: 2×3)
   (ii) Active participation in routine class: 05 Marks.

   F.Y.B.A. :

   (i) One class Test of 20 marks to be conducted during Tutorial session.
   Paper pattern of the Test:
   Q1: Definitions/ Fill in the blanks/ True or False with Justification (04 Marks).
   Q2: Multiple choice 5 questions. (10 Marks: 5×2)
   Q3: Attempt any 2 from 3 descriptive questions. (06 marks: 2×3)
   (ii) Journal : 05 Marks.

 II. **Semester End Theory Examinations :** There will be a Semester-end external Theory examination of 75 marks for each of the courses USMT101/UAMT101, USMT102 of Semester I and USMT201/UAMT201, USMT202 of semester II to be conducted by the college.

1. Duration: The examinations shall be of 2 and $\frac{1}{2}$ hours duration.

2. Theory Question Paper Pattern:

    a) There shall be FOUR questions. The first three questions Q1, Q2, Q3 shall be of 20 marks, each based on the units I, II, III respectively. The question Q4 shall be of 15 marks based on the entire syllabus.

    b) All the questions shall be compulsory. The questions Q1, Q2, Q3, Q4 shall have internal choices within the questions. Including the choices, the marks for each question shall be 25-27.

    c) The questions Q1, Q2, Q3, Q4 may be subdivided into sub-questions as a, b, c, d & e, etc and the allocation of marks depends on the weightage of the topic.

3. **Semester End Examinations Practicals:**

    At the end of the Semesters I & II Practical examinations of three hours duration and 100 marks shall be conducted for the courses USMTP01, USMTP02.
    In semester I, the Practical examinations for USMT101 and USMT102 are held together by the college.
    In Semester II, the Practical examinations for USMT201 and USMT202 are held together by the college.

    Paper pattern: The question paper shall have two parts A and B.
    Each part shall have two Sections.

    Section I Objective in nature: Attempt any Eight out of Twelve multiple choice questions (04 objective questions from each unit) ($8 \times 3 = 24$ Marks).

    Section II Problems: Attempt any Two out of Three (01 descriptive question from each unit) ($8 \times 2 = 16$ Marks).

Practical Course	Part A	Part B	Marks out of	duration
USMTP01	Questions from USMT101	Questions from USMT102	80	3 hours
USMTP02	Questions from USMT201	Questions from USMT202	80	3 hours

Marks for Journals and Viva:
For each course USMTP01 (USMT101, USMT102) and USMTP02 (USMT201, USMT202):

1. Journal: 10 marks (5 marks for each journal).

2. Viva: 10 marks.

Each Practical of every course of Semester I and II shall contain at least 10 objective questions and at least 6 descriptive questions.
A student must have a certified journal before appearing for the practical examination.
In case a student does not posses a certified journal he/she will be evaluated for 80 marks.
He/she is not qualified for Journal + Viva marks.

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UNIVERSITY OF MUMBAI

Syllabus for F.Y.B.Sc.
Program BSc
Course: ZOOLOGY

Semester I and II

(Credit Based Semester and Grading System
with effect from the academic year 2015–2016)

Syllabus Committee Members

Dr. Anil S. Singh	-	Convenor
Dr. Manisha Kulkarni	-	Co-convenor
Dr. Jyotsna Mahale	-	Co-convenor
Dr. Meenakshi Sundaresan	-	Co-convenor
Prof. Lata Sardesai	-	Co-convenor
Prof. P.C. Mathew	-	Co-convenor
Dr. Dilip Kakavipure	-	Co-convenor
Dr. V.M. Patole	-	Co-convenor
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Prof. Shanta Janyani	-	Co-convenor
Dr. S. Rangoonwala	-	Co-convenor
Dr. Minakshi Gurav	-	Member (Teacher)
Dr. Shirley B. Agwuocha	-	Member (Teacher)
Dr. Vishakha Shingala	-	Member (Teacher)
Dr. Gayathri N.	-	Member (Teacher)
Dr. Ansariya Rana	-	Member (Teacher)
Dr. Aditya S. Akerkar	-	Member (Teacher)
Dr. Shashikala Prajapati	-	Member (Teacher)
Dr. R.B. Singh	-	Member (Teacher)
Prof. Nitin Wasnik	-	Member (Teacher)
Prof. Nikhil C. Disoria	-	Member (Teacher)
Ms. Purva S. Prabhu	-	Member (Student)
Ms. Sachi R. Mayekar	-	Member (Student)
Ms. NehaVajandar	-	Member (Student)
Ms. Payal A. Shah	-	Member (Student)
Ms. Anuradha Gaikar	-	Member (Student)
Ms. Sonal S. Prabhulkar	-	Member (Student)

Syllabus for
FYBSc
Course – ZOOLOGY

1. Preamble

2. Pedagogy

3. Syllabus Semester I & II

4. References and Additional Reading

5. Scheme of Examination and Paper Pattern

6. Distribution of periods

7. Model Question bank

Aims

- To nurture interest in the students for the subject of Zoology

- To create awareness of the basic and modern concepts of Zoology

- To orient students about the importance of abiotic and biotic factors of environment and their conservation.

- To provide an insight to the basic nutritional and health aspects of human life.

- To inculcate good laboratory practices in students and to train them about scientific handling of important instruments.

Preamble

While presenting this new syllabus to the teachers and students of Semester I and Semester II (F.Y.B.Sc.) Zoology, I am extremely happy to state that for the first time efforts have been made to seek inputs of all the stake holders to make it more relevant.

In the first meeting of the Board of Studies an apex committee was formed to study syllabi worldwide with a view to include modern modules and plan semesters at UG and PG programs in advance to avoid overlapping and duplication of topics in various courses.

Meeting with the industry at the Indian Merchants' Chamber and with the meritorious alumni helped adding need based components. For the first time students were a part of the syllabus committee and the process became participative when the draft was finalized in an open meeting with all the Zoology teachers after having sought democratic criticism on the proposed syllabus placed on the University website for about one month.

While following the guidelines of UGC, use of animals is excluded from the practicals, substituting the same with audiovisual, ICT and simulation aids and that the syllabus is made more interesting with new, innovative topics. Providing the pedagogy as also indicating objectives and desired outcome of every topic for the teachers, and question bank for the students apart from the question paper pattern became an integral part of the syllabus, therefore.

Care is taken to provide the drafts from time to time and declare the final syllabus well in advance enabling the teachers to make preparations before commencement of the academic year and facilitating students to execute their right to know the details before admissions.

The success of this revamped syllabus will depend totally on the enthusiasm of the teachers which is very high all throughout the process and their hands will be strengthened by publishing the University text books for the first time. This curriculum of the Zoologists, for the Zoologists and by the Zoologists developed with the united efforts will take our ever progressive subject to greater heights in the years to come.

- **VINAYAK DALVIE, Chairman, BOS in Zoology**

Syllabus for
FYBSc.
Course – ZOOLOGY
To be implemented from Academic year 2015-16
SEMESTER - I

COURSE CODE	UNIT	TOPICS	CREDITS	LECTURES/WEEK
USZO101	I	Wonders of animal world	2	1
	II	Biodiversity and its conservation		1
	III	Footsteps to follow		1
USZO102	I	Laboratory safety and Units of Measurement	2	1
	II	Animal Biotechnology		1
	III	Instrumentation		1
USZOP1	Practical based on both courses		2	6

SEMESTER - II

COURSE CODE	UNIT	TOPICS	CREDITS	LECTURES/WEEK
USZO201	I	Population Ecology	2	1
	II	Ecosystem		1
	III	National park and Sanctuaries		1
USZO202	I	Nutrition and Health	2	1
	II	Public health and Hygiene		1
	III	Common human Diseases		1
USZOP2	Practical based on both courses		2	6

SYLLABUS F.Y.B.Sc. ZOOLOGY

UNIT WISE DISTRIBUTION

Semester I		Semester II	
Course 1	**Course 2**	**Course 3**	**Course 4**
Unit 1 Wonders of animal world	Unit 1 Laboratory Safety and Units of Measurement	Unit 1 Population Ecology	Unit 1 Nutrition and Health
Unit 2 Biodiversity and its Conservation	Unit 2 Animal Biotechnology	Unit 2 Ecosystem	Unit 2 Public Health and Hygiene
Unit 3 Footsteps to follow	Unit 3 Instrumentation	Unit 3 National Parks and Sanctuaries	Unit 3 Common Human Diseases
Practical (USZO P1)	Practical (USZO P1)	Practical (USZO P2)	Practical (USZO P2)

PEDAGOGY
F.Y.B.Sc. Syllabus

First year B.Sc. course is the entry point for the students to undergraduate classes which acts like a guiding force for them to make up their mind in selecting a subject they would wish to pursue their studies in future for carving their career in a particular field.

The syllabus committee in the subject of Zoology for F.Y.B.Sc. Class has designed this syllabus with a view that it is most appropriate time when we transform our traditional closed classroom teaching learning practices to more of field and activity based studies, the correct methodology for the study of Natural Sciences. It is recommended to orient the students about ecosystem, bio-diversity, wildlife conservation and management with the help of models, photographs, movies, documentaries, charts and use of ICT and then take learners to field to have realistic experiences. This will enable them to get true insight about endurance of animal life in relation to human activity inducing sentiment of love, care and protection in the young mind and heart leading to understand importance of co-existence and conservation of bio-diversity. An interaction with the officials of wildlife protection force should be allowed to get basic knowledge about the relevant acts through lectures which for creating awareness about these issues and also to make best use of the knowledge in their own interest as well as for the country. Instrumentation and Animal Biotechnology component would initiate academia- industry interface and should be edified in collaboration with expertise from relevant research institutes and industrial establishments and entrepreneurs by inviting them as guest speakers or through industrial visits, excursions for practical experience about the principle, working and application of the instruments for commercial use. Population ecology need to be explained in the context with census to enlighten pupils about the effect of diversity and dynamism of human population on socio economic status of India. Experts from the field of nutrition and health can be invited to enlighten learners on the topics of nutritional value of food, balanced diet, ill-effects of eating junk food and aerated drinks. Medical professionals, relevant NGO's maybe engaged to educate students regarding myth, precautionary measures, immunization drives of common diseases, ill-effects of self-medication and stress, significance of BMI through series of programmes. During medical emergencies it is of immense importance to provide first aid assistance to the diseased within the golden period i.e. of few minutes. This enhances the possibility to save life, thus it is strongly recommended to form a consortium of colleges to conduct training in rotation of first aid techniques for teachers and students both with the help of organizations like Red Cross Society, Health Department of Civic Bodies, Civil Defence Department and Local Self Government etc.

Dr. Anil S. Singh
Convenor

F.Y.B.Sc. ZOOLOGY
(THEORY)
SEMESTER I

USZO101 (Course 1)
Wonders of Animal World, Biodiversity and its Conservation

Unit 1: Wonders of Animal World (15 L)

Objective: To take learners through a captivating journey of hoarded wealth of marvellous animal world.

Desired Outcome: Curiosity will be ignited in the mind of learners, to know more about the fascinating world of animals which would enhance their interest and love for the subject of Zoology.

  1.1**:**   Echolocation in Bats and Cetaceans - Dolphins and Whales

  1.2**:**   Mechanism of Pearl formation in Mollusca

  1.3**:**   Bioluminescence in Animals: Noctiluca, Glow worm, Firefly, Angler Fish (Mechanism and use for the animal)

  1.4**:**   Regeneration in Animals - Earthworm (Annelida) and Lizard (Reptile)

  1.5**:**   Mimicry in Butterflies and its significance: Great Eggfly and Common Crow, Common Palmfly and Plain Tiger.

  1.6**:**   Mechanism of Coral formation and types of Coral reefs

  1.7**:**   Bird migration: Definition, types and factors inducing bird migration

  1.8**:**   Adaptive features of desert animals: Reptiles (Phrynosoma) and Mammals (Camel)

  1.9**:**   Breeding and Parental care in:

       1.9.1**:** Pisces - Ovo-viviparous (Black Molly/Guppy), Mouth brooders (Tilapia), Brood pouches (Sea horse)

       1.9.2**:** Amphibia - Mouth brooders (Darwin's Frog), Egg carriers (Midwife Toad)

1.9.3**:** Mammals - Egg-laying (Duck-billed Platypus), Marsupials (Kangaroo)

1.10**:** Aves: Brood Parasitism (Cuckoo)

Unit 2: Biodiversity and its Conservation (15 L)

Objective: To orient learners about rich heritage of Biodiversity of India and make them understand significance of its conservation.

Desired Outcome: Learners would appreciate treasure of Biodiversity, its importance and hence would contribute their best for its conservation.

2.1: **Introduction to Biodiversity** - Definition, Concepts, Scope and Significance

2.2: **Levels of Biodiversity** - Introduction to Genetic, Species and Ecosystem Biodiversity

2.3: **Introduction of Biodiversity Hotspots-** (Western Ghats and Indo-Burma Border)

2.4: **Values of biodiversity** - Direct and Indirect use value

2.5: **Threats to Biodiversity** - Habitat loss and Man-Wildlife conflict

2.6: **Biodiversity conservation and management**

2.6.1**:** Conservation strategies: *in situ,* ex-situ, National parks, Sanctuaries and Biosphere reserves.

2.6.2**:** Introduction to International efforts : Convention on Biological Diversity (CBD), International Union for Conservation of Nature and Natural Resources (IUCN), United Nations Environment Program - World Conservation Monitoring Centre (UNEP-WCMC)

2.6.3**:** National Biodiversity Action Plan, 2002

2.6.4: Introduction to Indian Wildlife (Protection) Act, 1972 and Convention for International Trade of endangered species

Unit 3: Footsteps to follow (15 L)

Objective: To teach learners about innovative and novel work of scientists/philosopher/entrepreneurs in the field of biological sciences.

Desired Outcome: Minds of learners would be impulsed to think differently and would be encouraged ipso facto to their original crude ideas from the field of biological sciences.

3.1: Dr. Hargobind Khorana (Genetic code)

3.2: Dr. Varghese Kurien (Amul –White revolution)

3.3: Dr. Salim Ali (Ornithologist)

3.4: Anna Hazare (Water Conservation-Ralegan Siddhi)

3.5: Baba Amte (Anandvan)

3.6: Kiran Mazumdar Shaw (Biocon)

3.7: Gadre Fisheries (Surimi)

3.8 : Rajendra Singh

Two cases preferably of local importance to the college be additionally taught.

USZO102 (Course 2)

INSTRUMENTATION and ANIMAL BIOTECHNOLOGY

Unit 1: Laboratory safety, Units and Measurement (15 L)

Objective: To make learners aware of risks involved in handling of different hazardous chemicals, sensitive (electrical/electronic) instruments and infectious biological specimens especially during practical sessions in the laboratory and to train them to avoid mishap.
Desired Outcome: Learners would work safely in the laboratory and avoid occurrence of accidents (mishaps) which will boost their scholastic performance and economy in use of materials/chemicals during practical sessions.

1.1: Introduction to good laboratory practices

1.2: **Use of safety symbols**: meaning, types of hazards and precautions

1.3: **Units of measurement**:
1.3.1**:** Calculations and related conversions of each: Metric system- length (meter to micrometer); weight (gram to microgram), Volumetric (Cubic measures)
1.3.2**:** Temperature: Celsius, Fahrenheit, Kelvin
1.3.3**:** Concentrations: Percent solutions, ppt, ppm, ppb dilutions, Normality, Molarity and Molality.
1.3.4**:** Biostatistics: Introduction and scope, Sampling and its types, Central Tendencies (mean, median, mode) Tabulation, Graphical representations (Histograms, bar diagrams, pie diagrams).

Unit 2: Animal Biotechnology (15 L)

Objective: To acquaint learners to the modern developments and concepts of Zoology highlighting their applications aiming for the benefit of human being.
Desired Outcome: Learners would understand recent advances in the subject and their applications for the betterment of mankind; and that the young minds would be tuned to think out of the box.

2.1: **Biotechnology**: Scope and achievements of Biotechnology (Fishery, Animal Husbandry, Medical, Industrial)

2.2: **Transgenesis**: Retro viral method, Nuclear transplantation method, DNA microinjection method and Embryonic stem cell method

2.3: Cloning (Dolly)

2.4: Ethical issues of transgenic and cloned animals

2.5: **Applications of Biotechnology**:

2.5.1**:** DNA fingerprinting: Technique in brief and its application in forensic science (Crime Investigation)
2.5.2**:** Recombinant DNA in medicines (recombinant insulin)
2.5.3**:** Gene therapy: Ex-vivo and *In vivo,* Severe Combined Immunodeficiency (SCID), Cystic Fibrosis

2.5.4**:** Green genes: Green Fluorescent Protein (GFP) from Jelly fish-valuable as reporter genes used to detect food poisoning.

Unit 3: Instrumentation (15 L)

Objective: To provide all learners a complete insight about the structure and train them with operational skills of different instruments required in Zoology.
Desired Outcome: Students will be skilled to select and operate suitable instruments for the studies of different components of Zoology of this course and also of higher classes including research.

3.1: **Microscopy**

    3.1.1**:** Construction, principle and applications of dissecting and compound microscope.

3.2: **Colorimetry and Spectroscopy** - Principle and applications.

3.3: **pH** - Sorenson's pH scale, pH meter - principle and applications.

3.3: **Centrifuge** - Principle and applications (clinical and ultra centrifuges).

3.4: **Chromatography** - Principle and applications (Partition and Adsorption)

3.5: **Electrophoresis -** Principle and applications (AGE and PAGE)

Practical USZOP1 (Course I)

1. Mounting of foraminiferan shells from sand (any 3)
2. Study of types of Corals - Brain, Organ pipe, Stag Horn, Mushroom coral Study of

3Study of the following;
   a. Symbiosis (Termite and Trychonympha, hermit crab and sea anemone)
   b. Camouflage (leaf insect, chameleon)
   c. Cannibalistic mate-eating animals (Spider and Praying Mantis)
   d. Animal architects: Termites, Harvester ant and Baya weaver bird
   e. Study of bioluminescent organisms – Noctiluca, glow worm, fire fly, angler fish.
4. Breeding and parental care in Amphibia- *Rhacophorus*, Midwife toad, Darwin's frog, Caecilian.
5. Mounting of scales of fish (placoid, cycloid and ctenoid)
6   a) Study of Adaptive radiation in Reptiles - Turtle, Tortoise, *Phrynosoma*, *Draco*)
       b) Identification and differentiation of venomous and non-venomous snakes (Scales, Fangs, Bite marks, etc.)
7. Study of Types of feathers(contour, filoplume, down), beaks(Nectar feeding , Insect catching, Fruit eating, Scavenging, Filter feeding), claws (perching, wading, swimming, hopping) in birds
8 a.   Identification of birds - Coppersmith Barbet, Bulbul, Rose ringed Parakeet, Magpie Robin, two local birds.
   b. Field Report – To be done in a group of ten students (submission of written / typed report preferably along with photographs/ tables/ graphs.
   Other Suggested topics for field observation/survey:
   - Butterflies/ Fishes/ Migratory birds of local area.
   - Variations in Human like Attached vs. Free Earlobes, Blood Groups, Eye colour, etc. using statistical method.
9. Observations of fauna in the field (with reference to theory syllabus).

   *Note - The practicals may be conducted by using specimens authorised by the wild such other regulating authorities though it is strongly recommended that the same sh taught by using photographs/audio-visual aids/ simulations / models, etc. as recomme the UGC and as envisaged in the regulations of the relevant monitoring bodies. specimens, however, shall be procured for the purpose of conducting practicals m here-in-above.

   #There shall be at least one excursion/field trip

Practical USZOP1 (Course II)

1. Interpretation of safety symbols (toxic, corrosive, explosive, flammable, skin itant, oxidizing, compressed gases, aspiration hazards and Biohazardous fectious material.)

2. b) Study of Central tendencies and plotting of Bar diagram, histogram and pie diagram.

Identification of transgenic fish (Trout and Salmon) / cloned animals (Dolly sheep, cc cat and Snuppy dog) from photograph.

3. Extraction of fruit juice with pectinase from apple/guava/or any other suitable fruit

4. Calculation of pH of three different samples (one each acidic, alkaline and neutral) using pH paper/Universal Indicator and confirming the result with pH meter.
Application of DNA Fingerprinting in criminology (photograph of electrophoretic pattern to be given for interpretation by the students)

5. a) Study of parts of microscope and their functions.
   b) Technique of focussing a permanent slide under 10x and 45x (objectives).

6. a) Dilution of given sample and estimation of OD by using colorimeter.
   b) Calculation of concentration from the given OD using formula.

7. Calculation of pH of three different samples (one each acidic, alkaline and neutral) using pH paper/universal indicator/pH indicator from red cabbage and confirming the result with pH meter.
   a) Seperation of amino acids from the mixture by paper chromatography.

8. b) Calculation of Rf value of separated pigments/amino acids from given chromatogram and their identification from standard chart.

9. a) Seperation of pigments by adsorption chromatography using chalk.
   b) Seperation of lipids by TLC,

*Note - The practicals may be conducted by using specimens authorised by the wildlife and such other regulating authorities though it is strongly recommended that the same should be taught by using photographs/audio-visual aids/ simulations / models, etc. as recommended by the UGC and as envisaged in the regulations of the relevant monitoring bodies. No new specimens, however, shall be procured for the purpose of conducting practicals mentioned here-in-above.

Course I (USZO101)

REFERENCES AND ADDITIONAL READING

1. Wonders of the Animal World - University Text Book of Zoology, F.Y.B.Sc. Semester I Course 1. V.V. Dalvie, G.B. Raje, P. Sardesai, N.S. Prabhu, University Press.

2. Vertebrate Zoology Volume I- Jordan and Verma , S. Chand and Co.
3. Invertebrate Zoology Volume II- Jordan andVerma , S. Chand and Co.
4. Invertebrate Zoology- T. C. Majupuria , S. Nagin and Co.
5. Chordate Zoology- P. S. Dhami and J. K. Dhami , R. Chand and Co.
6. Invertebrate Zoology- P. S. Dhami and J. K. Dhami , R. Chand and Co.
7. Introduction to Vertebrates- Moore Cambridge University- Low Priced Edition
8. Zoology- S. A. Miller and J. B. Harley, Tata McGraw Hill
9. Modern Textbook of Zoology, Invertebrates, R. L. Kotpal
10. Fundamentals of Ecology- E. P. Odum , Sunders Publication
11. Fundamentals of Ecology- M.C.Dash-2nd edition, Tata McGraw Hill
12. Essentials of Ecology and Environmental Science - S.V.S Rana
13. Biodiversity- S.V.S Rana- Prentice Hall Publications
14. Modern Biology- V. B. Rastogi
15. Biology of Mollusca- D. R. Khanna
16. A Textbook of Zoology, Vol. II- T. Jeffery Parker and William. A. Haswell-Low Price Publications
17. Ecology and Environment- P. D. Sharma, R. K. Rastogi Publications
18. Introduction to Ecology- R. Dajoz
19. Wildlife Laws and its Impact on Tribes- Mona Purohit , Deep and Deep Publications
20. Biodiversity- K.C.Agarwal- Agro Botanica Publications
21. Butterflies of India – Isaac Kehimkar- BNHS Publication

Course II   (USZO102)
REFERENCES AND ADDITIONAL READINGS

1. Basic Laboratory Techniques, Instrumentation and Biotechnology- University Text Book of Zoology, F.Y.B.Sc. Semester I Course 2. V.V. Dalvie, R. G. Deshmukh, R. D'souza and H.U. Shingadia University Press.

2. Introduction to Practical Biochemistry – David T. Plummer (Tata McGraw Hill Publishing Co. Ltd.)

3. Introductory Practical Biochemistry – S.K. Sawhney and Randhir Singh (Narosa Publishing House)

4. Methods in Biostatistics – B. K. Mahajan, (Jaypee Publications)

5. Microscopy and Cell Biology - V. K. Sharma, (Tata McGraw Hill Publishing Co. Ltd.)

6. Bioinstrumentation – L. Veerakumari, (M.J.P. Publishers)

7. Principles and Techniques of Practical Biochemistry – Keith Wilson and John Walker, (Cambridge University Press)

8. Biotechnology- Thieman and Pallidino, Pearson edu.

9. Biotechnology –Glick and Pasternak

10. Biochemistry –Satyanarayana

11. Understanding biotechnology- Aluizio Borem ,David Bowe-Low price edition –Pearson Publication

12. A Textbook of Biotechnology – R. C. Dubey, S. Chand Publication.

13. A Manual of Medical Laboratory Technology -A. H. Patel, Navneet Prakashan Ltd.

14. Biological instruments and methodology – Dr. P. K. Bajpai, S. Chand company Ltd.

15. Calculations in Molecular biology and Biotechnology - Frank H. Stephenson, Academic Press.

SCHEME OF EXAMINATION (THEORY)

(a)   Internal assessment of twenty five (25) marks per course per semester should be conducted according to the guidelines given by University of Mumbai vide circular number UG/04 of 2014 Dated 5th June 2014 to be implemented from academic year 2014-15.

(b)   External assessment of seventy five (75) marks per course per semester should be conducted as per the following skeleton question paper pattern.

(c)   One practical examination of fifty (50) marks per course each should be conducted at the end of every semester.

SKELETON- EXAMINATION PATTERN FOR THE ABOVE SYLLABUS

All Questions are compulsory

Figures to the right indicate full marks

Time: 2.5 hours   **Total marks: 75**

Q.1.	UNIT 1 Answer any four out of eight (5 marks each)	20 marks
Q.2.	UNIT 2 a. Answer any one of the two (10 marks) b. Answer any two out of the four (5 marks each)	20 marks
Q.3.	UNIT 3 Answer any two out of four (10 marks each)	20 marks
Q.4.	a. Unit 1 - (One note of five marks OR objective type questions) b. Unit 2 - (One note of five marks OR objective type questions) c. Unit 3- (One note of five marks OR objective type questions)	15 marks

*For Question 4 it is recommended to have objective questions such as –

(a)   Match the column   (b)   MCQ

(c)   Give one word for   (d)   True and False

(e)   Define the term   (f)   Answer in one sentence etc.

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MODEL QUESTION BANK SEMESTER I
USZO101(COURSE I)

Question bank is suggestive and not exhaustive. The paper setters are free to modify the questions or include new questions to the best of their wisdom

UNIT 1 - (05 Marks)

1. Write a note on echolocation in Dolphins/ Whales
2. Write a short note on : Pearl formation in Mollusca
3. Describe : Mechanism of bioluminescence
4. Enumerate the uses of bioluminescence
5. Describe the uses of bioluminescence for………… (Noctiluca, Glow worm, Firefly, Angler fish, etc.)
6. Write a short note on : Luciferin – Luciferase interaction
7. Describe the process of regeneration in Earthworm
8. What is regeneration? Explain the term with an example
9. What is mimicry? Explain with an example.
10. Describe: mimicry in butterfly
11. Describe briefly the formation of Corals
12. Write a short note on types of coral reefs.
13. Describe needs of migration in birds.
14. Describe briefly, the factors inducing migration in birds.
15. How does Camel adapt itself to the desert environment?
16. Describe parental care and breeding in …………………. (Examples of Pisces, Amphibia)
17. Describe briefly: Brood parasite
18. Explain parental care in Duck-billed Platypus

UNIT 2 - (05 Marks/10 Marks)

Questions that could be asked for 10 marks:

1. Explain biodiversity and its importance. What is a biodiversity hotspot? Explain Western Ghats as biodiversity hotspot in India.
2. Explain: Direct use value / Indirect use value
3. Explain biodiversity and its types.
4. Enumerate and explain threats to biodiversity.
5. State the factors which amount to habitat loss.
6. Explain the concept of Man-Wildlife conflict with an example.
7. Give a detailed account on *in situ* hybridization and ex-situ hybridization

8. Describe National Park and state its importance in conservation
9. Describe Sanctuary and state its importance in conservation
10. Give a brief account on biosphere reserve.
11. Give a detailed account on: CBD (Convention on Biological Diversity).
12. Give an account of national biodiversity plan 2002.
13. Describe important clauses of Convention for International Trade of endangered species.

Questions that could be asked for 05 marks:

1. Explain biodiversity and mention its types.
2. Explain biodiversity and give two importance
3. Explain biodiversity hotspot
4. Describe *in situ* conservation strategies.
5. Write note on ex-situ conservation strategies.
6. Give an account of genetic / species / ecosystem biodiversity.
7. Enumerate importance threat to biodiversity.
8. State direct and indirect use value of biodiversity.

UNIT 3 - (10 Marks)

1. Give a detailed account on: ………………….(Name of the eminent personality) For e.g.: Gadre Fisheries, Kiran Mazumdar Shaw, Baba Amte etc.
2. Describe in detail - ……………………(Name of the case study)
   For e.g.: Amul white revolution, Biocon, Genetic code etc.
3. Give a detailed account on the contribution made by Dr.Salim Ali in the field of Ornithology.
4. What is white revolution? State contribution of Dr. Verghese Kurian for it.
5. Describe the work of water conservation of Anna Hazare.

MODEL QUESTION BANK SEMESTER I USZO102 (COURSE II)

Question bank is suggestive and not exhaustive. The paper setters are free to modify the questions or include new questions to the best of their wisdom

UNIT I: (5 marks)

1.   Describe in brief (Minimum five points)
   a.   Good laboratory practices
   b.   Chemical hazards in a laboratory
   c.   Physical hazards in a laboratory
   d.   Biological hazards in a laboratory
   e.   Personal hygiene in laboratory
   f.   Waste disposal
2.   Define and give conversions of the three scales of measuring temperature.
3.   Define Molarity. How would you prepare
   a.   1 litre of 0.1 M NaOH solution? (Mol.wt. of NaOH=40)
   b.   100 ml of 1M NaOH
   c.   500 ml of 0.2 M NaOH
4.   Define Normality. How would you prepare 1 litre of 2 N NaOH solution?
5.   Explain briefly the measures of central tendencies?
6.   Define mean, median and mode and explain each with an example.
7.   The observations of length (in cm) of 10 fishes are 22, 24, 34, 26, 28, 31, 20, 25, 36, 32. Calculate the arithmetic mean of fish length (in cm).
8.   Calculate the arithmetic mean for the following data on fish length by Direct method.

Class interval (length in cm)	5-15	15-25	25-35	35-45	45-55
Frequency (no. of fish)	9	21	40	22	8

9. Calculate the arithmetic mean for the above data on fish length by shortcut method.
10. How do you find the median of the data and state the significance of median?
11. What is mode? How do you calculate mode for ungrouped and grouped data?
12. What is random sampling? State the significance.
13. Explain simple, subdivided and multiple bar diagrams.
14. What is a pie diagram? Write the formula for calculating the angles of degrees for different components.
15. The following data shows the areas in million square miles of the oceans of the world. Construct a pie diagram for the data.

Ocean	Pacific	Atlantic	Indian	Antarctic	Arctic	Total
Area (million sq. miles)	70.8	41.2	28.5	7.6	4.8	152.9

16. What

Plot a histogram/Bar diagram? Explain how it is constructed.

UNIT 2: (5 marks)

1. Give applications of Biotechnology in the field of Medicine / Fishery / Animal Husbandry.
2. Give the Scope of Biotechnology in different areas as a diagrammatic sketch
3. What is SCID? Name the scientist who discovered the gene therapy for it.
4. In SCID which enzyme does not work properly?
5. Which cells are used for SCID gene therapy?
6. Which gene is defective in SCID?
7. Define transgenesis and mention any two transgenic animals.
8. Ethical issues of transgenesis.
9. Enlist five applications of DNA finger printing.
10. What are green genes? State one application of it.

(10 marks)

1. Describe SCID and its treatment with suitable diagram.
2. Explain various methods of transgenesis.
3. What is Cystic fibrosis? Explain its diagnostic biotechnological method.
4. Define transgenesis and explain retro viral method with its application.

UNIT 3: (10 marks)

1. Describe the components of a compound microscope giving function.

2. Explain the principle and the applications of compound microscope.
3. Discuss in detail the principle, construction and applications of dissecting microscope.
4. Write the principle and applications of
   a. Colorimeter
   b. Centrifuge
   c. Spectroscopy
   d. Compound microscope
   e. Dissecting microscope
5. Explain the principle of centrifugation and add a note on its application.
6. What is pH? Give the principle and applications of pH meter.
7. Describe paper chromatography as a separation technique.
8. Describe Agarose gel electrophoresis. Add a note on its applications.
9. Explain the principle and applications of Polyacrylamide gel electrophoresis.
10. With the help of a diagram, explain the parts of a colorimeter. Discuss the principle and uses.
11. Describe principle and uses of colorimeter.
12. Explain the principle and application of adsorption chromatography.

PRACTICALS

USZOP1 (Course I)

Skeleton -Practical Examination Question Paper Pattern

Time: 2 hrs   **Marks: 50**

Q.1.   From the given sample mount foraminiferan shells (Minimum three types)   (15 Marks)

OR

Mounting of scales (placoid and cycloid/ctenoid) from fishes.

Q.2.   Identify the photograph of the given animals and comment on the type of interaction /speciality. (symbiosis, camouflage, cannibalistic mate eating animals and animal architects,bioluminiscence). Any two (10 Marks)

Q.3.   Identify giving reasons - Venomous/Non-venomous snake (from photographs).   (5 Marks)

Q.4.   Identification (one specimen each)   (10 Marks)

a. Types of corals

b. Amphibians-breeding and parental care

c. Adaptive radiation in reptiles

d. Types of feathers/ claws in birds

e. Types of beaks in birds

Q.5.   Field study report (Biodiversity) and viva on it.   (10 Marks)

USZOP1 (Course II)

Skeleton -Practical Examination Question Paper Pattern

Time: 2 hrs   **Marks: 50**

Q. 1   Dilute the given sample and estimate the OD using colorimeter (Three dilutions)   (15marks)
OR
Calculate concentration from given OD by formula (3 concentrations)
OR
Find pH of water samples (three) and comment on their chemical nature.
OR
Using red cabbage pH indicator, determine pH of the given samples and comment on their chemical nature
OR
Extract fruit juice using pectinase and compare the result with a set without using pectinase.

Q. 2.   Perform experiment for separation of pigments by adsorption chromatography.   (10Marks)
OR
Perform experiment for separation of mixture of amino acids by paper chromatography
OR
Calculate R_f value and identify the pigment from chromatogram.
OR
Perform Thin Layer Chromatography (TLC) for separation of lipids

Q. 3.   Focus the given slide under 10 X and 45 X and show it to examiner.   (5 Marks)
OR
Prepare a frequency distribution table / Plot histogram / Pie diagram / Bar diagram from the given data.

Q. 4.   Identification   (10 Marks)
(Safety Symbols (two), parts of compound microscope, transgenic animals, DNA fingerprinting)

Q. 5.   Journal and Viva voce(on practical component)   (10 Marks)

SEMESTER-II

USZO201 (Course: 3)

Ecology and Wildlife Management

Unit 1: Population ecology: (15 L)

Objective: To facilitate the learning of population ecology, its dynamics and regulatory factors important for its sustenance.

Desired Outcome: This unit would allow learners to study about nature of animal population, specific factors affecting its growth and its impact on the population of other life form.

1.1: Population dynamics
      1.1.1: Population density
      1.1.2: Natality
      1.1.3: Mortality
      1.1.4: Fecundity
      1.1.5: Age structure
      1.1.6: Sex ratio
      1.1.7: Life tables
      1.1.8: Survivorship curves
      1.1.9: Population dispersal and distribution patterns
      1.1.10 Niche concept

1.2: Population growth regulation
      1.2.1: Intrinsic mechanism – Density dependent fluctuations and oscillations
      1.2.2: Extrinsic mechanism- Density independent, environmental and climate factors, population interactions

1.3: Population growth pattern
      1.3.1: Sigmoid
      1.3.2: J Shaped

1.4: Human census (India) – Concept, mechanism and significance

Unit 2: Ecosystem: (15 L)

Objective: To impart knowledge of different components of ecosystem and educate about essentials of coexistence of human beings with all other living organisms.

Desired Outcome: Learners will grasp the concept of interdependence and interaction of physical, chemical and biological factors in the environment and will lead to better understanding about implications of loss of fauna specifically on human being, erupting spur of desire for conservation of all flora and fauna.

2.1: Concept of Ecosystems

2.1.1**:** Ecosystem - Definition and components
2.1.2**:** Impact of temperature on biota
2.1.3**:** Biogeochemical cycles (Water, Oxygen, Nitrogen, Sulphur)
2.1.4**:** Fresh water ecosystem – Lentic and Lotic
2.1.5**:** Food chain and food web in ecosystem (Fresh water and Grass land).
2.1.6**:** Ecological pyramids - energy, biomass and number.
2.1.7**:** Animal interactions (commensalism, mutualism, predation, antibiosis, parasitism)

Unit 3: National parks and Sanctuaries of India (15 L)

Objective: To enlighten learners about the current status of wild life conservation in India in the light of guidelines from different relevant governing agencies vis-à-vis with adversity of poaching and biopiracy.
Desired Outcome: Learners would be inspired to choose career options in the field of wild life conservation, research, photography and ecotourism.

3.1: Concept of Endangered and Critically Endangered species using examples of Indian Wildlife with respect to National Parks and Wildlife

Sanctuaries of India (Sanjay Gandhi National Park, Tadoba Tiger Reserve, Corbett National Park, Kaziranga National Park, Gir National Park, Silent Valley, Pirotan Island Marine Park, Keoladeo Ghana National Park, Bandipur Sanctuary)

3.2: Management strategies with special reference to Tiger and Rhinoceros in India

3.3: Ecotourism

3.4: Biopiracy

SEMESTER-II
Course: 4 [USZO 202]
NUTRITION, PUBLIC HEALTH AND HYGIENE

Unit 1: Nutrition and Health (15 L)

Objective: To make learners understand the importance of balanced diet and essential nutrients of food at different stages of life.

Desired Outcome: Healthy dietary habits would be inculcated in the life style of learners in order to prevent risk of developing health hazards in younger generation due to faulty eating habits.

1.1: Concept of balanced diet, dietary recommendations to a normal adult, infant, pregnant woman and aged.
1.2: Malnutrition disorders – Anemia (B_{12} and Iron deficiency), Rickets, Marasmus, Goiter, Kwashiorkar (cause, symptoms, precaution and remedy).
1.3: Constipation, piles, starvation, acidity, flatulence, peptic ulcers (cause, symptoms, precaution and remedy).
1.4: Obesity (Definition and consequences).
1.5: Importance of fibres in food.
1.6: Significance of breast feeding.
1.7: Swine flu (cause, symptoms, precaution and remedy).
1.8: BMI calculation and its significance.

Unit 2: Public Health and Hygiene   **(15 L)**

Objective: To impart knowledge about source, quantum and need for conservation of fast depleting water resource and essentials of maintaining proper sanitation, hygiene and optimizing use of electronic gadgets.

Desired Outcome: Promoting optimum conservation of water, encouragement for maintaining adequate personal hygiene, optimum use of electronic gadgets, avoiding addiction, thus facilitating achievement of the goal of healthy young India in true sense.

2.1: **Health**

    2.1.1: Definition of Health, the need for health education and health goal.

    2.1.2: Physical, psychological and Social health issues.

    2.1.3: WHO and its programmes - Polio, Small pox, Malaria and Leprosy (concept, brief accounts and outcome with respect to India).

    2.1.4: Ill effects of self-medication.

2.2: **Water and water supply**

    2.2.1: Sources and properties of water.

    2.2.2: Purification of water, small scale, medium scale and large scale (rapid sand filters)

    2.2.3 : Water footprint (concept, brief accounts and significance).

2.3: **Hygiene:**

    2.3.1: Hygiene and health factors at home, personal hygiene, oral hygiene and sex hygiene.

2.4: **Radiation risk:**

    2.4.1: Mobile Cell tower and electronic gadgets (data of recommended level, effects and precaution).

2.5: **Blood bank** – Concept and significance

UNIT 3: Common Human Diseases and Disorders   (15 L)

Objective: To educate learners about causes, symptoms and impact of stress related disorders and infectious diseases.

Desired Outcome: Learners will be able to promptly recognize stress related problems at initial stages and would be able to adopt relevant solutions which would lead to psychologically strong mind set promoting positive attitude important for academics and would be able to acquire knowledge of cause, symptoms and precautions of infectious diseases.

3.1:   Stress related disorders
　　　　3.1.1**:** Hypertension, Diabetes type II, anxiety, insomnia, migraine, depression (cause, symptoms, precaution and remedy)

3.2:   Communicable and non-communicable diseases
　　　　3.2.1**:** Tuberculosis , Typhoid and Dengue
　　　　3.2.2**:** Hepatitis (A and B), AIDS, Gonorrhea and Syphilis
　　　　3.2.3**:** Diseases of respiratory system- Asthma, Bronchitis.
　　　　3.2.4: Oral Cancer
　　　　　　(Discuss cause/causative agents, symptoms, diagnostics, precaution /prevention and remedy)

Practical USZOP2 (Course III)

1. Interpretation of the given graphs/ tables and comment on pattern of population nature :
   i. Survivorship curve
   ii. Life tables
   iii. Fecundity tables
   iv. Age structure
   v. Sex ratio

2. a) Calculation of Natality, Mortality, Population density from given data
   b) Estimation of population density by capture recapture method

3. Interpretation of Growth curves (Sigmoid and J shaped)

4. Estimation of hardness from given water sample (tap water v/s well water)

5. Estimation of Free carbon dioxide (Free CO_2) from two different samples-
   aerated drinks(diluted) v/s tap water

6. Identification and interpretation of aquatic and terrestrial (Grassland) food chains and food webs

7. Construction of food chain/food web using given information/data.

8. a) Identification and interpretation of ecological pyramids of energy, biomass and number
   b) Construction of different types of pyramid from given data.

9. Study of the following:
   a) Endangered (Great Indian Bustard, Asiatic lion, Blackbuck, Olive Ridley sea turtle) and critically endangered species (Slender-billed vulture, Gharial, Malabar civet) of Indian wildlife and state reasons for their decline
   b) Study Biodiversity hotspots using world map (Western Ghats and Indo-Burma)
   Study of sanctuaries, national parks, biosphere reserves in India with respect to its brand fauna as listed in theory)

   *Note - The practicals may be conducted by using specimens authorised by the wildlife and such other regulating authorities though it is strongly recommended that the same should be taught by using photographs/audio-visual aids/ simulations / models, etc. as recommended by the UGC and as envisaged in the regulations of the relevant monitoring bodies. No new specimens, however, shall be procured for the purpose of conducting practicals mentioned here-in-above.

   #There shall be at least one excursion/field trip

SEMESTER II

Practical USZOP2 (Course IV)

1. Qualitative estimation of Vitamin C by Iodometric method.

2. Study of microscopic structure of starch granules of different cereals (wheat, maize and jowar).
    3. a) Estimation of maltose from brown/white bread.
       b) Moisture content from biscuits or other suitable food products.
    4. Food adulteration Test:
       a) Milk adulterants (starch and glucose), methylene blue reduction Test (MBRT).
       b) Adulterants in Cheese, Butter, Jaggery, Ghee, Honey, Iodised Salt.

5. a) Estimation of protein content of two egg varieties.
    b) Study of efficacy of different antacids (any two antacids).

6. .Study of Human Parasites

    Endoparasites - Protozoans (*Entamoeba, Plasmodium*),
    Helminths (*Ascaris, Wuchereria*),
    Ectoparasites (Head louse, tick) and Exoparasites (Bed bug, Mosquito).

7. Screening of anaemic/non-anaemic persons using $CuSO_4$ method.

8. First Aid – Demonstration Practical Training for teachers and students to be conducted by the experts from Redcorss, Civil defence, Civic authorities by individual institute or cluster colleges in rotation.

9. BMI analysis - Measurement of Height/ Weight and calculation of BMI using formula, preparation and submission of report. (10 students/ group-50 readings/group)

*Note - The practicals may be conducted by using specimens authorised by the wildlife and such other regulating authorities though it is strongly recommended that the same should be taught by using photographs/audio-visual aids/ simulations / models, etc. as recommended by the UGC and as envisaged in the regulations of the relevant monitoring bodies. No new specimens, however, shall be procured for the purpose of conducting practicals mentioned here-in-above.

Semester II USZOP2 (Course III)

Skeleton -Practical Examination Question Paper Pattern

Time: 2 hrs   **Marks: 50**

Q.1. Estimate Hardness from given water samples and compare the results.   (15 Marks)

<div align="center">OR</div>

Estimate Free CO_2 from given samples and compare the results.

Q.2. Solve the given problems (using statistical approach wherever possible) based on (Any two)
                                                        (10Marks)

       Natality
       Mortality
       Sex Ratio
       Fecundity
       Population density

Q.3. Identify brand animals (Min. 4) and place them in their respective National parks/ Sanctuaries on the given map quoting reasons for their decline.   (5 Marks)

<div align="center">OR</div>

Mark National parks and Sanctuaries on the map of India and mention the name of their brand animals stating reason for their decline. (Min. 4)

                                                    (5 Marks)

<div align="center">OR</div>

Identify endangered and critically endangered animals (photographs) one each and state their reason of decline   (5 Marks)

Q.4. Study the given information and give answers on the basis of food chain/food web and ecological pyramids.   (10 Marks)

<div align="center">OR</div>

Prepare food chain/food web and ecological pyramid from the given data and give its significance.   (10 Marks)

<div align="center">OR</div>

Identify and interpret the given graph/growth curve/age structure and comment on the pattern of population dispersal.   (10 Marks)

<div align="center">OR</div>

Determine Population density by capture and recapture method.   (10 Marks)

Q.5. Journal and Viva voce (Based on practical component)   (10 Marks)

Skeleton -Practical Examination Question Paper Pattern

Time: 2 hrs   **Marks: 50**

Q.1.   Estimate Vitamin C from given sample.   (15 Marks)

                        OR

Estimate Maltose content from bread.

                    OR

Estimate protein content from two different types of eggs.

Q.2.   Analyse the given food sample and identify food adulterants (any 2 samples).   (10 Marks)

                        OR

Evaluate milk quality by Methylene Blue Reduction Test (MBRT).

                        OR

Determine efficacy of different antacids (any two) on acidic solution.

Q.3.   Determine moisture content from biscuits/ any other suitable food product.   (5 Marks)

                        OR

On the basis of microscopic structure of starch granules identify different cereals (any two).

                        OR

Detect adulterants present in th given milk sample (any two).

                        OR

Determine whether given blood sample is from anaemic/non-anaemic person using $CuSO_4$

Method and suggest the appropriate diet.

Q.4.   Identification   (10 Marks)

        a)   One specimen of Protozoan Parasites.

        b)   One specimen of Helminth Parasites.

        c)   One specimen from Ectoparasite

        d)   One specimen from Exoparasite

        e)   One specimen from Endoparasite

Q.5.   Submission of report of Body Mass Index (viva based on it)   (10 Marks)

Note: There shall be at least one excursion/field trip.

CourseUSZO201III (Course(USZO201)III)

REFERENCES AND ADDITIONAL READING

1. Introduction to Ecology and Wildlife - University Text Book of Zoology, F.Y.B.Sc. Semester II Course 3. University Press.
2. Fundamentals of Ecology - Eugene P. Odum and Grey W. Barrett, Brook Cole/ Cengage learning
3. Fundamentals of Ecology - M. C. Dash , Tata McGraw Hill company Ltd, New Delhi
4. Ecology - Mohan P. Arora , Himalaya Publishing House
5. Field Biology and Ecology -- Alen H. Benton and William E. Werner ,Tata McGraw Hill ltd, New Delhi
6. Ecology and Environment - Sharma P. D , Rastogi Publication, Mumbai
7. Ecology : Principles and Applications - Chapman J.L , Cambridge University trust
8. Ecology - Subramaniam and Others, Narosa Publishing House
9. Wildlife laws and its impact on tribes - Mona Purohit, Deep and deep Publication
10. Biology - Eldra Solomon, Linda R. Berg and Diana W. Martin, Thomson/ Brooks/ Cole
11. Economic Zoology, Biostats and Animal Behaviour - Shukla, Mathur, Upadhyay, Prasad. Rastogi Publications.

USZO202 (Course IV)

REFERENCES AND ADDITIONAL READING

1. Common Diseases, Health and Hygiene - University Text Book of Zoology, F.Y.B.Sc. Semester II Course 4. University Press.

2. Common Medical Symptoms edited - P. J. Mehta National Inblisents and Distributions

3. Parks Textbook of Preventive and Social Medicine K. Park M/S Banarasidas Bhanot Jabalpar.

4. Human Physiology – Volume I – II C. C. Chatterjee, Medical Allied agency, Kolkatta.

5. Parasitology (Protozoology and Helminthoology) - K. D. Chatterjee, Chatterjee Medial Publishers.

6. Nand's handbook of Forensic Medicine and Toxicology - Apurba Nandy, NCBA publication.
7. Essentials of Public Health and Sanitation- Part I and Part II. All India Institute of Local Self Government.
8. Epidemiology and Management for Health Care for all. P.V. Sathe, A. P. Sathe, Popular Prakashan, Mumbai.
9. Textbook of Medical Parasitology- C. K. JayaramPaniker. Jaypee Brothers.
10. A Treatise on Hygiene and Public Health. -B. N. Ghosh. Calcutta Scientific Publishing Company.
11. Prevention of Food Adulteration, Act 1954. Asian Law House.
12. Clinical Dietetics and Nutrition - F. P. Antia and Philip, Oxford University Press.
13. A Complete Handbook of Nature Cure - Dr. H. K. Bakru, Jaico Publishing House.
14. Dietetics - B. Srilakshmi, New Age International (P) Ltd. Publishers.
15. Nutrition: Principles and Application in Health Promotion - J. B. Lippincott Company. Philadelphia.
16. Are You Healing Yourself Mr. Executive - Dr. R. H. Dastur. IBH Publishing Company.
17. Food Nutrition and Health- Dr. Shashi Goyal, Pooja Gupta, S. Chand Publications.
18. Public Health Nutrition. Edited - Michael J. Gidney, Barrie M. Margetts, John M. Kearney and Lenore Arab. Willey Blackwell Publication.
19. Food and Nutrition – Vol. I and II - Dr. Swaminathan , Bappco Publication.
20. Textbook of Human Nutrition - Mahtab Bamji, Prahlad Rao.
21. Total Health by Paramjit Rana.

SCHEME OF EXAMINATION THEORY

(a) Internal assessment of twenty five (25) marks per course per semester should be conducted as class test according to the guidelines given by University of Mumbai vide circular number UG/04 of 2014 Dated 5th June 2014 to be implemented from academic year 2014-15.

(b) External assessment of seventy five (75) marks per course per semester should be conducted as per the following skeleton paper pattern.

(c) One practical examination of fifty (50) marks per course each should be conducted at the end of every semester.

SKELETON- EXAMINATION PATTERN FOR THE ABOVE SYLLABUS

All Questions are compulsory

Figures to the right indicate full marks

Time: 2.5 hours   **Total marks: 75**

Q.1.	UNIT 1 Answer any four out of eight (5 marks each)	20 marks
Q.2.	UNIT 2 a. Answer any one of the two (10 marks) b. Answer any two out of the four (5 marks each)	20 marks
Q.3.	UNIT 3 Answer any two out of four (10 marks each)	20 marks
Q.4.	a. Unit 1 - (One note of five marks OR objective type questions) b. Unit 2 - (One note of five marks OR objective type questions) c. Unit 3- (One note of five marks OR objective type questions)	15 marks

*For Question 4 it is recommended to have objective questions such as –

    (a) Match the column   (b) MCQ

    (c) Give one word for   (d) True and False

    (e) Define the term   (f) Answer in one sentence etc.

USZO203 (COURSE III)

Question bank is suggestive and not exhaustive. The paper setters are free to modify the questions or include new questions to the best of their wisdom

UNIT 1: (10 marks)

Describe with suitable Example
1. J-Shaped and Sigmoid growth patterns
2. Population dispersal and distribution patterns
3. Natality and Mortality
4. Natality and Fecundity
5. Fecundity and Mortality
6. Density dependant fluctuation and oscillations
7. Population interactions
8. Age structure and population density
9. Concept of niche and its significance in population ecology.

Write notes on / Give a brief account of: (5 marks)

1. Population density
2. Natality
3. Mortality
4. Fecundity
5. Age structure
6. Sex ratio
7. Survivorship curve
8. Sigmoid growth pattern
9. J-shaped growth curve
10. Intrinsic mechanism
11. Extrinsic mechanism
12. Niche
13. Population dispersal and distribution pattern

UNIT 2: (5 marks)

1. Effect of temperature on metabolism

16. Impact of temperature on reproduction
17. Effect of temperature on animal behaviour
18. Define ecosystem and describe any two abiotic factors
19. Define ecosystem and describe any two biotic factors
20. Explain producers / autotrophs
21. Give a brief account of various levels of consumers in an ecosystem
22. Describe in short the inter-relationship between biotic and abiotic factors
23. Describe the following (any one of the cycles can be asked) water cycle, nitrogen cycle and oxygen cycle, sulphur cycle.
24. Explain any one of the following - lake or river
25. Explain food chain from terrestrial or aquatic ecosystem
26. What is food web and explain the same with a suitable example
27. Give a brief account of: Energy pyramid, Pyramid of biomass, Pyramid of numbers.

Unit 3: (10 marks question)

1. State the differences between National park and Wildlife Sanctuary?
2. Write an account of critically endangered species of Indian wildlife with at least two examples.
3. Explain briefly management strategy of any one tiger project in India.
4. Briefly explain management strategy of Rhinoceros project in India.
5. Write in detail about Indian Wildlife (Protection) Act 1972.
6. What is biopiracy? Explain with suitable examples.
7. Write a note on flora and fauna of Sanjay Gandhi national park.
8. Write an account of Tadoba tiger reserve project.
9. Give an account of biodiversity of Jim Corbett national park.
10. Write a note on Ranthambore Tiger reserve.
11. Write in details about Gir Lion project.
12. Write a note on Keoladeo Ghana National park.
13. Write an account of biodiversity of Silent valley.
14. Describe in detail about Bandipur sanctuary.
15. Write a note on ecotourism in India with few examples.

Question bank is suggestive and not exhaustive. The paper setters are free to modify the questions or include new questions to the best of their wisdom

Unit I (5 marks)

Explain the following:

1. Concept of balanced diet and dietary recommendations of any one of the following:
   a) Normal adult b)Infant c) Pregnant woman d) Aged
2. Cause and symptoms of the following: a) Anemia b) B_{12} deficiency c) Vitamin D deficiency   d) Marasmus e) Kwashiorkar f) Goiter, g) Swine flu, h) Dengue
3. Precautions and remedy for all above mentioned health conditions.
4. Significance of breast feeding.
5. Importance of fibres in food.
6. Food adulterants and toxins with two side effects of each.
7. Causes, symptoms, precautions and treatment of a) Constipation, b) Piles, c) Insomnia, d) Starvation, e) Flatulence, f) Peptic ulcer, g) Obesity
8. BMI and its significance.

Unit II (5/10 marks)

Question of 5 marks:

1. Give a brief account and outcome of WHO Programs:
   a) Polio b) Smallpox c) Malaria d) Leprosy
2. a) Explain the concept of health goal and health knowledge.
   b) Enlist different needs of health education.
   c) State five points of social health issues.

Question of 10 marks:

1. Describe sources and properties of water in relation to human consumption.

2. Describe methods of purification of water – small scale, medium scale and large scale.
3. Explain the concept of water footprint and give its significance.
4. Describe disposal of human and animal waste – STP and ETP, its functioning and significance.
5. Give a brief of risk of radiation from mobile cell towers and electronic gadgets.
6. Explain the concepts of physical health, psychological health and myth related to it.
7. Describe the term hygiene and explain in brief health factors related to it at home.
8. Explain personal hygiene, oral hygiene and sex hygiene with significance of each.
9. Describe ill effects of self medication with respect to antibiotics and steroids.
10. Give brief account of first aid symbols.
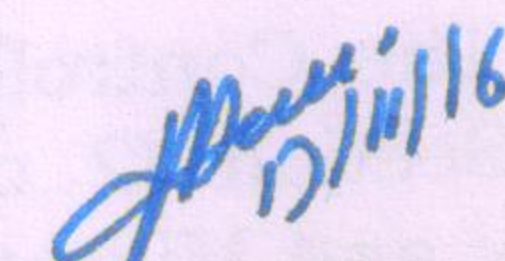
Unit III (10 marks)

1. Explain causes, symptoms, precautions and remedy
   a) Hypertension   b) Diabetes Type II   c) Anxiety and Insomnia d) Migraine and depression
2. Explain causes, symptoms, precautions and remedy
   a) Tuberculosis   b) Common flu   c) Dengue d) Malaria   e) Typhoid
   f) Hepatitis A   g) Hepatitis B   h) AIDS

CIRCULAR:-

A reference is invited to the Syllabi relating to the B.Sc. degree course , **vide** this office Circular No. UG/128 of 2011, dated 13th June, 2011 and the Principals of affiliated Colleges in Science are hereby informed that the recommendation made by the Ad-hoc Board of Studies in Chemistry at its meeting held on 7th July, 2016 has been accepted by the Academic Council meeting held on 14th July, 2016 **vide** item No. 4.12 and that in accordance therewith, the revised syllabus as per the Choice Based Credit System for F.Y. B.Sc. programme in Chemistry (Sem. I & II), which are available on the University's web site (www.mu.ac.in) and that the same has been brought into force with effect from the academic year 2016-17.

(Dr.M.A.Khan)
REGISTRAR

MUMBAI – 400 032
19 November, 2016

To,

The Principals of the affiliated Colleges in Science.

A.C/4.12/14.07.2016

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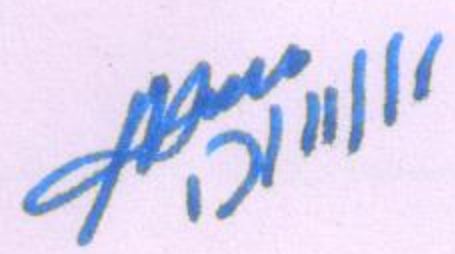
No. UG/166 -A of 2016   MUMBAI-400 032   19 November, 2016

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1) The Co-ordinator, Faculties of Science,
2) The Chairman, Board of Studies in Chemistry,
3) The Professor-cum-Director, Institute of Distance & Open Learning (IDOL)
4) The Director, Board of College and University Development,
5) The Co-Ordinator, University Computerization Centre,
6) The Controller of Examinations.

(Dr.M.A.Khan)
REGISTRAR

PTO..

UNIVERSITY OF MUMBAI

Syllabus for Approval

Sr. No.	Heading	Particulars
1	Title of Course	Chemistry
2	Eligibility for Admission	12th of all recognised Board
3	Passing marks	
4	Ordinances/Regulations (if any)	
5	No. of Semesters	Two
6	Level	U.G.
7	Pattern	Semester
8	Status	New
9	To be implemented from Academic year	2016-2017

Date: **Signature:**

Name of BOS Chairperson: **Professor A.V.Karnik**

Draft of the proposed syllabus for CBCS

F. Y. B. Sc. Chemistry

For the subject of chemistry there shall be two papers for 45 lectures each comprising of three units of 15 L each.

Semester-I

1. Paper-I / II (General Chemistry) Unit-I will be for Physical Chemistry
2. Paper-I / II Unit-II will be for Inorganic Chemistry and
3. Paper- I / II Unit-III will be for Organic Chemistry.

Semester-II

1. Paper-I /II (General Chemistry) Unit-I will be for Physical Chemistry
2. Paper-I / II Unit-II will be for Inorganic Chemistry and
3. Paper-I / II Unit-III will be for Organic Chemistry.

Choice Based Credit System F.Y.B.Sc. Chemistry Syllabus

To be implemented from the Academic year 2016-2017

SEMESTER I

Course Code	Unit	Topics	Credits	L / Week
USCH101	I	Chemical Thermodynamics Chemical calculations	2	1
	II	Atomic structure, Periodic Table and periodicity		1
	III	Basics of Organic Chemistry: Classification and Nomenclature of Organic Compounds Bonding and Structure of organic compounds Fundamentals of organic reaction mechanism		1
USCH102	I	Chemical Kinetics Liquid state	2	1
	II	Comparative chemistry of Main Group Elements		1
	III	Stereochemistry I		1
USCHP1		Chemistry Practicals	2	6

SEMESTER II

Course Code	UNIT	Topics	Credits	L /Week
USCH201	I	Gaseous state Chemical Equilibrium and thermodynamic parameters	2	1
	II	Concept of Qualitative Analysis Acid Base Theories		1
	III	Chemistry of Aliphatic Hydrocarbons		1
USCH202	I	Ionic equilibria, Molecular Spectroscopy Solid State Chemistry	2	1
	II	Chemical bond and Reactivity Oxidation Reduction Chemistry		1
	III	Stereochemistry II: Cycloalkanes and Conformational Analysis Aromatic hydrocarbons		1
USCHP2		Chemistry Practicals	2	6

Semester I
Paper I
Unit-I

1.1 Chemical Thermodynamics: **(10L)**

Thermodynamic terms: System, surrounding, boundaries, open, closed and isolated system, intensive and extensive properties, state functions and path functions, zeroth law of thermodynamics

First law of thermodynamics: concept of heat (q), work (w), internal energy (U), statement of first law, enthalpy, relation between heat capacities, sign conventions, calculations of heat (q), work (w), internal energy (U), and enthalpy (H) (Numericals expected)

Thermochemistry: Heats of reactions, standard states, enthalpy of formation of molecules, enthalpy of combustion and its applications, calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data, Kirchhoff's equation (Numericals expected)

1.2 Chemical Calculations: **(5L)**

Expressing concentration of solutions: Normality, molality, molarity, formality, mole fractions, weight ratio, volume ratio, weight to volume ratio, ppm, ppb, millimoles, milliequivalents (Numericals expected)

Unit II

2.1 Atomic structure: **(10L)**

(Qualitative treatment only; it is expected that the learner knows the mathematical statements and understands their physical significance after completing this topic. No derivations of the mathematical equations required)
   a) Historical perspectives of the atomic structure; Rutherford's Atomic Model, Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Structure of hydrogen atom.
   b) Hydrogenic atoms:
      1. Simple principles of quantum mechanics;
      2. Atomic orbitals
           i) Hydrogenic energy levels
           ii) Shells, subshells and orbitals
           iii) Electron spin
           iv) Radial shapes of orbitals
           v) Radial distribution function
           vi) Angular shapes of orbitals.

3. Many Electron Atoms
   i) Penetration and shielding
   ii) Effective nuclear charge
4. Aufbau principle

2.2: Periodic Table and periodicity : (5L)

Long form of Periodic Table; Classification for elements as main group, transition and inner transition elements; Periodicity in the following properties : Atomic and ionic size; electron gain enthalpy; ionization enthalpy, effective nuclear charge (Slater's rule); electronegativity ; Pauling, Mulliken and Alred Rochow electronegativities (Numerical problems expected, wherever applicable.)

Unit III

3. Basics of Organic Chemistry

3.1 Classification and Nomenclature of Organic Compounds: (5L)

Review of basic rules of IUPAC nomenclature. Nomenclature of mono and bi-functional aliphatic compounds on the basis of priority order of the following classes of compounds: alkanes, alkenes, alkynes, haloalkanes, alcohols, ethers, aldehydes, ketones, carboxylic acids, carboxylic acid derivatives (acid halides, esters, anhydrides, amides), nitro compounds, nitriles and amines; including their cyclic analogues.

3.2 Bonding and Structure of organic compounds: (4L)

Hybridization: $sp^3,$ $sp^2,$ sp hybridization of carbon and nitrogen; sp^3 and sp^2 hybridizations of oxygen in Organic compounds (alcohol, ether, aldehyde, ketone, carboxylic acid, ester, cyanide, amine and amide)
Overlap of atomic orbitals: Overlaps of atomic orbitals to form sigma and pi bonds, shapes of organic molecules.
Shapes of molecules; Influence of hybridization on bond properties (as applicable to ethane, ethene, ethyne)
.
3.3 Fundamentals of organic reaction mechanism: (6L)

Electronic Effects: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment; Organic acids and bases; their relative strengths.
Bond fission: Homolytic and Heterolytic fission with suitable examples. Electrophiles and Nucleophiles; Nucleophilicity and basicity;
Types (primary, secondary, tertiary, allyl, benzyl), shape and their relative stability of reactive intermediates: Carbocations, Carbanions and Free radicals.

Introduction to types of organic reactions: Addition, Elimination and Substitution reaction. (With one example of each)

Semester I
Paper II
Unit I

1.1 Chemical Kinetics: (8L)

Rate of reaction, rate constant, measurement of reaction rates, order and molecularity of reaction, integrated rate equation of first and second order reactions (with equal initial concentration of reactants) (Numericals expected)

Determination of order of reaction by (a) Integration method (b) Graphical method (c) Ostwald's isolation method (d) Half time method (Numericals expected)

1.2 Liquid State: (7L)
Surface tension: Introduction, methods of determination of surface tension by drop number method (Numericals expected)

Viscosity: Introduction, coefficient of viscosity, relative viscosity, specific viscosity, reduced viscosity, determination of viscosity by Ostwald viscometer (Numericals expected)

Refractive index: Introduction, molar refraction and polarizability, determination of refractive index by Abbe's refractometer (Numericals expected)

Liquid crystals: Introduction, classification and structure of thermotropic phases (Nematic, smectic and cholesteric phases), applications of liquid crystals

Unit-II

2.0 Comparative chemistry of Main Group Elements: (15L)

Metallic and non-metallic nature, oxidation states, electronegativity, anomalous behaviour of second period elements, allotropy, catenation, diagonal relationship. Comparative chemistry of carbides, nitrides, oxides and hydroxides of group I and group II elements. Some important compounds- $NaHCO_3$, Na_2CO_3, $NaCl$, $NaOH$, CaO, $CaCO_3$; oxides of carbon, oxides and oxyacids of sulphur and nitrogen with respect to environmental aspects.

Unit III

3. Stereochemistry I: (15L)

Fischer Projection, Newman and Sawhorse Projection formulae (of erythro, threo isomers of tartaric acid and 2,3 dichlorobutane) and their interconversions ;
Geometrical isomerism in alkene and cycloalkanes: cis–trans and syn-anti isomerism E/Z notations with C.I.P rules.
Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two similar and dissimilar chiral-centres, Distereoisomers, meso structures, racemic mixture and resolution (methods of resolution not expected). Relative and absolute configuration: D/L and R/S designations.
Conformation analysis of alkanes (ethane, propane and n-butane); Relative stability with energy diagrams.

Semester II
Paper I
Unit-I

1.1 Gaseous State: (8L)
Ideal gas laws, kinetic theory of gases, Maxwell-Boltzmann's distribution of velocities (qualitative discussion), ideal gases, real gases, compressibility factor, Boyle's temperature (Numericals expected)

Deviation from ideal gas laws, reasons for deviation from ideal gas laws, Van der Waals equation of state, Joule-Thomson effect: qualitative discussion and experimentation, inversion temperature. (Numericals expected)

1.2 Chemical Equilibria and Thermodynamic Parameters: (7L)
Reversible and irreversible reactions, law of mass action, dynamic equilibria, equilibrium constant, (K_c and K_p), relationship between K_c and K_p, Le Chatelier's principle, factors affecting chemical equilibrium (Numericals expected)

Statement of second law of thermodynamics, concepts of entropy and free energy, spontaneity and physical significance of free energy, thermodynamic derivation of equilibrium constant (Numericals expected)

Unit II

2.1 Concept of Qualitative Analysis: (7L)

a) Testing of Gaseous Evolutes, Role of Papers impregnated with Reagents in qualitative analysis (with reference to papers impregnated with starch iodide, potassium dichromate, lead acetate, dimethylglyoxime and oxine reagents).

b) Precipitation equilibria, effect of common ions, uncommon ions, oxidation states, buffer action, complexing agents on precipitation of ionic compounds. (Balanced chemical equations and numerical problems expected.)

2.2 Acid Base Theories: (8L)

Arrhenius, Lowry- Bronsted, Lewis, Solvent – Solute concept of acids and bases, Hard and Soft acids and bases. Applications of HSAB
Applications of acid base chemistry in:
   i) Understanding organic reactions like Friedel Craft's (acylation/alkylation) reaction
   ii) Volumetric analysis with special reference to calculation of titration curve involving strong acid and strong base.

Unit III

3. Chemistry of Aliphatic Hydrocarbons

3.1 Carbon-Carbon sigma bonds: (3L)

Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation -relative reactivity and selectivity.

3.2 Carbon-Carbon pi bonds: (12L)

Formation of alkenes and alkynes by elimination reactions: Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations.

Reactions of alkenes: Electrophilic additions their mechanisms (Markownikoff/ Anti Markownikoff addition),
Mechanism of oxymercuration-demercuration, hydroboration-oxidation, ozonolysis, reduction(catalytic and chemical), syn and anti-hydroxylation (oxidation). 1, 2-and 1, 4-addition reactions in conjugated dienes and, Diels-Alder reaction; Allylic and benzylic bromination using N-bromosuccinimide and mechanism, e.g. propene, 1-butene, toluene, ethylbenzene.
Reactions of alkynes: Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes.

Semester II
Paper II
Unit I

1.1 Ionic Equilibria: (7L)

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water, ionization of weak acids and bases, pH scale, common ion effect, dissociation constants of mono-, di- and triprotic acid (exact treatment for monoprotic acid)

Buffers: Introduction, types of buffers, derivation of Henderson equation for acidic and basic buffers, buffer action, buffer capacity (Numericals expected)

1.2 Molecular Spectroscopy: (4L)

Electromagnetic radiation, electromagnetic spectrum, Planck's equation, interaction of electromagnetic radiation with matter: Absorption, emission, scattering, flourescence, electronic, vibrational and rotational transitions, Beer-Lambert's law (Numericals expected)

1.3 Solid State Chemistry (4L)
Types of solids, crystal lattice, lattice points, unit cell, space lattice and lattice plane, laws of crystallography: Law of constancy of interfacial angle, law of symmetry and law of rational indices (Numericals expected)

Unit II

2.1: Chemical Bond and Reactivity: (7L)

Types of chemical bond, comparison between ionic and covalent bonds, polarizability (Fajan's Rule), shapes of molecules, Lewis dot structure, Sidgwick Powell Theory, basic VSEPR theory for AB_n type molecules with and without lone pair of electrons, isoelectronic principles, applications and limitations of VSEPR theory.

2.2: Oxidation Reduction Chemistry: (8L)

a) Reduction potentials
b) Redox potentials: half reactions; balancing redox equations.
c) Redox stability in water
    i) Latimer and Frost Diagrams
    ii) pH dependence of redox potentials.
d) Applications of redox chemistry
    i) Extraction of elements: (example: isolation of copper by auto reduction)
    ii) Redox reagents in Volumetric analysis: a) I_2; b) $KMnO_4$
    iii) Titration curves:i) single electron systems (example Ce(IV) against Fe(II)); and ii) Multi electron systems as in KMnO4 against Fe(II))

Unit III

3.1 Stereochemistry-II: Cycloalkanes and Conformational Analysis: (5L)

Types of cycloalkanes and their relative stability, Baeyer strain theory, Conformation analysis of cyclohexane: Chair, Boat and Twist boat forms; Relative stability with energy.

3.2 Aromatic Hydrocarbons: (10L)

Aromaticity: Hückel's ruleanti-aromaticity, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft alkylation/acylation with their mechanism. , Hammond's postulate, Directing effects of the groups.

Reference Books:

Unit I:

1. Atkins P.W. and Paula J.de, Atkin's Physical Chemistry, 10th Ed., Oxford University 12 Press (2014).
2. Ball D.W., Physical Chemistry, Thomson Press, India (2007).
3. Castellan G.W., Physical Chemistry, 4th Ed., Narosa (2004).
4. Mortimer R.G., Physical Chemistry, 3rd Ed., Elsevier: NOIDA, UP (2009).
5. Engel T. and Reid P., Physical Chemistry, 3rd Ed., Pearson (2013).
6. Peter A. and Paula J. de., Physical Chemistry, 10th Ed., Oxford University Press (2014).
7. McQuarrie D.A. and Simon J.D., Molecular Thermodynamics, Viva Books Pvt. Ltd.,New Delhi (2004).
8. Levine I.N., Physical Chemistry, 6th Ed., Tata Mc Graw Hill (2010).
9. Metz C.R., 2000 Solved Problems in Chemistry, Schaum Series (2006).
10. Mortimer R.G., Physical Chemistry, 3rd Ed., Elsevier: NOIDA, UP (2009).
11. Banwell C.N., Fundamentals of Molecular Spectroscopy, 4th Ed., Tata McGraw Hill (1994).
12. K.L. Kapoor, A Textbook of Physical Chemistry, Macmillan (2000).

Unit II:

1. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
2. Douglas, B.E. and McDaniel, D.H. Concepts & Models of Inorganic Chemistry Oxford, 1970
3. Atkins, P.W. & Paula, J. Physical Chemistry, 10th Ed., Oxford University Press, 2014.
4. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications, 1962.
5. Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India Edition, 2002.

Unit III:

1. Morrison, R. T. and Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt Ltd. (Pearson Education).2012
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt Ltd. (Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt Ltd. (Pearson Education).
4. Eliel, E. L. and Wilen, S. H. Stereochemistry of Organic Compounds, Wiley: London, 1994.
5. Kalsi, P. S. Stereochemistry Conformation and Mechanism, New Age International, 2005.
6. Mc Murry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.

CHEMISTRY LAB:

Semester I

Unit I: Physical Chemistry

1. To prepare 0.1 N succinic acid and standardize the NaOH of two different concentrations
2. To determine the rate constant for the hydrolysis of ester using HCl as catalyst
3. To determine enthalpy of dissolution of salt (like KNO_3)

Unit II: Inorganic Chemistry
.
1. Commercial analysis of (any two)
   a) Mineral acid
   b) Organic acid
   c) Salt of weak acid and strong base.

2. Titration using double indicator: analysis of solution of Na_2CO_3 and $NaHCO_3$.
3. Gravimetric analysis
   a) To determine the percent purity of sample of $BaSO_4$ containing NH_4Cl
   b) To determine the percent purity of ZnO containing $ZnCO_3$.

Unit III: Organic Chemistry

1. Purification of any two organic compounds by recrystallization selecting suitable solvent. (Provide 1g.).
   Learners are expected to report
      a) Solvent for recrystallization.
      b) Mass and the melting points of purified compound.

   Learners should calibrate thermometer before determining melting point.

2. Chromatography (Any one)
   a) Separation of a mixture of two sugars by ascending paper chromatography
   b) Separation of a mixture of o-and p-nitrophenols by thin layer chromatography (TLC)

Semester II
Chemistry Lab

Unit I: Physical Chemistry

1. To determine the rate constant for the saponification reaction between ethyl acetate and NaOH
2. To determine dissociation constant of weak acid (Ka) using Henderson's equation and the method of incomplete titration pHmetrically.
3. To verify Beer-Lambert's law, using $KMnO_4$ solution by colorimetric method.
4. To standardize commercial sample of HCl using borax and to write material safety data of the chemicals involved.

Unit II: Inorganic Chemistry

1. **Qualitative analysis: (at least 4 mixtures to be analyzed)**
   Semi-micro inorganic qualitative analysis of a sample containing two cations and two anions.
   Cations (from amongst):
   Pb^{2+}, Ba^{2+}, Ca^{2+}, Sr^{2+}, Cu^{2+}, Cd^{2+}, Fe^{2+}, Ni^{2+}, Mn^{2+}, Mg^{2+}, Al^{3+}, Cr^{3+}, K^+, NH^{4+}
   Anions (From amongst):
   CO_3^{2-}, S^{2-}, SO_3^{2-}, NO_2^-, NO_3^-, Cl^-, Br^-, I^-, SO_4^{2-}, PO_4^{3-}
   (Scheme of analysis should avoid use of sulphide ion in any form for precipitation / separation of cations.)
2. **Redox Titration:** To determine the percentage of copper(II) present in a given sample by titration against a standard aqueous solution of sodium thiosulfate (iodometry titration)

Unit III: Organic Chemistry

Characterization of organic compound containing C, H, (O), N, S, X elements.
(minimum 6 compounds)

Reference Books

Unit I: Physical Chemistry
1. Khosla B.D., Garg V.C. and Gulati A., Senior Practical Physical Chemistry, R. Chand and Co., New Delhi (2011).
2. Garland C. W., Nibler J.W. and Shoemaker D.P., Experiments in Physical Chemistry, 8th Ed., McGraw-Hill, New York (2003).
3. Halpern A.M. and McBane G.C., Experimental Physical Chemistry, 3rd Ed., W.H. Freeman and Co., New York (2003).
4. Athawale V.D. and Mathur P., Experimental Physical Chemistry, New Age International, New Delhi (2001).

Unit II: Inorganic Chemistry
    Mendham, J., A. I. Vogel's *Quantitative Chemical Analysis 6th Ed.,* Pearson, 2009.

Unit III: Organic Chemistry

1. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)
2. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012)
3. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996
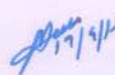
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UNIVERSITY OF MUMBAI
No. UG/ 69 of 2016-17

CIRCULAR:-

A reference is invited to the Syllabi relating to the B.Sc. degree course , **vide** this office Circular No. UG/131 of 2011, dated 13th June, 2011 and the Principals of affiliated Colleges in Science are hereby informed that the recommendation made by Board Studies in Physics at its meeting held on 24th May, 2016 has been accepted by the Academic Council meeting held on 24th June, 2016 **vide** item No. 4.50 and that in accordance therewith, the revised syllabus as per the Credit Based Semester and Grading System for F.Y. B.Sc. Physics (Sem.I & II), which are available on the University's web site (www.mu.ac.in) and that the same has been brought into force with effect from the academic year 2016-17.

MUMBAI – 400 032
21st September, 2016

(Dr.M.A.Khan)
REGISTRAR

To,

The Principals of the affiliated Colleges in Science.
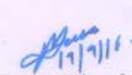
A.C/4.50/24.06.2016

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No. UG/69 -A of 2016   MUMBAI-400 032   21st September, 2016

Copy forwarded with Compliments for information to:-

1) The Deans, faculties of Science,
2) The Chairman, Board of Studies in Physics,
3) The Professor-cum-Director, Institute of Distance & Open Learning (IDOL)
4) The Director, Board of College and University Development,
5) The Co-Ordinator, University Computerization Centre,
6) The Controller of Examinations.

(Dr.M.A.Khan)
REGISTRAR

PTO..

UNIVERSITY OF MUMBAI

**Syllabus for Sem I & II
Program: B.Sc.
Course: Physics**

(Credit Based Semester and Grading
System for Academic year 2016-17)

Syllabus for B.Sc. Physics(Theory&Practical)
As per credit based system
First Year B.Sc. 2016–2017.

The revised syllabus in Physics as per credit based system for the First Year B.Sc. Course will be implemented from the academic year **2016–2017.**

Preamble:

The systematic and planned curricula from these courses shall motivate and encourage learners to understand basic concepts of Physics.

Objectives:

- To develop analytical abilities towards real world problems
- To familiarize with current and recent scientific and technological developments
- To enrich knowledge through problem solving, hands on activities, study visits, projects etc.

Course code	Title	Credits
	Semester I	
USPH101	Classical Physics	2
USPH102	Modern Physics	2
USPHP1	Practical I	2
		Total= 06
	Semester II	
USPH201	Mathematical Physics	2
USPH202	Electricity and Electronics	2
USPHP2	Practical II	2
		Total=06

Name of the Programme	Duration	Semester	Subject
B.Sc.inPhysics	Sixsemesters	I	Physics
CourseCode	Title	Credits	
USPH101	**Classical Physics**	2for USPH101	

Learning Outcomes:

On successful completion of this course students will be able to:
1. Understand Newton's laws and apply them in calculations of the motion of simple systems.
2. Use the free body diagrams to analyzetheforces on the object.
3. Understand the concepts of friction and the concepts of elasticity, fluid mechanics and be able to perform calculations using them.
4. Understand the concepts of lens system and interference.
5. Apply the laws of thermodynamics to formulate the relations necessary toanalyze athermodynamic process.
6. Demonstrate quantitative problem solving skills in all the topics covered

Unit:I   **15lectures**

1. Newton's Laws**:**
Newton's first, second and third laws of motion, interpretation and applications, pseudo forces, Inertial and non-inertial frames of reference.Worked out examples (with friction present)
2. Elasticity:
Review of Elastic constants Y, K, η and σ;Equivalence of shear strain to compression and extension strains. Relations between elastic constants, Couple for twist in cylinder.
3. Fluid Dynamics**:**
Equation of continuity, Bernoulli's equation, applications of Bernoulli's equation, streamline and turbulent flow, lines of flow in airfoil, Poiseuille's equation.

Unit:II   **15lectures**
1. Lens Maker's Formula (Review), Newton's lens equation,magnification-lateral, longitudinal and angular.

2. Equivalent focal length of two thin lenses, thick lens, cardinal points of thick lens, Ramsdenand Huygens eyepiece.

3. Aberration: Spherical Aberration, Reduction of Spherical Aberration, Chromatic aberration and condition for achromatic aberration.

3. Interference: Interference in thin films, Fringes in Wedge shaped films, Newton's Rings (Reflective).

UNIT III   **15 lectures**

1. Behavior of real gases and real gas equation, Van der Waal equation

2.Thermodynamic Systems, Zeroth law of thermodynamics, Concept of Heat, The first law, Non Adiabatic process and Heat as a path function, Internal energy, , Heat Capacity and specific heat, Applications of first law to simple processes, general relations from the first law, Indicator diagrams, Work done during isothermal and adiabatic processes, Worked examples, Problems.

Note:Agoodnumberofnumericalexamplesareexpectedtobecoveredduringthe prescribed lectures.

References:

1. Halliday, Resnick and Walker, Fundamental of Physics (extended) – (6th Ed.), John Wiley and Sons.
2. H. C. Verma, Concepts of Physics – (Part–I), 2002 Ed. BharatiBhavan Publishers.

3. Iradov

4. Brijlal,Subramanyam and Avadhanulu A Textbook of Optics, 25th revised ed.(2012) S. Chand

5. Brijlal, Subramanyam and Hemne, Heat Thermodynamics and Statistical Physics, S Chand, Revised, Multi-coloured,2007 Ed.

6. Jenkins and White, Fundamentals of Optics by (4th Ed.), McGraw Hill International.

Additional References :

1. Thornton and Marion, Classical Dynamics – (5th Ed)
2. D S Mathur, Element of Properties of Matter, S Chand & Co.
3. R Murugeshan and K Shivprasath, Properties of Matter and Acoustics S Chand.
4. M W Zemansky and R H Dittman, Heat and Thermodynamics, McGraw Hill.
5. D K Chakrabarti, Theory and Experiments on Thermal Physics, (2006 Ed) Central books.
6. C L Arora, Optics, S Chand.
7. Hans and Puri, Mechanics –, 2nd Ed. Tata McGraw Hill

Nameofthe Programme	Duration	Semester	Subject
B.Sc.inPhysics	Sixsemesters	I	Physics
CourseCode	Title	Credits	
USPH102	**Modern Physics**	2for USPH102	

Learning Outcomes:

After successful completion of this course students will be able to
1. Understand nuclear properties and nuclear behavior.
2. Understand the type isotopes and their applications.
3. Demonstrate and understand the quantum mechanical concepts.
4. Demonstrate quantitative problem solving skills in all the topics covered.

Unit I   15lectures

1. Structure of Nuclei:Basic properties of nuclei, Composition, Charge, Size, Rutherford's expt. for estimation of nuclear size, density of nucleus, Mass defect and Binding energy, Packing fraction, BE/A vs A plot, stability of nuclei (N Vs Z plot) and problems.
2. Radioactivity: Radioactive disintegration concept of natural and artificial radioactivity, Properties of α, β, γ-rays, laws of radioactive decay, half-life, mean life (derivation not required), units of radioactivity, successive disintegration and equilibriums, radioisotopes. Numerical Problems.
3. Carbon dating and other applications of radioactive isotopes (Agricultural, Medical, Industrial, Archaeological -information from net).

Unit II   15 lectures

Interaction between particles and matter, Ionization chamber, Proportional counter and GM counter, problems
Nuclear Reactions: Types of Reactions and Conservation Laws. Concept of Compound and Direct Reaction, Q value equation and solution of the Q equation, problems.
Fusion and fission definitions and qualitative discussion with examples.

1. Origin of Quantum theory, Black body (definition), Black Body spectrum, Wien's displacement law, Matter waves, wave particle duality, Heisenberg's uncertainty Principle. Davisson-Germer experiment, G. P. Thompson experiment.

2. X-Rays production and properties. Continuous and characteristic X-Ray spectra, X-Ray Diffraction, Bragg's Law, Applications of X-Rays.

3. Compton Effect, Pair production, Photons and Gravity, Gravitational Red Shift.

Note: Agoodnumberofnumericalexamplesareexpectedtobecoveredduringthe prescribed lectures

References:

1. Kaplan: Nuclear Physics, Irving Kaplan, 2nd Ed. Narosa Publishing House
2. SBP: Dr. S. B. Patel, Nuclear Physics Reprint 2009, New Age International
3.BSS: N Subrahmanyam, Brijlal and Seshan, Atomic and Nuclear Physics Revised Ed. Reprint 2012, S. Chand
4. Arthur Beiser, Perspectives ofModernPhysics : Tata McGraw Hill

Additional References:

1   S N Ghosal, Atomic Physics   S Chand
2   S N Ghosal, Nuclear Physics 2nd ed. S Chand

Name of the Programme	Duration	Semester	Subject
B.Sc.inPhysics	Sixsemesters	I	Physics
CourseCode	Title	Credits	
USPHP1	**Practical I**	2	

Leaning Outcome:

On successful completion of this course students will be able to:
  i)   To demonstrate their practical skills.
  ii)   To understand and practice the skills while doing physics practical.
  iii) To understand the use of apparatus and their use without fear.
  iv)   To correlate their physics theory concepts through practical.
  v)   Understand the concepts of errors and their estimation.

A. <u>Regularexperiments:</u>

1	J by Electrical Method: To determine mechanical equivalent of heat (Radiation correction by graph method)
2	Torsional Oscillation: To determine modulus of rigidity η of a material of wire by torsional oscillations
3	Bifilar Pendulum
4	Spectrometer: To determine of angle of Prism.
5	Y by vibrations: To determine Y Young's Modulus of a wire material by method of vibrations- Flat spiral Spring
6	To determine Coefficient of Viscosity (η) of a given liquid by Poisseuli's Method
7	Surface Tension/ Angle of contact
8	Combination of Lenses To determine equivalent focal length of a lens system by magnification method.
9	Spectrometer: To determine refractive index μ of the material of prism
10	To study Thermistor characteristic Resistance vs Temperature
11	Constant volume/constant pressure
12	Newton's Rings To determine radius of curvature of a given convex lens using Newton's rings.
13	Wedge Shaped Film

B. Skill Experiments:

1.	Use of Verniercalipers, Micrometer Screw Gauge, Travelling Microscope
2.	Graph Plotting : Experimental, Straight Line with intercept, Resonance Curve etc.
3.	Spectrometer: Schuster's Method
4.	Use of DMM
5	Absolute and relative errors calculation.

C) Any one out of following isequivalent to two experiments from section A and/ or B

    1. Students should collect the information of at least five Physicists with their work. Report that in journal.

    2. Students should carry out mini-project upto the satisfaction of professor In-charge of practical.

    3. Study tour. Students participated in study tour must submit a study tour report.

Minimum 8experimentsfrom the listshouldbecompletedinthe first semester. Any four skill experimentsaretobereportedinjournalCertifiedjournalis a must tobeeligibletoappearforthesemesterendpractical.

Theschemeofexaminationfortherevisedcoursein Physicsat theFirstYearB.Sc.Semester endexaminationwillbeasfollows.

SemesterEnd Practical Examination:
Schemeof examination:

There will be no internal assessment for practical.
Acandidatewillbeallowedtoappearforthesemester end practical examinationonlyifthecandidatesubmits aCertified journalatthetimeofpracticalexaminationofthe semester oracertificatefrom theHeadoftheDepartment /Institute totheeffectthathecandidate hascompleted the practicalcourseofthatsemesterofF.Y.B.Sc.Physicsaspertheminimumrequirement. The duration of the practical examination will be two hours per experiment. There will be two experiments through which the candidate will be examined in practical. The questions on slips for the same should be framed in such a way that candidate will be able to complete the task and should be evaluated for its skill and understanding of physics.

Nameofthe Programme	Duration	Semester	Subject
B.Sc.inPhysics	Sixsemesters	II	Physics
CourseCode	Title	Credits	
USPH201	**Mathematical Physics**	2for USPH201	

Learning Outcomes:

On successful completion of this course students will be able to:
1. Understand the basic mathematical concepts and applications of them in physical situations.
2. Demonstrate quantitative problem solving skills in all the topics covered.

Unit I   **15 lectures**
   1.   Vector Algebra :
Vectors, Scalars, Vector algebra, Laws of Vector algebra, Unit vector, Rectangular unit vectors, Components of a vector, Scalar fields, Vector fields, Problems based on Vector algebra.
Dot or Scalar product, Cross or Vector product, Commutative and Distributive Laws, Scalar Triple product, Vector Triple product (Omit proofs). Problems and applications based on Dot, Cross and Triple products.
2. Gradient, divergence and curl:
The ∇ operator, Definitions and physical significance of Gradient, Divergence and Curl; Distributive Laws for Gradient, Divergence and Curl (Omit proofs); Problems based on Gradient, Divergence and Curl.

Unit: II   **15lectures**
   1.   Differential equations**:**
Introduction, Ordinary differential equations, First order homogeneous and non- homogeneous equations with variable coefficients, Exact differentials, General first order Linear Differential Equation, Second-order homogeneous equations with constant coefficients. Problems depicting physical situations like LC and LR circuits, Simple Harmonic motion (spring mass system).
   2.   Transient response of circuits: Series LR, CR, LCR circuits. Growth and decay of currents/charge.

Unit:III   **15lectures**
   1.   Superposition of Collinear Harmonic oscillations: Linearity and Superposition Principle. Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies (Beats).

2. Superposition of two perpendicular Harmonic Oscillations: Graphical and Analytical Methods. Lissajous Figures with equal an unequal frequency and their uses

3. Wave Motion: Transverse waves on string, Travelling and standing waves on a string. Normal modes of a string, Group velocity, Phase velocity, Plane waves, Spherical waves, Wave intensity.

Note: Agoodnumberofnumericalexamplesareexpectedtobecoveredduringthe prescribed lectures

References:

1. MS: Murray R Spiegel, Schaum's outline of Theory and problems of Vector Analysis, Asian Student Edition
2. CH**:** Charlie Harper, Introduction to Mathematical Physics , 2009 (EEE) PHI Learning Pvt. Ltd.
3. CR: D. Chattopadhyay, P C Rakshit , Electricity and Magnetism 7th Ed. New Central Book agency.
4. Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill.
5. The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
6. The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.

Additional References:
1. BrijLal**,N.** Subrahmanyam **,** JivanSeshan, Mechanics and Electrodynamics, , (S. Chand) (Revised & Enlarged ED. 2005)
2. A K Ghatak, Chua, Mathematical Physics, 1995, Macmillan India Ltd.
3. Ken Riley**, Michael** Hobson **and Stephen** Bence, Mathematical Methods for Physics and Engineering, Cambridge (Indian edition).
4. H. K. Dass, Mathematical Physics, S. Chand & Co.
5. Jon Mathews & R. L. Walker, Mathematical Methods of Physics: W A Benjamin Inc.

Nameofthe Programme	Duration	Semester	Subject
B.Sc.inPhysics	Sixsemesters	II	Physics
CourseCode	Title	Credits	
USPH202	**Electricity and Electronics**	2for USPH202	

Unit I :   **15 lectures**

    1. Alternating current theory:(Concept of L, R, and C: Review)

AC circuit containing pure R, pure L and pure C, representation of sinusoids by complex numbers, Series L-R, C-R and LCR circuits. Resonance in LCR circuit (both series and parallel), Power in ac circuit. Q-factor.

    2. AC bridges: AC-bridges: General AC bridge, Maxwell,de-Sauty, Wien Bridge , Hay Bridge.

Unit II: Electronics   **15 lectures**

1.Circuit theorems: (Review: ohm's law, Kirchhoff's laws)

Superposition Theorem, Thevenin's Theorem, Ideal Current Sources, Norton's Theorem, Reciprocity Theorem, Maximum Power Transfer Theorem.

Numericals related to circuit analysis using the above theorems.

2.DC power supply:Half wave rectifier , Full wave rectifier, Bridge rectifier, PIV and Ripple factor of full wave rectifier, Clipper and Clampers(Basic circuits only), Capacitor Filter.

Zener diode as voltage stabilizer.

3.Digital electronics : Logic gates(Review), NAND and NOR as universal building blocks. EXOR gate: logic expression, logic symbol, truth table, Implementation using basic gates and its applications, Boolean algebra, Boolean theorems. De-Morgan theorems, Half adder and Full adder

Unit III : Electrostatics and Magnetostatics   **15 lectures**

1.The Electric Field : Introduction, Coulomb's Law, The Electric Field, Continuous charge Distribution, Electric Potential, Introduction to Potential, Comments on Potential, The Potential of a Localized Charge Distribution

2.Work and Energy in Electrostatics**:** The Work Done to Move a charge, The Energy of a Point Charge Distribution

3.Magnetostatics**:** Magnetic Fields

4.TheBiotSavart Law**:** Steady Currents,The Magnetic Field of a Steady Current

Helmholtz coil and solenoid.

Note: Agoodnumberofnumericalexamplesareexpectedtobecoveredduringthe prescribed lectures

References :
CR: D. Chattopadhyay, P C Rakshit , Electricity and Magnetism 7th Ed. New Central Book agency.
TT :B.L. Theraja and A.K. Theraja , A Textbook of Electrical Technology Vol. I , S. Chand Publication
BN :Boylestad and Nashelsky, Electronic devices and Circuit Theory: 7th edition, Prentice Hall of India.
VKM: V K Mehta and R Mehta Electronics Principals, MulticolouredRevised 11th Ed. reprint in 2012 ,S Chand.
David J. Griffiths : Introduction to Electrodynamics, Prentice Hall India (EEE) 3rd Ed.
A B Bhattacharya, Electronics Principlesand Applications, Central publisher.
A P Malvino, Digital Principles and Applications: Tata McGraw Hill
Tokhiem, Digital electronics, 4thed, McGraw Hill International Edition.

SEMESTER II

Name of the Programme	Duration	Semester	Subject
B.Sc.inPhysics	Sixsemesters	II	Physics
CourseCode	Title	Credits	
USPHP2	**Practical II**	2	

Leaning Outcome:

i)   To understand and practice the skills while doing physics practical.
ii) To understand the use of apparatus and their use without fear.
iii) To correlate their physics theory concepts through practical.
iv) Understand the concepts of errors and their estimation.

A) Regular experiments:

1	Flywheel
2	To study Zener Diode as Regulator
3	To study load regulation of a Bridge Rectifier
4	LR Circuit: To determine the value of given inductance and phase angle
5	CR Circuit: To determine value of given capacitor and Phase angle
6	Frequency of AC Mains: To determine frequency of AC mains.
7	LCR series Resonance: To determine resonance frequency of LCR series circuit.
8	To study NAND and NOR gates as Universal Building Blocks
9	To study EX-OR Gate, half adder and full adder and verify their truth tables.
10	To verify De Morgan's Theorems
11	Thevenin's Theorem: To verify Thevenin's theorem for DC circuits
12	Norton's Theorem: To verify Norton's Theorem for DC circuits
13	LDR Characteristics: To study the dependence of LDR resistance on intensity of light.

B) List of Demo-experiments: (Min. four)

1.	Angular Momentum conservation (Rotating Platform)
2.	Light dependent switch
3.	Laser beam divergence, Intensity
4.	Use of Oscilloscope
5	Charging and discharging of a capacitor

6	Use of PC for graph plotting
7	Clipper and Clamper circuits.

C) Any one out of following isequivalentto two experiments from section A and/ or B
   1. Students should collect the information of at least fourPhysics events and their outcome. Report that in journal.
   2. Students should carry out mini-project up to the satisfaction of professor In-charge of practical
   3. Study tour. Students participated in study tour must submit a study tour report.

Minimum 8experimentsfrom the listshouldbecompletedinthe first semester. Any four skill experimentsaretobereportedinjournalCertifiedjournalis musttobeeligibletoappearforthe semester endpractical.

Theschemeofexaminationfortherevisedcoursein Physicsat theFirstYearB.Sc.Semester endexaminationwillbeasfollows.

SemesterEnd Practical Examination:
Schemeof examination:

There will be no internal assessment for practical
A candidate will be allowed to appear for the semester end practical examination only if the candidate submits a Certified journal at the time of practical examination of the semester or a certificate from the Head of the Department /Institute to the effect that the candidate has completed the practical course of that semester of F.Y.B.Sc. Physics as per the minimum requirement. The duration of the practical examination will be two hours per experiment. There will be two experiments through which the candidate will be examined in practical. The questions on slips for the same should be framed in such a way that candidate will be able to complete the task and should be evaluated for its skill and understanding of physics

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Semester I USBO101	L	Cr
Paper I -- Plant Diversity 1	**45**	**2**
UNIT I	**15**	
ALGAE		
1	Structure, life cycle and systematic position of *Nostoc* and *Spirogyra*.		
2	Economic importance of Algae.		
UNIT II	**15**	
FUNGI		
1	Structure, life cycle and systematic position of *Rhizopus* and *Aspergillus*		
2	Economic importance of Fungi.		
3	Modes of nutrition in Fungi (Saprophytism and Parasitism).		
UNIT III	**15**	
BRYOPHYTA		
1	General characters of Hepaticae		
2	Structure, life cycle and systematic position of *Riccia*.		

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Semester I USBO102	L	Cr
Paper II – Form and Function 1	**45**	**2**
UNIT I	**15**	
CELL BIOLOGY		
1 General structure of plant cell: cell wall Plasma membrane (bilayer lipid structure, fluid mosaic model)		
2 Ultra structure and functions of the following cell organelles: Endoplasmic reticulum and Chloroplast		
UNIT II	**15**	
ECOLOGY		
1 Energy pyramids, energy flow in an ecosystem.		
2 Types of ecosystems: aquatic and terrestrial.		
UNIT III	**15**	
GENETICS		
1 Phenotype/Genotype, Mendelian Genetics- monohybrid, dihybrid; test cross; back cross ratios.		
2 Epistatic and non epistatic interactions; multiple alleles.		

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	Semester I USBOP1	L	Cr
	PRACTICAL Paper I – Plant Diversity 1	30	1
1	Study of stages in the life cycle of *Nostoc* from fresh/ preserved material and permanent slides.		
2	Study of stages in the life cycle of *Spirogyra* from fresh/ preserved material and permanent slides.		
3	Economic importance of algae: *Ulva* (Biofuel), *Spirulina* (Neutraceutical), *Gelidium* (Agar)		
4	Study of stages in the life cycle of *Rhizopus* from fresh/ preserved material and permanent slides.		
5	Study of stages in the life cycle of *Aspergillus* from fresh/ preserved material and permanent slides.		
6	Economic importance of Fungi: Mushroom , Yeast, wood rotting fungi (any bracket fungus).		
7	Study of stages in the life cycle of *Riccia* from fresh/ preserved material.		
8	Study of stages in the life cycle of *Riccia* with the help of permanent slides.		
	PRACTICAL PAPER II- FORM AND FUNCTION 1	30	1
1	Examining various stages of mitosis in root tip cells (*Allium)*		
2	**Cell inclusions:** Starch grains (Potato and Rice); Aleurone Layer (Maize)		
3	Cystolith (*Ficus*); Raphides (*Pistia*); Sphaeraphides (*Opuntia*).		
4	Identification of cell organelles with the help of photomicrograph: Plastids: Chloroplast, Amyloplast, Endoplasmic Reticulum and Nucleus		
4	**Identification of plants adapted to different environmental conditions:** Hydrophytes: Floating: Free floating (*Pistia*/*Eichornia*); Rooted floating (*Nymphaea*); Submerged (*Hydrilla*)		
5	Mesophytes (any common plant); Hygrophytes (*Typha*/*Cyperus*)		

6	Xerophytes : Succulent (*Opuntia*); Woody Xerophyte (*Nerium*); Halophyte (*Avicennia* pneumatophore) No sections in ecology, only identification and description of specimens. Morphological adaptations only.		
7	Calculation of mean, median and mode.		
8	Calculation of standard deviation.		
9	Frequency distribution, graphical representation of data- frequency polygon, histogram, pie chart.		
10	Study of Karyoptypes: Human: Normal male and female, *Allium cepa* .		

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Semester II USBO201	Hrs	Cr
Paper I -- Plant Diversity 1	45	2
UNIT I	15	
PTERIDOPHYTES		
1 Structure life cycle, systematic position and alternation of generations in *Nephrolepis*		
2 Stelar evolution		
UNIT II	15	
GYMNOSPERMS		
2 Structure life cycle systematic position and alternation of generations in *Cycas*		
3 Economic importance of Gymnosperms		
Unit III		
ANGIOSPERMS	15	
1. Leaf: simple leaf, types of compound leaves, Incisions of leaf, venation, phyllotaxy, types of stipules, leaf apex, leaf margin, leaf base, leaf shapes. Modifications of leaf: spine, tendril, hooks, phyllode, pitcher, *Drosera* or insectivorous plants.		
2 Inflorescence: Racemose: simple raceme, spike, catkin, spadix, panicle. Cymose: monochasial, dichasial, polychasial. Compound: corymb, umbel, cyathium, capitulum, verticellaster, hypanthodium.		
3 Study of following families: Malvaceae, Amaryllidaceae.		

Semester II USBO202	Hrs	Cr
Paper II – Form and Function 1	45	2
UNIT I	15	
ANATOMY		
1 Simple tissues, complex tissues.		
2 Primary structure of dicot and monocot root, stem and leaf.		
3 Epidermal tissue system: types of hair, monocot and dicot stomata.		

UNIT II		**15**	
PHYSIOLOGY			
1	Photosynthesis: Light reactions, photolysis of water, photophosphorylation (cyclic and non cyclic), carbon fixation phase (C_3, C_4 and CAM pathways).		
UNIT III		**15**	
MEDICINAL BOTANY			
1	Concept of primary and secondary metabolites, difference between primary and secondary metabolites.		
2	Grandma's pouch: Following plants have to be studies with respect to botanical source, part of the plant used, active constituents present and medicinal uses: *Oscimum sanctum, Adathoda vasica, Zinziber officinale, Curcuma longa, Santalum album, Aloe vera*.		

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	Semester II USBOP2	**Cr**
	PRACTICAL Paper I – Plant Diversity 1	**1**
1	Study of stages in the life cycle of *Nephrolepis* : Mounting of ramentum, hydathode, T.S. of rachis.	
2	T.S. of pinna of *Nephrolepis* passing through sorus.	
3	Stelar evolution with the help of permanent slides: Protostele: haplostele, actinostele, plectostele, mixed protostele, siphonostele: ectophloic, amphiphloic, dictyostele, eustele and atactostele.	
4	*Cycas:* T.S of leaflet (*Cycas* pinna)	
5	Megasporophyll, microsporophyll, coralloid root, microspore, L.S. of ovule of *Cycas* – all specimens to be shown.	
6	Economic importance of Gymnosperms: *Pinus* (turpentine, wood, seeds)	
7	Leaf morphology : as per theory	
8	Types of inflorescence: as per theory	
9	Malvaceae	
10	Amaryllidaceae	
	PRACTICALPaper II – Form and Function 1	**1**
1	Primary structure of dicot and monocot root.	
2	Primary structure of dicot and monocot stem.	
3	Study of dicot and monocot stomata.	

4	Epidermal outgrowths: with the help of mountings
	        Unicellular: *Gossypium/*Radish
	        Multicellular: *Lantana/*Sunflower
	        Glandular: *Drosera* and Stinging: *Urtica* – only identification with the help of permanent slides.
	        Peltate: *Thespesia*
	        Stellate: *Erythrina*/*Sida acuta*/*Solanum/Helecteris*	

	T-shaped: *Avicennia*	
5	Separation of chlorophyll pigments by strip paper chromatography.	
6	Separation of amino acids by paper chromatography.	
7	Change in colour because of change in pH: Anthocyanin: black grapes/Purple cabbage	
8	Test for tannins: tea powder/catechu.	
9	Identification of plants or plant parts for grandma's pouch as per theory.	

University of Mumbai
Board of Studies in Botany
FYBSc Syllabus Credit System 2014-2015 onwards

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DISTRIBUTION OF TOPICS AND CREDITS
F Y B Sc. BOTANY SEMESTER I

Course	Nomenclature	Credits	Topics
USBO1O1	PLANT DIVERSITY 1	02	1. Algae
			2. Fungi
			3. Bryophyta
USBO1O2	FORM AND FUNCTION I	02	1. Cell Biology
			2. Ecology
			3. Genetics
USBOP1	Plant Diversity I, form and Function I (Practical I & II)	02	

F Y B Sc BOTANY SEMESTER II

Course	Nomenclature	Credits	Topics
USBO2O1	PLANT DIVERSITY I	02	1. Pteridophytes
			2. Gymnosperms
			3. Angiosperms
USBO2O2	FORM AND FUNCTION I	02	1. Anatomy
			2. Physiology
			3. Medicinal Botany
USBOP2	Plant Diversity I, Form and Function I (Practical I & II)	02	

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References

1. College Botany Volume I and II Gangulee, Das and Dutta latest edition. Central Education enterprises
2. Cryptogamic Botany Volume I and II by G M Smith McGraw Hill.
3. Genetics by Russel. Wesley Longman inc publishers. (5th edition)
4. Plant Physiology by Taiz and Zeiger Sinauer Associates inc. publishers
5. Fundamentals of Ecology by E P Odum and G W Barrett. Thompson Asia Pvt Ltd. Singapore.
6. Cell Biology by De Robertis

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Scheme of Examinations

Internal and External Assessment as per CBSS of University of Mumbai

Note:

- Two short field excursions for habitat studies are compulsory.
  Field work of not less than eight hours duration is equivalent to one period per   week for a batch of 15 students.
- A candidate will be allowed to appear for the practical examinations only if he/she submits a certified journal of F.Y.B.Sc. Botany or a certificate from the Head of the department / Institute to the effect that the candidate has completed the practical course of F.Y.B.Sc. Botany as per the minimum requirements. In case of loss of journal a candidate must produce a certificate from the Head of the department /Institute that the practicals for the academic year were completed by the student. However such a candidate will be allowed to appear for the practical examination but the marks allotted for the journal will not be granted.

UNIVERSITY OF MUMBAI

Revised Syllabus for the F.Y.B.A/F.Y.B.Sc.

Program: F.Y.B.A/F.Y.B.Sc.

Course: Foundation Course

(Semester I & II)

(As per Credit Based Semester and Grading System
with effect from the academic year 2012–2013)

Lectures 45
Marks 100

Unit 1
Overview of Indian Society:
Understand the multi-cultural diversity of Indian society through its demographic composition: population distribution according to religion, caste, and gender;
Appreciate the concept of linguistic diversity in relation to the Indian situation;
Understand regional variations according to rural, urban and tribal characteristics;
Understanding the concept of diversity as difference.   *(5 lectures)*

Unit 2
Concept of Disparity- 1:
Understand the concept of disparity as arising out of stratification and inequality;
Explore the disparities arising out of gender with special reference to violence against women, female foeticide (declining sex ratio), and portrayal of women in media;
Appreciate the inequalities faced by people with disabilities and understand the issues of people with physical and mental disabilities.   *(10 lectures)*

Unit 3
Concept of Disparity-2:
Examine inequalities manifested due to the caste system and inter-group conflicts arising thereof;
Understand inter-group conflicts arising out of communalism;
Examine the causes and effects of conflicts arising out of regionalism and linguistic differences.   *(10 lectures)*

Unit 4
The Indian Constitution:
Philosophy of the Constitution as set out in the Preamble;
The structure of the Constitution-the Preamble, Main Body and Schedules;
Fundamental Duties of the Indian Citizen; tolerance, peace and communal harmony as crucial values in strengthening the social fabric of Indian society;
Basic features of the Constitution.   *(10 lectures)*

Unit 5
Significant Aspects of Political Processes:
The party system in Indian politics;
Local self-government in urban and rural areas; the 73rd and 74th Amendments and their implications for inclusive politics;
Role and significance of women in politics.   *(10 lectures)*

Unit 6
Growing Social Problems in India:
    a) Substance abuse- impact on youth & challenges for the future
    b) HIV/AIDS- awareness, prevention, treatment and services
    c) Problems of the elderly- causes, implications and response
    d) Issue of child labour- magnitude, causes, effects and response
    e) Child abuse- effects and ways to prevent
    f) Trafficking of women- causes, effects and response

(15 lectures)

Note:
15 lectures will be allotted for project guidance
Unit Number 6 will not be assessed for the Semester End Exam

Lectures 45
Marks 100

Unit 1
Globalisation and Indian Society:
Understanding the concepts of liberalization, privatization and globalization;
Growth of information technology and communication and its impact manifested in everyday life;
Impact of globalization on industry: changes in employment and increasing migration;
Changes in agrarian sector due to globalization; rise in corporate farming and increase in farmers' suicides. (7 lectures)

Unit 2
Human Rights
Concept of Human Rights; origin and evolution of the concept;
The Universal Declaration of Human Rights;
Human Rights constituents with special reference to Fundamental Rights stated in the Constitution;

(10lectures)

Unit 3
Ecology
Importance of Environment Studies in the current developmental context;
Understanding concepts of Environment, Ecology and their interconnectedness;
Environment as natural capital and connection to quality of human life;
Environmental Degradation- causes and impact on human life;
Sustainable development- concept and components; poverty and environment

(10 lectures)

Unit 4
Understanding Stress and Conflict:
Causes of stress and conflict in individuals and society;
Agents of socialization and the role played by them in developing the individual;
Significance of values, ethics and prejudices in developing the individual;
Stereotyping and prejudice as significant factors in causing conflicts in society.
Aggression and violence as the public expression of conflict;

(10 lectures)

Unit 5
Managing Stress and Conflict in Contemporary Society:
Types of conflicts and use of coping mechanisms for managing individual stress;
Maslow's theory of self-actualisation;
Different methods of responding to conflicts in society;
Conflict-resolution and efforts towards building peace and harmony in society.

(8 lectures)

Unit 6
Contemporary Societal Challenges:
a) Increasing urbanization, problems of housing, health and sanitation;
b) Changing lifestyles and impact on culture in a globalised world.
c) Farmers' suicides and agrarian distress.
d) Debate regarding Genetically Modified Crops.
e) Development projects and Human Rights violations.
f) Increasing crime/suicides among youth.

(15 lectures)

Note:
15 lectures will be allotted for project guidance
Unit Number 6 will not be assessed for the Semester End Exam

Internal Assessment and
Question Paper Pattern for FC- Semester I & II Course
At the F Y B A Examinations

The student will be assessed on the basis of Internal Assessment of 40 marks and a Semester End Exam of 60 marks. The student will have to secure a minimum of 40% marks in aggregate and a minimum of 40% in each component of assessment i.e. 16 out of 40 in Internal Assessment and 24 out of 60 in Semester End Exam.

Internal Assessment:
There will be one mid-semester test of 10 marks on Units 1 and 2.
The test will, as far as possible, comprise of objective questions and/or short notes.
The student will have to submit an assignment/project for 20 marks before appearing for the Semester End Exam. This assignment/project will be entirely based on Unit 6 and can take the form of street-plays/exhibition/power-point presentations or similar other modes suitable to the topic selected; students can work in groups of not more than 8 for the purpose of this assignment. Students will have to submit a hard copy of the assignment before appearing for the Semester End Exam. The assignment will be assessed for 20 marks of which 10 marks may be allotted for a viva, to assess the level of engagement of the student with the topic assigned.
Unit 6 will not be included in the Semester End Exam.
10 marks will be assigned to the participation of the student in class discussions and the projects undertaken along with the leadership skills and presentation skills exhibited during the class sessions.

Semester End Exam:

There will be a Semester End Exam for 60 marks of 2 hours duration.

This exam will comprise of four compulsory questions covering Units 1-5 of the syllabus.

Question No. 1, 2 and 3 will be Full-length questions for 15 marks each; there will be an internal choice in each of these questions requiring the students to answer one of two questions asked.

Full-length questions will be from Units 2, 3, 4 and 5 only.

Question No. 4 will be of the Short Note type where each Short Note will be for 3 marks each. Students will be required to answer 5 out of 8 Short Notes.

Short note questions will be from Units 1, 2, 3, 4 and 5.

Unit 1 will not feature in the Full-length questions but will be asked only in the form of Short Note questions.

NOTE: All other rules regarding Standard of Passing, ATKT, etc., will be as per those decided by the Faculty of Arts passed by the Academic Council from time to time.

Lectures 45
Marks 100

Unit 1
Overview of Indian Society:
Understand the multi-cultural diversity of Indian society through its demographic composition: population distribution according to religion, caste, and gender; Appreciate the concept of linguistic diversity in relation to the Indian situation; Understand regional variations according to rural, urban and tribal characteristics; Understanding the concept of diversity as difference.   *(5 lectures)*

Unit 2
Concept of Disparity- 1:
Understand the concept of disparity as arising out of stratification and inequality; Explore the disparities arising out of gender with special reference to violence against women, female foeticide (declining sex ratio), and portrayal of women in media; Appreciate the inequalities faced by people with disabilities and understand the issues of people with physical and mental disabilities.   *(10 lectures)*

Unit 3
Concept of Disparity-2:
Examine inequalities manifested due to the caste system and inter-group conflicts arising thereof;
Understand inter-group conflicts arising out of communalism;
Examine the causes and effects of conflicts arising out of regionalism and linguistic differences.   *(10 lectures)*

Unit 4
The Indian Constitution:
Philosophy of the Constitution as set out in the Preamble;
The structure of the Constitution-the Preamble, Main Body and Schedules;
Fundamental Duties of the Indian Citizen; tolerance, peace and communal harmony as crucial values in strengthening the social fabric of Indian society;
Basic features of the Constitution.   *(10 lectures)*

Unit 5
Significant Aspects of Political Processes:
The party system in Indian politics;
Local self-government in urban and rural areas; the 73rd and 74th Amendments and their implications for inclusive politics;
Role and significance of women in politics.   *(10 lectures)*

Unit 6

Growing Social Problems in India:
  a) Substance abuse- impact on youth & challenges for the future
  b) HIV/AIDS- awareness, prevention, treatment and services
  c) Problems of the elderly- causes, implications and response
  d) Issue of child labour- magnitude, causes, effects and response
  e) Child abuse- effects and ways to prevent
  f) Trafficking of women- causes, effects and response

(15 lectures)

Note:
15 lectures will be allotted for project guidance
Unit Number 6 will not be assessed for the Semester End Exam

Revised Syllabus (From 2012-13)
Foundation Course for F. Y. B.Sc.
Semester II
Course Code: US FC 2C1

Lectures 45
Marks 100

Unit 1
Globalisation and Indian Society:
Understanding the concepts of liberalization, privatization and globalization;
Growth of information technology and communication and its impact manifested in everyday life;
Impact of globalization on industry: changes in employment and increasing migration;
Changes in agrarian sector due to globalization; rise in corporate farming and increase in farmers' suicides.   (7 lectures)

Unit 2
Human Rights
Concept of Human Rights; origin and evolution of the concept;
The Universal Declaration of Human Rights;
Human Rights constituents with special reference to Fundamental Rights stated in the Constitution;

(10lectures)

Unit 3
Ecology
Importance of Environment Studies in the current developmental context;
Understanding concepts of Environment, Ecology and their interconnectedness;
Environment as natural capital and connection to quality of human life;
Environmental Degradation- causes and impact on human life;
Sustainable development- concept and components; poverty and environment
(10 lectures)

Unit 4
Understanding Stress and Conflict:
Causes of stress and conflict in individuals and society;
Agents of socialization and the role played by them in developing the individual;
Significance of values, ethics and prejudices in developing the individual;
Stereotyping and prejudice as significant factors in causing conflicts in society.
Aggression and violence as the public expression of conflict;
(10 lectures)

Unit 5
Managing Stress and Conflict in Contemporary Society:
Types of conflicts and use of coping mechanisms for managing individual stress;
Maslow's theory of self-actualisation;
Different methods of responding to conflicts in society;
Conflict-resolution and efforts towards building peace and harmony in society.

(8 lectures)

Unit 6
Contemporary Societal Challenges:
a) Increasing urbanization, problems of housing, health and sanitation;
b) Changing lifestyles and impact on culture in a globalised world.
c) Farmers' suicides and agrarian distress.
d) Debate regarding Genetically Modified Crops.
e) Development projects and Human Rights violations.
f) Increasing crime/suicides among youth.

(15 lectures)

Note:
15 lectures will be allotted for project guidance
Unit Number 6 will not be assessed for the Semester End Exam

Internal Assessment and
Question Paper Pattern for FC- Semester I & II Course
At the F Y B Sc Examinations

The student will be assessed on the basis of Internal Assessment of 40 marks and a Semester End Exam of 60 marks. The student will have to secure a minimum of 40% marks in aggregate and a minimum of 40% in each component of assessment i.e. 16 out of 40 in Internal Assessment and 24 out of 60 in Semester End Exam.

Internal Assessment:
        There will be one mid-semester test of 10 marks on Units 1 and 2.
        The test will, as far as possible, comprise of objective questions and/or short notes.
        The student will have to submit an assignment/project for 20 marks before appearing for the Semester End Exam. This assignment/project will be entirely based on Unit 6 and can take the form of street-plays/exhibition/power-point presentations or similar other modes suitable to the topic selected; students can work in groups of not more than 8 for the purpose of this assignment. Students will have to submit a hard copy of the assignment before appearing for the Semester End Exam. The assignment will be assessed for 20 marks of which 10 marks may be allotted for a viva, to assess the level of engagement of the student with the topic assigned.
        Unit 6 will not be included in the Semester End Exam.
        10 marks will be assigned to the participation of the student in class discussions and the projects undertaken along with the leadership skills and presentation skills exhibited during the class sessions.

Semester End Exam:

There will be a Semester End Exam for 60 marks of 2 hours duration.

This exam will comprise of four compulsory questions covering Units 1-5 of the syllabus.

Question No. 1, 2 and 3 will be Full-length questions for 15 marks each; there will be an internal choice in each of these questions requiring the students to answer one of two questions asked.

Full-length questions will be from Units 2, 3, 4 and 5 only.

Question No. 4 will be of the Short Note type where each Short Note will be for 3 marks each. Students will be required to answer 5 out of 8 Short Notes.

Short note questions will be from Units 1, 2, 3, 4 and 5.

Unit 1 will not feature in the Full-length questions but will be asked only in the form of Short Note questions.

NOTE: All other rules regarding Standard of Passing, ATKT, etc., will be as per those decided by the Faculty of Science and passed by the Academic Council from time to time.