Shikshan Haach Dharma

S. A. P. D. Jain Pathashala's

(Jain Minority Institute)

Walchand College of Arts & Science, Solapur

(Autonomous)

Affiliated to P.A.H. Solapur University, Solapur

Name of the Faculty: Science & Technology

CHOICE BASED CREDIT SYSTEM AS PER NEP 2020

SYLLABUS: CHEMISTRY

Name of the Course: B.Sc. I Chemistry (SEMESTER–I & II)

(Syllabus to be implemented w.e.f. June 2023-24)

Walchand College of Arts & Science, Solapur

(Autonomous)

About National Education Policy (NEP) - 2020

With the directions and guidelines issued by **Government of Maharashtra resolution dated 20th April 2023 and 16th May, 2023** regarding the implementation of NEP at UG and PG level, the Walchand College of Arts & Science (Autonomous), Solapur has taken decision to implement NEP 2020 with Choice Based Credit System (CBCS) at Undergraduate level and Post Graduate level. This has been done to achieve the goals and objectives set in NEP-2020 such as- worldwide recognition, acceptability, horizontal as well as vertical mobility for students completing undergraduate and post-graduate degree.

The CBCS provides an opportunity for the students to select from the prescribed courses comprising core, elective/minor or skill based. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations.

Outline of NEP:

The structure of the Three/Four-year bachelor's degree programme allows the opportunity to the students to experience the full range of holistic and multidisciplinary education in addition to a focus on the chosen major and minors as per their choices and the feasibility of exploring learning in different institutions. The structure allows students to learn various components like:

(a) Major (Core) Subject (DSC): This comprises of Mandatory and Elective Courses that require students to achieve:

- Minimum 50% of total credits corresponding to Three/Four - year UG Degree- Mandatory Courses are offered in all four years;
- 2 credit course on Major Specific IKS shall be included under Major;
- Elective courses of Major will be offered in the third and/or final year;
- Vocational Skill Courses, Internship/ Apprenticeship, Field Projects, Research Projects are related to Major

(b) Minor Subject (18-20 Credits)

- The Minor subjects may be from the different disciplines of the same faculty of DSC Major (Core) or they can be from different faculty altogether;

- The credits of Minor subjects shall be completed in the first three years of UG Programme

(c) Generic/ Open Elective Courses (OE) (10-12 credits)

- GE/OE are to be offered in I and/or II year;
- Faculty-wise baskets of OE shall be prepared by Autonomous College.
- OE/GE is to be chosen compulsorily from faculty other than that of the Major or as per the directions issued by NEP-Steering Committee

(d) Vocational and Skill Enhancement Courses (VSEC)

i) Vocational Skill Courses (VSC): (8-10 credits): Includes Hands on Training corresponding to the Major and/or Minor Subjects:

- To be offered in first three years;
- Wherever applicable vocational courses will include skills based on advanced laboratory practicals' of Major

ii) Skill Enhancement Courses (SEC): (06 credits)

- To be offered in I and II year;
- To be selected from the basket of Skill Courses approved by Autonomous College

(e) Ability Enhancement Courses (AEC), Indian Knowledge System (IKS) and Value Education Courses (VEC): (14 Credits)

i) AEC: (08 credits)

- To be offered in I and II year
- English: 04 Credits
- Modern Indian Language: 04 credits
- To be offered from the Basket approved by Autonomous College;

The focus for both languages should be on linguistic and communication skills.

ii) IKS: (2 Credits)

- To be offered in I Year
- Courses on IKS to be selected from the basket of IKS courses approved by Autonomous College

iii) VEC: 04 Credits

- To be offered in I year

- Value Education Courses (VEC) such as Understanding India, Environmental Science/Education, and Digital and Technological Solutions.

(f) Field Projects/ Internship/ Apprenticeship/ Community Engagement and Service corresponding to the Major (Core) Subject, Co-curricular Courses (CC) and Research Project

- Internship/Apprenticeship corresponding to the Major (Core) Subject: (8 Credits)
- Field Projects/Community Engagement and Service (CEP) corresponding to the Major (Core) Subject (minimum 4-6 credits)
  -To be offered in II and III years of UG Degree Programmes.
- Co-curricular Courses (CC) such as Health and Wellness, Yoga education, sports and fitness, Cultural Activities, NSS/NCC and Fine/ Applied/Visual/ Performing Arts: (8 credits)
  -To be offered in I and/or II year
- Research Projects: (12 credits)
  -To be offered in the final year for 4 year Honours with Research UG Degree

➢ **CREDIT:**

- Credit is a numerical value that indicates students work load (Lectures, Lab work, Seminar, Tutorials, Field work etc.) to complete a course unit. The contact hours are transformed into credits. Moreover, the grading system of evaluation is introduced for B.Sc. course wherein process of Continuous Internal Evaluation is ensured.
- **Theory: '**15 contact hours' for theory course constitute 'one credit'
- **Practical/Tutorial: '**30 contact hours' for practical course constitute 'one credit'.
- **Workshop based activities/Skill based activities:** Minimum 30 contact hours per credit in a semester is required
- **Internship/On-Job Training: '**30 contact hours' per credit in a semester is required (1 credit/week)
- **Community Engagement and Service-CEP/Field Project:'**30 contact hours' per credit in a semester is required

➢ **Credit Framework under Three/Four Years UG Programme with Multiple Entry and Multiple Exit Options:**

The minimum and maximum credit structure for different levels under three or four year UG programme with multiple entry and multiple exit options are as given below:

Levels	Code	Qualification Titles	Credit Requirements		Semester	Year
			Minimum	Maximum		
4.5	100-199	UG Certificate	40	44	2	1
5.0	200-299	UG Diploma	80	88	4	2
5.5	300-399	Three Year Bachelor's Degree	120	132	6	3
6.0	400-499	Bachelor's Degree Honours **OR** Bachelor's Degree-Honours with Research	160	176	8	4
	500-599	First Year PG & or PG Diploma	40	44	2	1
6.5	600-699	PG Degree	80	88	4	2
8.0	700-799	Ph.D.	16+ Ph.D. Work		---	---

Multiple Exit Options

Year	Exit Option	Reentry
First Year	Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/Internship OR Continue with Major and Minor	Students opting for exits at any level 'will have the option to reenter' the programme from where they had left off, in the same or in different higher educational institution 'within three years of exits' and complete the degree program within the stipulated maximum period of 07 years from the date admission of first year of UG.
Second Year	Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF Course/Internship OR Continue with Major and Minor	
Third Year	Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor	
Fourth Year Honours	Four Year UG Honours Degree in Major and Minor with160-176 credits	
Fourth Year Honours with Research	Four Year UG Honours with Research Degree in Major and Minor with160-176 credits	
Post-Graduation Degree		
Post-Graduation: First	PGDiploma(44Credits)after ThreeYear	Reentry to complete the PG degree after taking exit

Year	UGDegree	option will be permissible up to 5 years from the date admission to PG programme

- **Academic Bank of Credit (ABC):**

It is mandatory for all admitted students to get enrolled on ABC Portal and create ABC ID and share ABC-ID with academic institutions where they are enrolled. Credits earned by the students will be reflected in the students ABC account. This will allow students smooth transition during multiple entry and exit.

	B.Sc. Chemistry			
	SEMESTER-I			
Subject	**Paper Title**	**Credits**	**Hours/week**	**Total Contact Hours**
Chemistry-Major (Mandatory)	Paper-I: Basics of Physical and Inorganic Chemistry	4	4	60
Chemistry-Major (Mandatory)	Practical-I: Practical-Basics of Physical and Inorganic Chemistry	2	4 (hours/week/batch)	60
Chemistry- OE-I	OE-I (For Arts) Chemistry in Day-to-Day Life	2	2	30
Chemistry- OE	OE-Practical (For Arts) Practical- Chemistry in Day-to-Day Life	2	4 (hours/week/batch)	60
Chemistry-VSC	VSC-I: Basics of Textile Chemistry	1	1	15
	VSC-Practical-I: Practical- Basics of Textile Chemistry	1	2 (hours/week/batch)	30
Chemistry SEC-I	SEC-I: Chemistry in Everyday Life	1	1	15
	SEC-Practical-I: Practical-Chemistry in Everyday Life	1	2 (hours/week/batch)	30
Chemistry: IKS	IKS: Chemistry in Ancient India	2	2	30
Chemistry: CC	CC-I: Herbal Technology	1	1	15
	Practical-CC-I: Practical- Herbal Technology	1	2 (hours/week/batch)	30
	SEMESTER-II			
Chemistry-Major (Mandatory)	Paper-II: Basics of Organic and Analytical Chemistry	4	4	60
Chemistry-Major (Mandatory)	Practical-II Practical-Basics of Organic and Analytical Chemistry	2	4 (hours/week/batch)	60
Chem. OE-II	OE-II: (For Arts) Applications of Chemistry in Daily Life	2	2	30
Chem. OE	OE-Practical: (For Arts) Practical-Applications of Chemistry in Daily Life	2	4 (hours/week/batch)	60
Chemistry: VSC	VSC-II: Advanced Processes in Textile Chemistry	1	1	15
	VSC-Practical-II: Practical- Advanced Processes in Textile Chemistry	1	2 (hours/week/batch)	30
Chemistry SEC-II	SEC-II: Basics of Soil Analysis	1	1	15
	SEC-Practical-II: Practical-Basics of Soil Analysis	1	2 (hours/week/batch)	30

Chemistry: VEC-I	VEC-I: Introduction to Qualitative and Quantitative Analysis	2	2	30
Chemistry: CC	CC-II: Chemistry of Food, Nutrition and Preservation	1	1	15
	Practical-CC-II: Practical-Chemistry of Food, Nutrition and Preservation	1	2 (hours/week/batch)	30

Walchand College of Arts & Science (Autonomous), Solapur

Faculty of Science: Choice Based Credit System (CBCS) As Per NEP

(w.e.f. 2023-24)

Programme Outcomes (POs):

1. The Undergraduate students are to be passionately engaged in initial learning with an aim to think differently as agents of new knowledge, Understandinging and applying new ideas in order to acquire employability/self-employment.
2. They are trained to take up higher learning programmes.
3. They are made to be competent and socially responsible citizen of India.
4. They are to be exposed to technical, analytical and creative skills.

Programme Specific Outcomes (PSOs):

1. Human and Social Values and Responsibilities in the context of learning Chemistry.
2. Communicative Skills and the Creative scientific mind towards learning chemistry.
3. Positive approach towards Environment and Ecology from the Chemistry perspective.
4. Critical thinking and the Analytical mind, students develop for the in depth knowledge in advanced-level Chemistry.
5. The relevance of extension of Chemistry in the social context for solving social issues.
6 .Employability Skills shall enable the students to find jobs in core chemistry and other related fields.
7. Entrepreneurial Skills shall empower the students to start their own industries / business in core-chemistry fields 8.Analytical or Experimental Skills make the students capable of doing higher-level research works in the emerging fields of chemistry.

Outline of Examination

THEORY:

- For four credits: 100 Marks;
- For two credits: 50 Marks;
- For one credit: 25 Marks

1) Internal Evaluation (IE): Internal evaluation will consist of **40 % marks** per semester per paper. It may be held as **per the following scheme** per semester **(Annexure: I & II)**

Credits	Marks for Attendance	Classroom Test	Home Assignment	Marks for Presentation/Group Discussion/ Participation/Field work/Study visit	Total Marks
02	05	10	05	---	20
04	05	20	05	10	40

2) End Semester Examination (ESE): The detailed question paper pattern (**60 % marks per paper)** is given as in **Annexure- III; Annexure- IV and Annexure- V**

PRACTICAL:

1) Internal Evaluation (IE): Internal evaluation will carry **40 % marks** and may consist of:

Credits	Marks for Attendance	Internal Practical Exam	Journal	Total Marks
02	05	10	05	20

2) **End Semester Examination (ESE):** Practical examination **60 % marks** shall be conducted at the end of each semester. The detailed scheme is given in **Annexure-VI, VII and Annexure-VIII**

B.Sc. -I
Semester – I
Chemistry-Major
Paper-I: Basics of Physical and Inorganic Chemistry
(Total Credits -4, Total Contact Hours -60)
Total Marks 100

Unit-I

1. Chemical Kinetics (15)

Chemical Kinetics and it's scope, Rate of reaction, Definition and units of rate constant.
Factors affecting rate of reaction: Concentration, pressure, temperature and catalyst: with example of Ammonia synthesis by Haber's Process.
Order and Molecularity of reaction,
First order reaction: Derivation of Rate constant, Characteristics of first order reaction,
Example: Decomposition of N_2O_5
Second order reaction: Derivation of rate constant for equal and unequal concentration of the reactants.
Characteristics of Second order reaction,
Example: Reaction between $K_2S_2O_8$ and KI
Pseudo-uni-molecular reaction, Example: Hydrolysis of methyl acetate in presence of acid.
Numerical Problems

2. Gaseous State: (11)

Ideal and Non ideal gases, Deviation from ideal behaviour. (Only Boyle's law),
Causes of deviation from ideal behaviour,
van der Waal's equation, explanation of real gas behaviour by van der Waal's equation.
Critical Phenomena: PV-Isotherms of real gases (Andrew's isotherms), continuity of state, Relationship between critical constants and van der Waal's constants.
Liquefaction of gases,
Joule-Thomson effect. Numerical Problems

3. Thermodynamics: (04)

Spontaneous and non spontaneous processes,
Second law of thermodynamics and it's statements.
Carnot's Theorem (Heat engine),
Carnot cycle and its efficiency. Numerical Problems

Unit-II

4. Covalent bonding: Valence Bond Theory (VBT) (15)

i) Valence Bond Theory
Heitler–London Theory-Salient features, Limitations
Pauling-Slater Theory-Salient features, Limitations
Concept of Hybridization and its Need
Conditions (rules) for hybridization and Steps in hybridization
Types of hybridization and study of shapes of some simple inorganic molecules: $BeCl_2$, BF_3, $SiCl_4$, PCl_5, SF_6, IF_7
ii) Valence Shell Electron Pair Repulsion (VSEPR) Theory
Basic Assumptions
Study of molecules on the basis of VSEPR Theory w.r.t. NH_3, H_2O

5. Covalent bonding: Molecular Orbital Theory (MOT) (15)

Atomic and Molecular orbitals, L.C.A.O. Principle,
Bonding, Antibonding and Nonbonding Molecular orbitals,
Conditions for successful overlap,
Different types of overlap (s-s, s-px, px - px and py- py or pz- pz),
Energy level sequence of molecular orbitals for $n = 1$ and $n = 2$,

M. O. Diagrams for: a) Homonuclear diatomic molecule. H2, Li2, Be2, C2, N2 and O2
b) Heteronuclear diatomic molecules CO and NO w.r.t. bond order stability and magnetic properties

Reference Books:

1) Mathematical preparation of Physical Chemistry : F. Daniel Mc-Graw Hill Book Com.
2) Elements of Physical Chemistry : S. Glasstone and D. Lewis (D. Van Nostrand Co. Inc)
3) Physical Chemistry : W. J. Moore (Orient Longman)
4) Principles of Physical Chemistry :Maron Prutton
5) University Chemistry : B. H. Mahan (Addision - Weseley Publ. Co.)
6) Chemistry Principle &Applications : P.W. Atkins, M. J. Clugsto, M.J. Fiazer, R. A. Y. Jone (Longman)
7) Physical Chemistry : G. M. Barrow (Tata Mc-Graw Hill)
8) Essentials of Physical Chemistry : B. S. Bahl& G.D. Tuli (S. Chand)
9) Physical Chemistry : A. J. Mee.
10) Physical Chemistry :Alberty R. A. and Silbey, R.J.John Wiley and Sons, 1992
11) Principles of Physical Chemistry :B. R. Puri, L.R. Sharma and M.S.Patania, S.L.N. Chand & Co. 1987
12) Basic Chemical Thermodynamics : V. V. Rao.
13) University General Chemistry : CNR. Rao (McMillan)
14) Physical Chemistry Through problems : Dogra and Dogra (Wiley Eastern Ltd.,)
15) Physical Chemistry : S. Glasstone.
16) Physical Chemistry(3rd Edition) - Gilbert W. Castilian, Narosa Publishing House,1985
17) Chemical Kinetics by K. J. Laidler, Tata McGraw Hill Publishing Co., New Delhi.
18) Kinetics and Reaction Mechanisms by Frost and Pearson, Wiley, New York.
19) Advanced Inorganic Chemistry - Cotton and Wilkinson
20) Inorganic Chemistry - J. E. Huheey
21) Concepts and models of Inorganic Chemistry - Douglas & Mc-Daniel
22) Principles of Inorganic Chemistry - Puri, Sharma
23) New Concise Inorganic Chemistry - (ELBS) - J. D. Lee
24) Text book of Inorganic Chemistry - P. L. Soni
25) Advanced Inorganic Chemistry - Satyaprakash, Tuli, Basu
26) Theoretical Principles of Inorganic Chemistry - G. S. Manku
27) Principles of Inorganic Chemistry - Puri, Sharma & Kalia
28) Inorganic chemistry: Principles of structure and reactivity – J. E. Huheey
29) Advanced Inorganic Chemistry, Vol. I – Gurudeep Raj
30) A New Guide to Modern Valency Theory- G. J. Brown

Learning Objectives:

1. To acquire knowledge about rates of chemical reactions and distinguishing the reaction of a different order and their characteristics.
2. To get information about thermodynamics and its process.
3. To learn mathematical concepts such as graphical representation, derivative, and integration.
4. To achieve knowledge of the gases states such as ideal and non-ideal gases, isotherm, and liquefaction of gases.

Course Outcome: After successful completion of this course, students are expected to have/should be:

1. Understanding the significance of rates of chemical reactions.
2. Able to Understanding second law thermodynamics and Carnot cycle and its efficiency.
3. Able to the knowledge of mathematical concepts.
4. Also, get a better Understandinging gaseous state.

B.Sc. -I
Semester – I
Chemistry-Major
Practical- Basics Phyiscal and Inorganic Chemistry Practical
(Total Credits -2, Total Contact Hours -60)
Total Marks 50

A) Physical Chemistry
1) Determination of equivalent weight of Mg by Eudiometer.
2) Study of specific reaction rate of hydrolysis of methyl acetate in presence of HCl.
3) Study of specific reaction rate of hydrolysis of methyl acetate in presence of H2SO4
4) Study of reaction between K2S2O8 and KI (Equal Concentrations)
5) Determination of heat of ionization of weak acid.

B) Inorganic Chemistry
1) Inorganic Quantitative Analysis: Volumetric Analysis
i) To prepare a standard solution of Oxalic acid and determine the strength of Sodiumhydroxide solution in terms of normality and Kg/dm3
ii) To prepare a standard solution of Oxalic acid and determine the strength of Potassium permanganate solution in terms of normality and Kg/dm3
iii) To prepare standard solution of Potassium dichromate and determine strength of Ferrous Ammonium Sulphate solution in terms of normality and Kg/dm3 (Use internal indicator)

2) Inorganic preparation:
i) Preparation of ferrous ammonium sulphate
ii) Preparation of sodium cuprous thiosulphate

Reference Books:

1. Elements of Physical Chemistry : S. Glasstone and D. Lewis (D. Van Nostrand Co. Inc)
2. Physical Chemistry : W. J. Moore (Orient Longman)
3. Principles of Physical Chemistry :Maron Prutton
4. University Chemistry : B. H. Mahan (Addision - Weseley Publ. Co.)
5. Text book of Inorganic Chemistry - P. L. Soni
6. Advanced Inorganic Chemistry - Satyaprakash, Tuli, Basu
7. Theoretical Principles of Inorganic Chemistry - G. S. Manku
8. Principles of Inorganic Chemistry - Puri, Sharma & Kalia

OE-I (For Arts)

B.Sc. -I
Semester – I
Chemistry OE-I (Credit-2 Total Contact Hrs- 30)
Chemistry in Day-to-Day life
Total Marks - 50

Unit–I Food adulterations and some medicinal compounds (15)

1. Milk: Definition, Chemical composition of milk of different species like cow, buffalo and goat
2. Analysis of fat content, minerals in Dairy products like milk and butter.
3. Adulterations in milk: such as sugar, urea, starch, acids, soaps, microorganisms, formalin, ammonium sulphate and their detection methods
4. Estimation of added water in milk
5. Chemicals in Food: Artificial Sweeting Agents like Saccharin, Aspartame, Alitame, Sucralose, Cyclamate
6. Food preservatives
7. Importance of chemical compounds as medicine: Antacids, Sodium carbonate, Aluminium hydroxide, Magnesium hydroxide, Cis-platin

Unit-II Air Pollution (15)

1. Introduction: Meaning of terms: Environment, Pollution, Pollutant, Threshold Limit Value (TLV), Dissolved Oxygen (DO), Chemical Oxygen Demand (COD) and Biological Oxygen Demand (BOD)
2. Types of Pollution (Only Introduction): Air pollution, Water pollution, Sound pollution, Soil pollution, Automobile pollution and nuclear pollution.
3. Classification of Air pollutants, Causes of air pollution
4. Effects of Air Pollution: Diseases, Global warming and Green house effect, acid rain, ozone layer depletion, effects on animals
5. Oxides of Carbon, Sulphur and Nitrogen as air pollutants with respect to source and health hazards.
6. Brief account on some major air pollution disasters, Case study: Effect on Taj Mahal
7. Air pollution control: avoid using vehicals, energy conservation, plantation of trees, use of clean energy resources, other air pollution control measures.

Reference Books:

1. B. K. Sharma: introduction to Industiral Chemistry, Goel Publishing, Meerut (1998)
2. Medicinal Chemistry by Ashtoush Kar.
3. Drugs and Pharamaceutical Sciences Series, Marcel Dekker, Vol. II, INC, New York
4. Analysis of Foods – H.E. Cox
5. Foods: Facts and Principles. N. Shakuntala Many and S. Swamy, 4th ed. New Age International (1998)
6. Environmental Chemistry: A.K. De
7. Environmental Pollution Analysis: S.M. Khopkar
8. Industrial Chemistry by R.K. Das

Learning Objectives:

1. To get information about Food adulterations and some medicinal compounds
2. To acquire knowledge about Air Pollution

Course Outcome:

1. Understanding the significance of some medicinal compounds
2. Able to understand food adulterations

OE-Practical - I (For Arts)

B.Sc. -I
Semester – I
Chemistry OE-I (Credit-2 Total Contact Hrs- 60)
Practical - Chemistry in Day-to-Day life
Total Marks - 50

1. To determine added water, starch, urea, sugar and detergents in given milk sample.
2. To detect vanaspati, margarine, smashed potatoes or starch in given butter sample.
3. To detect chalk powder and urea in given sample of sugar.
4. To detect washing soda, chalk powder, Metanil yellow colour and sugar solution s in given Jaggery sample.
5. To detect Meatnil yellow colour and kesari flour in given Basen sample.
6. To detect added starch in Hing sample, and Boric acid in Maida sample.
7. To check the presence of Rhodamine B (red colour) in the given red Chilli powder sample
(Any other suitable and concerned practical shall also included)

Reference Books:

1. B. K. Sharma: introduction to Industiral Chemistry, Goel Publishing, Meerut (1998)
2. Medicinal Chemistry by Ashtoush Kar.
3. Drugs and Pharamaceutical Sciences Series, Marcel Dekker, Vol. II, INC, New York
4. Analysis of Foods – H.E. Cox
5. Foods: Facts and Principles. N. Shakuntala Many and S. Swamy, 4th ed. New Age International (1998)
6. Environmental Chemistry: A.K. De
7. Environmental Pollution Analysis: S.M. Khopkar
8. Industrial Chemistry by R.K. Das

B.Sc. -I
Semester – I
Chemistry VSC-I (Credit-1 Total Contact Hrs- 15)
Basics of Textile Chemistry
Total Marks - 25

Unit–I **(15)**

1. Textiles – History, role of India in global textile trade, current market potential
2. Fibers: Definition, classification of textile fibers according to their nature and origin, physical and chemical properties, comparison of natural and man-made fibers, structure and properties of cotton jute, linen, wool, silk and other natural fibers.
3. Method of manufacturing, chemical, physical properties and uses of some synthetic fibers like polyester, nylon 66, polyacrylonitrile, polyolefins
4. Yarn: Introduction to yarn, type of yarn: Slub, amseler, core, spun, hollow, loop, chenille, etc, physical and chemical properties, manufacturing and testing of yarn, factors affecting spinning, basic defects of yarn.
5. Pigments: Introduction, Definitions of pigment, Classification of inorganic and organic pigments with some examples only.

Reference Books:

1. Basics of Textile Chemical Processing by D. Gopalakrishnan and T. Karthik, ASTRAL, 2016
2. Textile Chemistry by Vishu Arora, Abhishek Publications, 2011
3. Chemistry For Textile Students by Barker North, Read Books Publications, 2007
4. Introduction to Industiral Chemistry by B. K. Sharma: Goel Publishing, Meerut (1998)
5. Chemical Technology in the Pre-treatment Processes of Textiles by S.R. Karmakar, 1999
6. Fundamentals of Textile and their care, Dantyagi S, Orient Longman Publication, 2006

Learning Objectives:

1. To get information about history, role of India in global textile trade
2. To acquire knowledge about textile fibers
3. To Understanding method of manufacturing, chemical, physical properties and uses of some synthetic fibers

Course Outcome:

1. Understanding the significance of history, role of India in global textile trade
2. Able to determine type of textile fibers, classify of fiber
3. Understanding of the significance and physical and chemical properties, manufacturing and testing of yarn

B.Sc. -I
Semester – I
Chemistry VSC-I (Credit-1 Total Contact Hrs- 30)
Practical- Basics of Textile Chemistry
Total Marks - 25

1. To identify the textile fibers in given different types of fibers.
2. To remove oil and fats from given cotton fabric.
3. To study testing of given starch, oils, softeners used in textile process.
4. To study Desizeing of Cotton Fabrics by Acid Desizing method and calculate weight loss in Process.
5. To study Degumming of the given Silk.
6. To study scouring of Cotton by Sodium Hydroxide and measure water absorbency and shrinkage.
7. To study Bleaching of Cotton with the bleaching powder. (Any one suitable agent)
8. To study Bleaching of Cotton with the Hydrogen peroxide.
9. To bleach the given polyester material with bleaching agent (Any one suitable agent)
10. To bleach the given cellulosic fabric with bleaching agent (Any one suitable agent)
    (Any other suitable and concerned practical shall also included)

Reference Books:

1. Basics of Textile Chemical Processing by D. Gopalakrishnan and T. Karthik, ASTRAL, 2016
2. Textile Chemistry by Vishu Arora, Abhishek Publications, 2011
3. Chemistry For Textile Students by Barker North, Read Books Publications, 2007
4. Introduction to Industiral Chemistry by B. K. Sharma: Goel Publishing, Meerut (1998)
5. Chemical Technology in the Pre-treatment Processes of Textiles by S.R. Karmakar, 1999
6. Fundamentals of Textile and their care, Dantyagi S, Orient Longman Publication, 2006

B.Sc. -I
Semester – I
Chemistry SEC-I: (Total Credits -1, Total Contact Hours -15)
Chemistry in Everyday life
Total Marks – 25

1. Vitamins and minerals: Need for vitamin in body, types of vitamins, water soluble and fat soluble vitamins, Vitamin B12, vitamin C (Cyanocobalamine), D, Vitamin K. Role of minerals in body, iodine deficiency and remedy. **(7)**

2. Chemistry of Materials Soaps and Detergents – their action, Biofuels – production of biofuels and its utility as alternative fuel source, Fibers: natural fibers, cotton, wool, silk, rayon, artificial fibers, polyamides, acrylic acid, PVC, PVA; Examples of natural biodegradable polymers, cellulose, cellulose acetate, cellophane, soy protein, corn, zein protein, wheat gluten protein, synthetic biodegradable polymers. Use of polymeric materials in daily life. **(8)**

Recommended Books/references:
1. Kaim W, Bioinorganic Chemistry, Vol 4, Brigitte Scwederski, Wiley, 1994.
2. Crichton R. H. Biological Inorganic Chemistry – An Introduction, Elsevier, 2008.
3. Berg J. M., Tymoczeko J. L., Stryer l. Biochemistry, W. H. Freeman, 2008.
4. Bertini, I., Gray, H. B., Lippard, S. J. and Valentine, J. S. (1994) Bioinorganic Chemistry. University Science Books (1994)
5. Lippard S., Berg J. M. Principles of Bioinorganic Chemistry; University Science Books 1994.
6. Polymer science, V. R. Gowariker, N. V.Viswanathan, J. Sreedhar, New Age International.

Learning Objectives:
1. To get information about need for vitamin in body, types of vitamins
2. To acquire knowledge about Chemistry of Materials Soaps and Detergents
3. To Understand methods of production of biofuels and its utility as alternative fuel source

Course Outcome:
1. Understanding the significance of vitamin in body and classify them
2. Able to understand Role of minerals in body, iodine deficiency and remedy
3. Understanding the significance and use of polymeric materials in daily life

B.Sc. -I
Semester – I
Chemistry SEC-I: SEC-Practical-I: (Total Credits -1, Total Contact Hours -30)
Practical- Chemistry in Everyday life
Total Marks - 25

1. Analysis of soaps and detergents.
2. Analysis of Biofuels - flash point, pour point, cloud point
3. Preparation of Nylon 66,6
4. Testing of adulterant in food, oil and vegetable
5. Vitamin-C preparation.

Recommended Books/references:

1. Kaim W, Bioinorganic Chemistry, Vol 4, Brigitte Scwederski, Wiley, 1994.
2. Crichton R. H. Biological Inorganic Chemistry – An Introduction, Elsevier, 2008.
3. Berg J. M., Tymoczeko J. L., Stryer l. Biochemistry, W. H. Freeman, 2008.
4. Bertini, I., Gray, H. B., Lippard, S. J. and Valentine, J. S. (1994) Bioinorganic Chemistry. University Science Books (1994)
5. Lippard S., Berg J. M. Principles of Bioinorganic Chemistry; University Science Books 1994.
6. Polymer science, V. R. Gowariker, N. V.Viswanathan, J. Sreedhar, New Age International.

B.Sc. -I
Semester – I
Chemistry IKS-I: (Total Credits -2, Total Contact Hours -30)
Chemistry in Ancient India
Total Marks - 50

Unit – I **(15)**

1. Theoretical framework for the practice of science in ancient India: Sāṅkhya-Pātañjala system, Evolution of different forms of matter (Pañcīkaraṇa) from the Vedāntic view.

2. Chemistry in practice as gleaned from the medical schools of ancient India, Qualities of compounds; formation of molecular properties in chemical compounds, Chemistry of colors, measures of weight and capacity, size of the minimum visible, Ideas of chemistry as in bṛhatsaṁhitā

Unit – II **(15)**

3. Metallurgical heritage: Arthaśāstra as the earliest text describing gold, silver, and other metals; Processing of gold, silver, copper, iron, tin, mercury, and lead as mentioned in the Indian texts in the ancient and Medieval Period Zinc distillation as mentioned in Rasārṇava and Rasaratnasamukāyā

4. Concepts of acid and bases in Indian chemistry from organic fruit, vegetable-based. Acids, plant-ash-based bases to mineral acids of the medieval period

References:

1) The Positive Sciences of the Ancient Hindus; BrijendraNath Seal; 4th Edition; 2016
2) Fine Arts & Technical Sciences in Ancient India with special reference to Someśvara's Mānasollāsa; Dr. Shiv Shekhar Mishra, Krishnadas Academy, Varanasi 1982
3) Mints and Minting in India; Upendra Thakur; Chowkhanba Publication; 1972
4) A Concise History of Science in India, ed. D M Bose, S N Sen and B V Subbarayappa; INSA; 2009
5) Science and Technology in Medieval India - A Bibliography of Source Materials in Sanskrit, Arabic and Persian by A Rahman, M A Alvi, S A Khan Ghori and K V Samba Murthy; 1982.
6) Science and Technological Exchanges between India and Soviet Central Asia (Medieval Period), ed B V Subbarayappa;1985
7) Scientific and Technical Education in India, 1781-1900 by S N Sen; 1991
8) History of Technology in India, Vol. I, ed. A K Bag (1997); Vol III, ed. K V Mital (2001); Vol-II by Harbans Mukhia (2012)

Learning Objectives:

1. To get information about theoretical framework for the practice of science in ancient India
2. To acquire knowledge about Chemistry in practice from the medical schools of ancient India
3. To Understanding method of processing of gold, silver, copper, iron, tin, mercury, and lead as mentioned in the Indian texts

Course Outcome:

1. Understanding the significance of history of Chemistry, practice of science in ancient In
2. Able to understand processing of gold, silver, copper, iron, tin, mercury, and lead as mentioned in the Indian texts
3. Understanding the significance and concepts of acid and bases in Indian chemistry

B.Sc. -I
Semester – I
Chemistry CC-I: (Total Credits -1, Total Contact Hours -15)

Herbal Technology
Total Marks - 25

Unit I **(7)**

Herbal Technology: Definition and scope; Herbal medicines: history and scope; Traditional systems of medicine, and overview of AYUSH (Traditional Indian Systems of Medicine); Cultivation - harvesting - processing - storage of herbs and herbal products.

Unit II **(8)**

Value added plant products: Herbs and herbal products recognized in India; Major herbs used as herbal medicines, nutraceuticals, cosmeticals and biopesticides, their Botanical names, plant parts used, major chemical constituents.

Reference Books:

1. Blumenthal M, Busse WR, Goldberg A, Gruenwald J, et al., editors. The Complete German Commission
2. E Monographs. American Botanical Council, Austin Texas 1998, 197
3. Blumenthal M, Goldberg A, Brinckmann J, editors. Herbal medicine. Expanded Commission E Monographs. The American Botanical Council, Austin Texas 2000, 389-93
4. Bradley PR editor. British Herbal Compendium. Vol 2. British Herbal Medicine Association, Bournemouth 2006, 270-275
5. British Herbal Pharmacopoeia. 4th ed. British Herbal Medicine Association, Exeter 1996, 75
    1. Dorsch W, Loew D, Meyer-Buchtela E, Schilcher H. Kinderdosierungen von Phytopharmaka. 3rd ed. Vol Kooperation Phytopharmaka, Bonn 2002, 70-71
6. Gruenwald J, Brendler T, Jaenicke C, editors. PDR for herbal medicines. 3rd ed. Thomson PDR, Montvale 2004, 679-81
7. Hänsel R, Keller K, Rimpler H, Schneider G, editors. Hagers Handbuch der Pharmazeutischen Praxis. 5th ed. Vol 5. Springer-Verlag, Berlin 1993, 367-384
8. Madaus G. Lehrbuch der biologischen Heilmittel. Vol 2. Georg Olms Verlag. Hildesheim-New York 1976 (reprint), 1354-61

Learning outcomes:

1. On completion of this course the students will be able to;
2. Develop their Understanding on Herbal Technology
3. Define and describe the principle of cultivation of herbal products.
4. List the major herbs, their botanical name and chemical constituents.
5. Evaluate the drug adulteration through the biological testing
6. Formulate the value added processing / storage / quality control for the better use of
7. herbal medicine
8. Develop the skills for cultivation of plants and their value added processing / storage
9. quality control

Course Outcome:

1. Understanding the significance of history, scope of Herbal medicines
2. Able to know nutraceuticals, cosmeticals and biopesticides, their Botanical names
3. Understanding the significance cultivation - harvesting - processing - storage of herbs and herbal products

B.Sc. -I
Semester – I
Chemistry CC-I Practicals : (Total Credits -1, Total Contact Hours -30)

Practical - Herbal Technology
Total Marks - 25

1. Preparation And Standardization of Herbal Lotion
2. Preparation And Standardization of Methi-Shikakai Shampoo
3. Preparation And Evaluation of Orange Syrup B.P.C
4. Determination of Aldehyde content
5. Determination of phenol content
6. Determination of Total Alkaloids
7. Preparation And Evaluation of Turmeric Cream
   (Any other suitable and concerned practical shall also included)

Reference Books:

1. Blumenthal M, Busse WR, Goldberg A, Gruenwald J, et al., editors. The Complete German Commission
2. E Monographs. American Botanical Council, Austin Texas 1998, 197
3. Blumenthal M, Goldberg A, Brinckmann J, editors. Herbal medicine. Expanded Commission E Monographs. The American Botanical Council, Austin Texas 2000, 389-93
4. Bradley PR editor. British Herbal Compendium. Vol 2. British Herbal Medicine Association, Bournemouth 2006, 270-275
5. British Herbal Pharmacopoeia. 4th ed. British Herbal Medicine Association, Exeter 1996, 75
6. Dorsch W, Loew D, Meyer-Buchtela E, Schilcher H. Kinderdosierungen von Phytopharmaka. 3rd ed. Vol Kooperation Phytopharmaka, Bonn 2002, 70-71
7. Gruenwald J, Brendler T, Jaenicke C, editors. PDR for herbal medicines. 3rd ed. Thomson PDR, Montvale 2004, 679-81
8. Hänsel R, Keller K, Rimpler H, Schneider G, editors. Hagers Handbuch der Pharmazeutischen Praxis. 5th ed. Vol 5. Springer-Verlag, Berlin 1993, 367-384
9. Madaus G. Lehrbuch der biologischen Heilmittel. Vol 2. Georg Olms Verlag. Hildesheim-New York 1976 (reprint), 1354-61

B.Sc. -I
Semester – II
Paper-II: Chemistry-Major (Total Credits -4, Total Contact Hours -60)
Basics of Organic and Analytical Chemistry
Total Marks - 100

Unit-I **(Contact hrs: 30)**

1. Fundamentals of organic reaction mechanism **(6)**

1.1 Introduction of reaction mechanism.
1.2 Types of arrow notations: Single headed curved arrow, Half headed curved arrow and double headed arrow.
1.3 Types of bond breaking: Homolytic and Heterolytic
1.4 Types of reagents: Electrophilic and Nucleophilic
1.5 Types and sub-types of following organic reactions with definition and at least one example of each. a)Substitution b) Addition c) Elimination d) Rearrangement. (Mechanism is not expected)
1.6 Reactive Intermediates: Carbocations, Carbanions, Carbon free radicals, Carbenes, Nitrenes (Definition with suitable example, formation, structure, and relative stability)

2. Structure and Bonding **(6)**

2.1 Hybridization:sp3, sp2 and sp w.r.t. methane, ethylene and acetylene respectively
2.2 Bond length, Bond angle and Bond energy with factors affecting these properties w.r.t. sp3, sp2 and sp hybridization.
2.3 Resonance effect w.r.t. phenol and nitrobenzene
2.4 Inductive effect, + I and –I
2.5 Strength of carboxylic acid w.r.t. inductive effect: Examples- a) Formic and acetic acid, b) monochloro, dichloro and trichloroacetic acid
2.6 Hyperconjugation w.r.t. toluene
2.7 Steric effect w.r.t. mesitoic acid

3. Stereochemistry of organic compounds **(7)**

3.1 Types of stereo-isomerism: Optical isomerism, Geometrical isomerism and Conformational isomerism
3.2 Optical activity
3.3 Essential conditions for Optical activity
a) Elements of symmetry
b) Chiral center w.r.t. lactic acid
3.4 Optical isomerism in lactic acid and tartaric acid
3.5 Enantiomers and diastereoisomers w.r.t. 2,3-dihydroxybutanoic acid
3.6 Racemic modification.
3.7 Geometrical isomerism: Introduction
3.8 Cause of geometrical isomerism.
3.9 Geometrical isomerism in maleic acid and fumaric acid.

4. Cycloalkanes **(3)**

4.1 Cycloalkanes: Nomenclature, Methods of formation:
a) Internal Wurtz reaction
b) Distillation of calcium or barium salt of dicarboxylic acid
4.2 Chemical properties of cyclopropane
a) Free radical substitution of chlorine in presence of light.
b) Action of HBr and conc. H_2SO_4 c) Catalytic reduction by H_2/Ni
4.3 Industrial applications of cycloalkanes.

5. Alkenes, Dienes and Alkynes **(10)**

5.1 Nomenclature of alkenes.
5.2 Methods of formation of alkenes with mechanism
a) By dehydration of lower alcohols.
b) By dehydrohalogenation of lower alkyl halides.
5.3 Chemical reactions of alkenes: Hydrogenation, Electrophilic and free radical additions, Hydroboration, Oxidation, Epoxidation, Ozonolysis, Hydration, Hydroxylation, Oxidation with $KMnO_4$, Polymerization of alkenes: ethylene and propylene
5.4 Nomenclature and classification of dienes.
5.5 Isolated, Conjugated and cumulated dienes.
5.6 Butadiene: Methods of formation, polymerisation, 1, 2- and 1,4- additions and Diel's-Alder reaction.
5.7 Alkynes: Nomenclature, Acidity of alkynes.
5.1 Electrophilic and Nucleophilic addition reactions, Hydroboration, Oxidation.
5.9 Industrial applications of ethylene, 1,3-butadiene and acetylene.

Unit-II **(Contact hrs: 30)**

6. Aromaticity and Benzene **(8)**

6.1 Aromatic, non-aromatic, antiaromatic and pseudo aromatic compounds.
6.2 Kekule structure of benzene
6.3 Resonance structures of benzene.
6.4 Molecular orbital picture of benzene.
6.5 Representation of benzene ring.
6.6 Modern theory of aromaticity. Fundamental Concepts: Delocalisation of electrons, coplanarity and Huckel's $(4n+2)\ \pi$ rule. Applications of Huckel's rule to napthalene, pyrrole and pyridine.
6.7 Mechanism of electrophilic aromatic substitution in benzene w.r.t. nitration, sulphonation, halogenations and Friedel-Craft's reaction: alkylation and acylation.

7. Physical properties of liquids **(14)**

7.1 Introduction, additive and constitutive properties
7.2 Viscosity, coefficient of viscosity, determination of viscosity by Ostwald's Viscometer
7.3 Surface tension:- Determination of surface tension by Drop –Weight method
7.4 Parachor: Macleod equation and its modification by Sugden, applications of parachor in the determination of molecular structures as benzene and NO_2 group
7.5 Dipole moment, electrical polarization of molecules
7.6 Use of dipole moment in the study of molecular structure
7.7 Refractive index, Snell's law
7.8 Specific and molecular refractivity, Abbe's refractometer: Critical angle Principle, construction, working and advantages
7.9 Molecular refractivity and chemical constitution

8. Chromatography **(6)**

8.1 Introduction and General principle of Chromatography
8.2 Classification of Chromatography based on nature of stationary and mobile phase.
8.3 Paper Chromatography: Principle, Experimental procedure and applications

Reference Books:

1) Organic Chemistry: Hendrickson, Cram, Hammond.
2) Organic Chemistry: Morrison and Boyd
3) Organic Chemistry: Volume I and III. L. Finar
4) Organic Chemistry: Pine
5) Advanced Organic Chemistry: Sachinkumar Ghosh

6) Advanced Organic Chemistry: B. S. Bahl and Arun Bahl
7) A Guide book to Mechanism in Organic Chemistry: Peter Sykes
8) Stereochemistry of Organic Chemistry: Kalsi,
9) Stereochemistry of Carbon Compounds: Eliel
10) Textbook of Organic Chemistry: P. L. Sony
11) Practical Organic Chemistry: A. I. Vogel
12) Advanced Organic Chemistry: Reactions, Mechanism and Structure: Jerry March
13) Organic Chemistry: M. R. Jain
14) Organic Chemistry: J. M. Shaigel
15) Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
16) Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
17) Stocchi, E. Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK (1990).
18) Sharma, B.K. & Gaur, H. Industrial Chemistry, Goel Publishing House, Meerut (1996).
19) Skoog, D.A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis
20) Douglas A Skoog, Donald M West, F James Holler ,Stainly R Crounch , Fundamentals of Analytical Chemistry, 9th edition
21) David Harvey, Modern Analytical Chemistry, McGraw Hill Higher education
22) Gurudeep R Chatwal, Sham K Anand, Instrumental Methods of Chemical Analysis, Himalaya Publishing House.
23) Barrow, G.M. Physical Chemistry Tata McGraw Hill (2007)

Learning Objectives:

1. To study nature of bonding in organic molecules.
2. To inculcate the detailed basics of reaction mechanism and various intermediates
3. To study the different types of electronic effects.
4. To Understanding the stereochemistry of organic compounds.
5. To inculcate imagination and critical thinking of 3D structures of organic compounds.
6. To study the unsaturated and alicyclic compounds.
7. To study the concept of aromaticity, its applications and reactions.
8. To study the different types elements present in the organic compounds 2 To Understanding the qualitative analysis methods of C, H, N, S and halogen
9. To study the basic principle and classification of chromatography.
10. To study the paper chromatography and its applications.

Course Outcome: After the end of the course, student will be:

1. Understanding the basics of bonding and able to draw correct structure of any organic molecule and comment on its stability.
2. Able to predict the reactivity of organic molecules by the help of electronic effects.
3. Understanding the different reactions along with formation of intermediates.
4. Able to think and predict the possible mechanism of various critical organic reactions.
5. Able to imagine 3D structure of organic molecules.
6. Easily comment on aromaticity of any organic compound and its stability
7. Able to distinguish between saturated, unsaturated, alicyclic, aromatic and heterocyclic compounds.
8. Understanding the basic elements present in the organic compounds
9. Able to Understanding the qualitative analysis methods of C, H, N, S and halogen
10. Easily Understanding the basic principle and classification of chromatography
11. Able to know paper chromatography and its applications.

B.Sc. -I
Semester – II
Chemistry-Major
Practical-II : (Total Credits -2, Total Contact Hours -60)
Practical -Basics of Organic and Analytical Chemistry
Total Marks - 50

1) Estimations : (any two)
i) Estimation of aniline, ii) Estimation of acetamide and iii) Estimation of Aspirin
2) Organic Qualitative Analysis.
Identification of at least five organic compounds with reactions including one from acids, one form phenols, one from bases and two from neutrals from the list of the compounds given belowi) Acids : Oxalic acid, Benzoic acid and Cinnamic acid
ii) Phenols : β - Naphthol, Resorcinol.
iii) Bases : Aniline, p - Toluidine.
iv) Neutrals : Acetone, Ethyl acetate, Glucose, Chloroform, Chlorobenzene, m-dinitrobenzene, Thiourea.
Note : A systematic study of an organic compound involves the following operations which should be taught in details with reactions in the detection of elements and functional group.
1) Preliminary tests and physical examination.
2) Determination of physical constant.
3) Detection of Elements.
4) Determination of functional group.
5) A search into the literature.
6) Special Test.
7) Summary.
8) Result.
3) Organic Preparation: (Any one)
i) Preparation of benzoic acid from benzamide.
ii) Preparation of dibenzal acetone from benzaldehyde and acetone.
(Wt. of crude product is expected. M.P. of the recrystallized product is not expected.)
4) Qualitative Analysis:
i) Spot Tests: Detection of following cations using spot tests : Cu^{2+}, Co^{2+}, Ni^{2+}, Fe^{3+}, Zn^{2+},Mg^{2+}, Al^{3+}, Pb^{2+}.

ii) Chromatography: Separation and identification of cations by Paper Chromatographic technique from the following mixtures : a) $Ni^{2+} + Cu^{2+}$ b) $Ni^{2+} + Co^{2+}$ c) $Cu^{2+} + Co^{2+}$

Reference Books:

1. Practical Organic Chemistry: A. I. Vogel
2. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
3. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
4. Stocchi, E. Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK (1990).
5. Sharma, B.K. & Gaur, H. Industrial Chemistry, Goel Publishing House, Meerut (1996).
6. Skoog, D.A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis
7. Douglas A Skoog, Donald M West, F James Holler ,Stainly R Crounch , Fundamentals of Analytical Chemistry, 9th edition
8. David Harvey, Modern Analytical Chemistry, McGraw Hill Higher education
9. Gurudeep R Chatwal, Sham K Anand, Instrumental Methods of Chemical Analysis, Himalaya Publishing House.
10. Barrow, G.M. Physical Chemistry Tata McGraw Hill (2007)

B.Sc. -I
Semester – II
Chemistry OE-II (Credit-2 Contact Hrs- 30)
Applications of Chemistry in Daily Life
Total Marks - 50

Unit–I Energy and Fuels **(15)**

1. Introduction, Sources of energy
2. Conventional Sources of Energy: i) Commercial Energy Sources- Coal, Oil and Natural Gas, Electricity ii) Non-commercial energy sources
3. Non-Conventional Sources of Energy: Solar Energy, Wind Energy, Tidal Energy, Geothermal energy
4. Difference Between Conventional and Non-conventional Sources of Energy
5. Difference Between renewable and non-renewable Sources of Energy
6. Petroleum and petrochemicals: Definitions and introduction
7. Constituents and refining of petroleum
8. Some mechanisms of petrochemistry: Cracking, Knocking, Octane number, Hydro-forming

Unit-II Water Pollution **(15)**

1. Introduction: Resources of water, Types of water Pollutants, water Pollution and its sources (Brief Account)
2. Treatment of water: A) Potable Water: Parameters of potability of water

Step I: Removal of suspended matter : a) Prolonged storage b) Screening c) Sedimentation d) Coagulation e) Filtration

Step II: Removal of germs and bacteria- Physical and Chemical method.

Physical Methods : a) Boiling b) Exposure to UV or Sunlight c) Distillation.

Chemical Method : a) Chlorination b) Fluorination c) Ozonisation d) Aeration e) Use of $KMnO_4$

3. Industrial Water: Mention names of the methods only, Ion exchange method in detail.
4. Municipal Sewage: Meaning of Sewage; mention the names of methods; activated sludge process in detail.

Reference Books:

1. B. K. Sharma: introduction to Industiral Chemistry, Goel Publishing, Meerut (1998)
2. Medicinal Chemistry by Ashtoush Kar.
3. Drugs and Pharamaceutical Sciences Series, Marcel Dekker, Vol. II, INC, New York
4. Analysis of Foods – H.E. Cox
5. Foods: Facts and Principles. N. Shakuntala Many and S. Swamy, 4th ed. New Age International (1998)
6. Environmental Chemistry: A.K. De
7. Environmental Pollution Analysis: S.M. Khopkar
8. Industrial Chemistry by R.K. Das

Learning Objectives:

1. To get information about need and Sources of energy
2. To acquire knowledge about classification of Sources of energy
3. To Understand Resources of water, Types of water Pollutants, water Pollution and its sources

Course Outcome:

1. Understanding of the significance and sources of energy
2. Able to classify the given energy source as Conventional and Non-conventional Sources
3. Understanding of the significance Treatment of water and methods of water purification

B.Sc. -I
Semester – II
Chemistry OE-II (Credit-2 Contact Hrs- 60)
Practical - Applications of Chemistry in Daily Life
Total Marks - 50

1. To determine the alkalinity in given water sample
2. To determine the acidity in given water sample
3. To determine the pH of given water sample
4. To determine temporary hardness of given water sample
5. To determine permanent hardness of given water sample
6. To determine turbidity of given water sample
7. To determine salinity of given water sample
8. To determine total suspended solids in given water sample by gouch crucible method.
9. To determine total dissolved solids in given water sample by conductivity method.
   (Any other suitable and concerned practical shall also included)

Reference Books:

1. B. K. Sharma: introduction to Industiral Chemistry, Goel Publishing, Meerut (1998)
2. Medicinal Chemistry by Ashtoush Kar.
3. Drugs and Pharamaceutical Sciences Series, Marcel Dekker, Vol. II, INC, New York
4. Analysis of Foods – H.E. Cox
5. Foods: Facts and Principles. N. Shakuntala Many and S. Swamy, 4th ed. New Age International (1998)
6. Environmental Chemistry: A.K. De
7. Environmental Pollution Analysis: S.M. Khopkar
8. Industrial Chemistry by R.K. Das

B.Sc. -I
Semester – II
Chemistry VSC-II (Credit-1 Contact Hrs- 15)
Advanced Processes in Textile Chemistry
Total Marks - 25

Unit–I Study of Textile processing **(15)**

1. Sizing: Sizing ingredients and their functions. Chemistry of Sizing ingredients. Physical and chemical properties of starch, softener, synthetic adhesives, Sizing of synthetic yarn.
2. Bleaching: Studying of the process of scouring and bleaching of cotton and synthetic materials.
3. Dyeing: Study of dyeing of cellulosic materials with dyes like direct, vat, sulphur, reactive, Study of dyeing of synthetic fibers like polyester, nylon and acrylic with suitable class of dyes.
4. Printing: Study of printing cellulosic fabrics with dyes like direct, reactive, vat, soluble vat, azoics and pigment colours. Study of direct discharge and resist style of printing. Brief study of some printing machines.
5. Finishing: Objects and classification of finishing processes. Finish applied on cellulose and synthetic fabrics, Study of some finishing process like water mangling starching, drying, steering, calendaring, mercerization, shrink resisting, treatment, optical brightening treatments.

Reference Books:

1. Sizing by D.B. Ajgaonkar, M.K. Talukdar and V.R. Wadekar; December-1969
2. Textile Bleaching, Steven A.B., Pitman and Sons, London, 1947
3. Technology of Bleaching and Dyeing, Chakraverty, R.R., Trivedi S.S., Vol. 1, Mahajan Publishers, Private Ltd., Ahmedabad, 1979.
4. Chemical Technology in the Pre-treatment Processes of Textiles by S.R.Karmakar, 1999
5. Digital printing of textiles, Ujiie.H.,Woodhead publishing,2006
6. Textile finishing, D. Heywood, ed., Society of Dyers and Colourists, Bradford, England, 2003

Learning Objectives:

1. To get information about Sizing, Bleaching about Dyeing of fiber
2. To acquire knowledge about printing and finishing process in textile industry
3. To Understand shrink resisting treatment and optical brightening treatments

Course Outcome:

1. Understanding of the significance Sizing, Bleaching about Dyeing of fiber
2. Able to understand about printing and finishing process in textile industry
3. Understanding of the significance of process of scouring and bleaching of cotton and synthetic materials

B.Sc. -I
Semester – II
Chemistry VSC-II (Credit-1 Contact Hrs- 30)
Practical -Advanced Processes in Textile Chemistry
Total Marks - 50

1. To study the dyeing of given cellulosic fabric with direct dye (Any one suitable dye)
2. To study the dyeing of given cellulosic fabric with vat dye (Any one suitable dye)
3. To study the dyeing of given cellulosic fabric with sulphur dye (Any one suitable dye)
4. To study the dyeing of given synthetic fabric with disperse reactive dye (Any one suitable dye)
5. To print silk material with acid /basic dyes.
6. To print wool material with metal complex dyes.
7. To determine colour fastness of various agencies like washing, light and rubbing.
8. To determine colour fastness to perspiration and bleaching agents.
9. To determine colour fastness to sublimation and hot pressing.
10. To collect the sample of finished fabrics and describe the type of finishes it may have.
    (Any other suitable and concerned practical shall also included)

Reference Books:

1. Sizing by D.B. Ajgaonkar, M.K. Talukdar and V.R. Wadekar; December-1969
2. Textile Bleaching, Steven A.B., Pitman and Sons, London, 1947
3. Technology of Bleaching and Dyeing, Chakraverty, R.R., Trivedi S.S., Vol. 1, Mahajan Publishers, Private Ltd., Ahmedabad, 1979.
4. Chemical Technology in the Pre-treatment Processes of Textiles by S.R.Karmakar, 1999
5. Digital printing of textiles, Ujiie.H.,Woodhead publishing,2006
6. Textile finishing, D. Heywood, ed., Society of Dyers and Colourists, Bradford, England, 2003

B.Sc. -I
Semester – II
Chemistry SEC-II: (Total Credits -1, Total Contact Hours -15)
Basics of Soil Analysis
Total Marks - 25

Unit I- Introduction to Soil analysis, Types of soil, Soil pollutatants, role of soil testing for environment, Uses of soil analysis. (3)

Unit – II : Sample Collection and Processing Purpose of Soil testing and analysis, selection of field, Method of Soil Sample collection Methods of soil sample processing, precautions during soil collection & processing, Preservation labeling and Storage of soil samples, various types of boys used for collection. (6)

Unit – III : Study of Instruments: Brief study of instruments : PH Meter, Conductivity meter, spectrometer, UV-Spectrophotometer, (Calibration, Instrumentation, applications only) use of soil testing kit and mobile soil testing van. Kjeldahl's Assembly for determination of nitrogen. (6)

Reference Books:

1. Introduction to soil laboratory manual -J.J.Harsett stipes.
2. Introduction to soil science laboratory manual, Palmer and troch - Lowa state.

Learning Objectives:

1. To get information about Soil analysis, Types of soil and Soil pollutatants
2. To acquire knowledge about Sample Collection and Processing Purpose of Soil testing and analysis
3. To Understand use of Instruments for soil analysis

Course Outcome:

1. Understanding of the significance Soil analysis, Types of soil and Soil pollutatants
2. Able to understand about Sample Collection and Processing Purpose of Soil testing and analysis
3. Understanding of the significance of soil analysis and handling of instruments

B.Sc. -I
Semester – II
Chemistry SEC-II: (Total Credits -1, Total Contact Hours -30)
Practical- Basics of Soil Analysis
Total Marks - 25

1. To determine pH of given soil sample.
2. To determine nutrient content (NPK) of soil.
3. To determine salinity of given soil sample.
4. To determine micronutrient content of soil sample.
5. Preparation of Various Chemical reagents required for soil testing.
6. Processing of Soil Sampling for analysis
7. Determination of Electrical Conductivity of Soil Sample using Electrical Conductivity meter.
8. Determination of Organic Carbon by wet Oxidation method.
9. Determination of available Nitrogen from Soil Sample.
10. Determination of available phosphorus from soil sample.
11. Determination of available Potassium from soil sample.
12. Determination of Calcium Carbonate from soil sample.
13. Determination of micronutrients from soil sample.
14. Determination of lime requirement of deiclic soil.
15. Determination of Gypsum requirement of Soil.

(Any other suitable and concerned practical shall also included)

Reference Books:

1. Introduction to soil laboratory manual -J.J.Harsett stipes.
2. Introduction to soil science laboratory manual, Palmer and troch - Lowa state.

B.Sc. -I
Semester – II
Chemistry VEC - I: (Total Credits -2, Total Contact Hours -30)
Introduction to Qualitative and Quantitative Analysis
Total Marks - 50

1. Fundamentals of Analytical Chemistry **(8)**

1.1 Basic principle of titrimetric analysis and classification
1.2 Preparation and dilution of reagents/solutions.
1.3 Normality, Molarity and Mole fraction, Weight by weight (w/w), Weight by volume (w/v). Use of N1V1= N2V2 formula
1.4 Preparation of ppm level solutions from source materials (salts), conversion factors, density and specific gravity of solutions, problems are expected.

2. Qualitative and Quantitative Analysis **(10)**

2.1 Qualitative analysis of Carbon, Hydrogen, Nitrogen & Sulphur
2.2 Quantitative analysis of-
a) Carbon and hydrogen by Combustion method
b) Nitrogen by Kjeldahl's method
c) Halogen and Sulphur by Carius method.
2.3 Determination of molecular weight of an acid by titration method.
2.4 Empirical formula and molecular formula determination.
2.5 Numerical Problems

3. Basic Principals in estimation of Acids, Phenols, Amines and Amides **(6)**

i) Estimation of aniline, ii) Estimation of acetamide and iii) Estimation of Aspirin

4) Basic Principals in Organic Qualitative Analysis **(6)**

Theoretical concepts involved in 1.Primary tests 2. Determination of Physical contants 3. Dtection of elements 4. Determination of functional group 5. Special tests.

Reference Books

1) G D Christian -Analytical Chemistry
2) Qualitative Organic Analysis 4th Edn by A I Vogel (ELBS)
3) Vogel's Quantitative Analysis by A I Vogel

Learning Objectives:

1. To get information about Basic principle of titrimetric analysis and classification
2. To acquire knowledge Normality, Molarity and Mole fraction
3. To understand Qualitative analysis of Carbon, Hydrogen, Nitrogen & Sulphur

Course Outcome:

1. Understanding of the basic principle of titrimetric analysis and classification
2. Able to understand about Normality, Molarity and Mole fraction
3. Understanding of the basic concepts involved in analysis of Carbon, Hydrogen, Nitrogen & Sulphur

B.Sc. -I
Semester – II
CC-II: (Total Credits -1, Total Contact Hours -15)
Chemistry of Food, Nutrition and Preservation
Total Marks - 25

1. Food preservation: Food preservation: definition, (15)
2. Objectives and principles of food preservation.
3. Different methods of food preservation.
4.Preserved Products: Jam, Jelly, Marmalade, Sauces, Pickles, Squashes, Syrups-types, composition and manufacture, selection, cost, storage, uses and nutritional aspects,
5. Food Standards : ISI, Agmark, FPO, MPO, PFA, FSSAI.

Reference Books

1. G D Christian -Analytical Chemistry
2. Qualitative Organic Analysis 4th Edn by A I Vogel (ELBS)
3. Vogel's Quantitative Analysis by A I Vogel
4. SrilakshmiB(2017): Nutrition Science,6th Multicolour Ed. New Age International (P) Ltd.
5. RodayS(2012): Food Science and Nutrition, 2nd Ed. Oxford University Press.
6. Mann J and TruswellS(2017) : Essentials of Human Nutrition, 5th Ed. Oxford University Press.
7. Wilson K and Walker J(2000): Principles and Techniques of Practical Biochemistry, 5th Ed. Oxford University Press.
8. Sadasivan S and ManikamK(2007): Biochemical Methods, 3rd Ed. New Age International (P) Ltd.
9. Oser B L(1965). Hawk's Physiological Chemistry, 14th Ed. McGraw-Hill Book
10. Gopalan C , Rama Sastri BV and Balasubramanian SC(2016): Nutritive value of Indian Foods, Indian Council of Medical Research.

Learning Objectives:

1. To get information about Objectives and principles of food preservation
2. To acquire knowledge of different methods of food preservation
3. To understand Food Standards

Course Outcome:

1. Understanding of the basic principle of food preservation
2. Able to understand different methods of food preservation
3. Understanding of the basic concepts involved storage, uses and nutritional aspects food preservation

B.Sc. -I
Semester – II
Practical-CC-II: (Total Credits -1, Total Contact Hours -30)
Chemistry of Food, Nutrition and Preservation Practical
Total Marks - 25

1. Identification of Mono, Di and polysaccharides,
2. Identification of Proteins,
3. Identification of glycerol.,
4. Determination of moisture content in food, ash content and determination of calcium, iron, vitamin-C.
5. Comparison with norms and interpretation of the nutritional assessment data and its significance.
6. Weight for age, height for age, weight for height, body Mass Index (BMI) Waist - Hip Ratio (WHR). Skin fold thickness.
7. Quantitative estimation of Sugars (Glucose, lactose, starch),
8. Estimation of acid value, iodine value, Saponification value of fats,
9. Estimation of blood Glucose,
10. Estimation of serum cholesterol

(Any other suitable and concerned practical shall also included)

Reference/suggested books

1. Srilakshmi B(2017): Nutrition Science,6th Multicolour Ed. New Age International (P) Ltd.
2. Roday S(2012): Food Science and Nutrition, 2nd Ed. Oxford University Press.
3. Mann J and Truswell S(2017) : Essentials of Human Nutrition, 5th Ed. Oxford University Press.
4. Wilson K and Walker J(2000): Principles and Techniques of Practical Biochemistry, 5th Ed. Oxford University Press.
5. Sadasivan S and Manikam K(2007): Biochemical Methods, 3rd Ed. New Age International (P) Ltd.
6. Oser B L(1965). Hawk's Physiological Chemistry, 14th Ed. McGraw-Hill Book
7. Gopalan C , Rama Sastri B V and Balasubramanian SC(2016): Nutritive value of Indian Foods, Indian Council of Medical Research.
8. Subalakshmi, G and Udipi, S A(2006):Food processing and preservation, 1st Ed. New Age International (P)Ltd.
9.Srilakshmi B(2018): Food Science, 7th Colour Ed. New Age International (P) Lt
10. Potter NN and Hotchkiss JH(1999): Food science,5th Ed , Spinger.

Annexure: I

Walchand College of Arts and Science, Solapur (Autonomous)
B. SC. Part – I Semester II (w.e.f. June, 2023)

Question Paper for Class Room Test (IE)

(02 Credit Theory Course)

Marks: 10

Q.No.1 Multiple choice questions - 04 marks.

Q.No.2 Attempt any two - 6 marks.

a)

b)

c)

Annexure: II:

Walchand College of Arts and Science, Solapur (Autonomous)
B. SC. Part – I Semester II (w.e.f. June, 2023)
Question Paper for Class Room Test (IE)

(04 Credit Theory Course)

Marks: 20

Q.No.1 Multiple choice questions - 08 marks.

Q.No.2 Attempt any two - 12 marks.

a)

b)

c)

Annexure: III

Walchand College of Arts and Science (Autonomous), Solapur

Theory question paper Pattern for **4 credit** course as per NEP 2020 **(ESE)**

w. e. f. 2023-24

Examination:_____

Class: B. Sc. Semester:

Subject: Paper:

Time: 2.5 hrs Marks: 60

Instructions:

1. All questions are compulsory
2. Figures to the right indicate full marks
3. Draw neat labeled drawings wherever necessary

Q. No.1 Choose the correct alternative from the following 08

i)

a) b) c) d)

ii)

iii)

iv)

v)

vi)

vii)

viii)

Q. No.2 Answer the following questions (Any six) 12

i)

ii)

iii)

iv)

v)

vi)

vii)

viii)

Q. No.3 Answer the following questions (Any two) 12

i)

ii)

iii)

Q. No.4 Answer the following questions (Any two) 12

i)

ii)

iii)

Q. No.5 Answer the following questions (Any two) 16

i)

ii)

iii)

Annexure IV

Walchand College of Arts and Science (Autonomous), Solapur

Theory question paper Pattern for **2 credit** course as per NEP 2020 **(ESE)**

w. e. f. 2023-24

Examination:_____

Class: B. Sc. Semester:

Subject: Paper:

Time: 1.5 hrs Marks: 30

Instructions:

4. All questions are compulsory
5. Figures to the right indicate full marks
6. Draw neat labeled drawings wherever necessary

Q. No.1 Select the correct alternative of the following 06

i)

a) b) c) d)

ii)

iii)

iv)

v)

vi)

Q. No.2 Attempt the following (Any three) 06

i)

ii)

iii)

iv)

v)

Q. No.3 Attempt the following (Any two) 06

i)

ii)

iii)

Q. No.4 Attempt the following (Any two) 06

i)

ii)

iii)

Q. No.5 Attempt the following (Any one) 06

i)

ii)

Annexure-V

Walchand College of Arts and Science (Autonomous), Solapur

Theory question paper Pattern for **1 credit** course as per NEP 2020 **(ESE)**

w. e. f. 2023-24

Examination:_____

Class: B. Sc. Semester:

Subject: Paper:

Time: 1.5 hrs Marks: 25

Instructions:

7. All questions are compulsory
8. Figures to the right indicate full marks
9. Draw neat labeled drawings wherever necessary

Q. No.1 Select the correct alternative of the following 05

i)

a) b) c) d)

ii)

iii)

iv)

v)

Q. No.2 Attempt the following (Any five) 05

i)

ii)

iii)

iv)

v)

vi)

vii)

Q. No.3 A) Attempt the following (Any one) 03

i)

ii)

B) Attempt the following (Any one) 02

i)

ii)

Q. No.3 A) Attempt the following (Any one) 03

i)

ii)

B) Attempt the following (Any one) 02

i)

ii)

Q. No.5 Attempt the following (Any one) 05

i)

ii)

Annexure-VI

Scheme of Marking for End Semester Examination (ESE)

(02 Credit Practical Course)

Semester-I

Time: 3 hours **Total Marks: 30**

Two experiments with 15 Marks

Annexure-VII

Scheme of Marking for End Semester Examination (ESE)

(01 Credit Practical Course for CC)

Time: 3 hours **Total Marks: 25**

Practical examination will be at the end of the semester. Every candidate has to perform one Practical.

a) Practical : 20 Marks

b) Journal + Oral : 05 Marks

The breakup of 20 marks should be given in the practical slip

Annexure-VIII

Scheme of Marking for End Semester Examination (ESE)

(02 Credit Practical Course)

Semester-II

Time: 3 hours **Total Marks: 30**

Two experiments with 15 Marks

Shikshan Haach Dharma
S. A. P. D. Jain Pathashala's
(Jain Minority Institute)

Walchand College of Arts & Science, Solapur

Autonomous College

(Affiliated to P.A.H. Solapur University, Solapur)

॥ शिक्षण हाच धर्म ॥

Walchand College of Arts and Science, Solapur
Autonomous
Estd. 1962

Name of Faculty: Science & Technology

New Choice Based Credit System
(According to NEP-2020)

B.Sc. Part-I

Subject: Zoology

With Effect from: 2023-24

Walchand College of Arts & Science, Solapur

(Autonomous)

About National Education Policy (NEP) - 2020

With the directions and guidelines issued by **Government of Maharashtra resolution dated 20th April 2023 and 16th May, 2023** regarding the implementation of NEP at UG and PG level, the Walchand College of Arts & Science (Autonomous), Solapur has taken decision to implement NEP 2020 with Choice Based Credit System (CBCS) at Undergraduate level and Post Graduate level. This has been done to achieve the goals and objectives set in NEP-2020 such as- worldwide recognition, acceptability, horizontal as well as vertical mobility for students completing undergraduate and post-graduate degree.

The CBCS provides an opportunity for the students to select from the prescribed courses comprising core, elective/minor or skill based. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations.

Outline of NEP:

The structure of the Three/Four-year bachelor's degree programme allows the opportunity to the students to experience the full range of holistic and multidisciplinary education in addition to a focus on the chosen major and minors as per their choices and the feasibility of exploring learning in different institutions. The structure allows students to learn various components like:

(a) Major (Core) Subject (DSC): This comprises of Mandatory and Elective Courses that require students to achieve:

- Minimum 50% of total credits corresponding to Three/Four - year UG Degree- Mandatory Courses are offered in all four years;
- 2 credit course on Major Specific IKS shall be included under Major;
- Elective courses of Major will be offered in the third and/or final year;
- Vocational Skill Courses, Internship/ Apprenticeship, Field Projects, Research Projects are related to Major

(b) Minor Subject (18-20 Credits)

- The Minor subjects may be from the different disciplines of the same faculty of DSC Major (Core) or they can be from different faculty altogether;
- The credits of Minor subjects shall be completed in the first three years of UG Programme

(c) Generic/ Open Elective Courses (OE) (10-12 credits)

- GE/OE are to be offered in I and/or II year;
- Faculty-wise baskets of OE shall be prepared by Autonomous College.
- OE/GE is to be chosen compulsorily from faculty other than that of the Major or as per the directions issued by NEP-Steering Committee

(d) Vocational and Skill Enhancement Courses (VSEC)

i) Vocational Skill Courses (VSC): (8-10 credits): Includes Hands on Training corresponding to the Major and/or Minor Subjects:

- To be offered in first three years;
- Wherever applicable vocational courses will include skills based on advanced laboratory practicals' of Major

ii) Skill Enhancement Courses (SEC): (06 credits)
- To be offered in I and II year;
- To be selected from the basket of Skill Courses approved by Autonomous College

(e) Ability Enhancement Courses (AEC), Indian Knowledge System (IKS) and Value Education Courses (VEC): (14 Credits)

i) AEC: (08 credits)
- To be offered in I and II year
- English: 04 Credits
- Modern Indian Language: 04 credits
- To be offered from the Basket approved by Autonomous College;

The focus for both languages should be on linguistic and communication skills.

ii) IKS: (2 Credits)
- To be offered in I Year
- Courses on IKS to be selected from the basket of IKS courses approved by Autonomous College

iii) VEC: 04 Credits
- To be offered in I year
- Value Education Courses (VEC) such as Understanding India, Environmental Science/Education, and Digital and Technological Solutions.

(f) Field Projects/ Internship/ Apprenticeship/ Community Engagement and Service corresponding to the Major (Core) Subject, Co-curricular Courses (CC) and Research Project
- Internship/Apprenticeship corresponding to the Major (Core) Subject: (8 Credits)
- Field Projects/Community Engagement and Service (CEP) corresponding to the Major (Core) Subject (minimum 4-6 credits)
  -To be offered in II and III years of UG Degree Programmes.
- Co-curricular Courses (CC) such as Health and Wellness, Yoga education, sports and fitness, Cultural Activities, NSS/NCC and Fine/ Applied/Visual/ Performing Arts: (8 credits)
  -To be offered in I and/or II year
- Research Projects: (12 credits)
  -To be offered in the final year for 4 year Honours with Research UG Degree

➢ **CREDIT:**

- Credit is a numerical value that indicates students work load (Lectures, Lab work, Seminar, Tutorials, Field work etc.) to complete a course unit. The contact hours are transformed into credits. Moreover, the grading system of evaluation is introduced for B.Sc. course wherein process of Continuous Internal Evaluation is ensured.
- **Theory: '**15 contact hours' for theory course constitute 'one credit'
- **Practical/Tutorial: '**30 contact hours' for practical course constitute 'one credit'.
- **Workshop based activities/Skill based activities:** Minimum 30 contact hours per credit in a semester is required
- **Internship/On-Job Training: '**30 contact hours' per credit in a semester is required (1 credit/week)

- **Community Engagement and Service-CEP/Field Project:** '30 contact hours' per credit in a semester is required

- **Credit Framework under Three/Four Years UG Programme with Multiple Entry and Multiple Exit Options:**

The minimum and maximum credit structure for different levels under three or four year UG programme with multiple entry and multiple exit options are as given below:

Levels	Code	Qualification Titles	Credit Requirements		Semester	Year
			Minimum	Maximum		
4.5	100-199	UG Certificate	40	44	2	1
5.0	200-299	UG Diploma	80	88	4	2
5.5	300-399	Three Year Bachelor's Degree	120	132	6	3
6.0	400-499	Bachelor's Degree Honours **OR** Bachelor's Degree-Honours with Research	160	176	8	4
	500-599	First Year PG & or PG Diploma	40	44	2	1
6.5	600-699	PG Degree	80	88	4	2
8.0	700-799	Ph.D.	16+ Ph.D. Work		---	---

Multiple Exit Options

Year	Exit Option	Reentry
First Year	Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/Internship OR Continue with Major and Minor	Students opting for exits at any level 'will have the option to reenter' the programme from where they had left off, in the same or in different higher educational institution 'within three years of exits' and complete the degree program within the stipulated maximum period of 07 years from the date admission of first year of UG.
Second Year	Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF Course/Internship OR Continue with Major and Minor	
Third Year	Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor	
Fourth Year Honours	Four Year UG Honours Degree in Major and Minor with160-176 credits	
Fourth Year Honours with Research	Four Year UG Honours with Research Degree in Major and Minor with160-176 credits	
Post-Graduation Degree		
Post-Graduation: First Year	PG Diploma (44 Credits) after Three Year UG Degree	Reentry to complete the PG degree after taking exit option will be permissible up to 5 years from the date admission to PG programme

- **Academic Bank of Credit (ABC):**

It is mandatory for all admitted students to get enrolled on ABC Portal and create ABC ID and share ABC-ID with academic institutions where they are enrolled. Credits earned by the students will be reflected in the students ABC account. This will allow students smooth transition during multiple entry and exit.

- **Program Outcomes:**

Zoology course aims to emphasize holistic learning of the natural sciences so that a graduate student must employ his knowledge in various domains ranging from core studies from microscopic animalcules to gigantic organism living in diverse ecosystems. He must use his knowledge in addressing the challenges of global concern such as environmental catastrophes, climate change, species extinctions, pandemics, sustainable economy and economy. A graduate in Zoology must use his knowledge to instill a sense of responsibility towards everything that is natural and try to inculcate his knowledge to solve the problems faced by nation and common public. His understanding on species behavior, population dynamics, physiology and the way they interact with other species and their environments must be of unique value not just for wild animals but for entire humanity. The program in Zoology must enable him/her to constantly endeavor to undertake further studies in Zoology and in multidisciplinary areas that involve advanced or modern biology and help develop a range of generic skills that are relevant to wage employment, self-employment and entrepreneurship.

- **Program Specific Outcomes:**

A student specializing in Zoology is expected to learn fundamentals of natural sciences that mostly include:

a) Evolution of Life on planet Earth: The intricate mechanism that led to evolution of first cell from primordial soup;
b) Diversity of life on planet Earth: Understanding the bewildering diversity of species, the way they are classified and interactions among them;
c) Anatomy, physiology & cell biology: Looking inside the complex architecture of body in varied species, the way they operate and peeping through complexity of cells, tissues & organs to gain an understanding from lowest to highest organization;
d) Molecular biology & biotechnology: To understand the blueprint of life: DNA, RNA & Protein. How these molecules form our building blocks, the way they control our structure & function from viruses to human;
e) Applied, allied & contemporary approaches: The science of Zoology has manifold applications ranging from-agriculture, sericulture, apiculture, dairy, eugeneics, proteomics, genomics, nanotechnology, vaccine synthesis, sociology, economics, GIS based biodiversity conservation etc.

The program of Zoology aims to integrate all these concepts so that a student is prepared to contribute his skills and knowledge as demanded in his future endeavors.

Walchand College of Arts & Science, Solapur (Autonomous)
Faculty of Science: Choice Based Credit System (CBCS)
(w.e.f. 2023-24)

Preamble: This course provides a broad overview of Zoology and to produces expert hands that would have sufficient knowledge and expertise to solve the urgent problems of the region by using Zoology. The course structure is basic science centric where students learn core science and are taught necessary fundamental subject for that purpose.

Objectives of the course: The objectives of B. Sc.-I Zoology course are:

- To provide an intensive and in depth learning to the students in field of Zoology.
- Beyond stimulating learning, understanding the techniques, the course also addresses the underlying recurring problems of disciplines in today scientific and changing world.
- To develop awareness & knowledge of different organization requirement and subject knowledge through varied branches and research methodology in students.
- To train the students to take up wide variety of roles like researchers, scientists, consultants, entrepreneurs, academicians, industry leaders and policy.

Eligibility and Admission:

A Candidate passing 10+2 with Biology, MLT, Dairy Science, Fisheries, Agricultural science as one of the subject and passed from state syllabus / CBSE / ICSE equivalent with minimum passing percentage of as per the directives of the higher education. The duration of the B.Sc.-I course is of 1 year (comprising 2 semesters).

Duration:

The duration of the B.Sc.-I course is of 1 year (comprising 2 semesters) and the B.Sc. entire program is of 3 years (06 Semesters) and/or 4 years (08 semester comprising Bachelors Degree-Honours and/or Bachelors Degree-Honours with Research degree) with multiple entry and exit options.

Medium of Instruction: English

Pattern of the Course: The autonomous college follows semester pattern.

Structure of Course for B.Sc.-I ZOOLOGY according to NEP
(Semester-I & II)
Choice Based Credit System (CBCS) Structure (2023-24)
(Theory and Practical)

B.Sc.				
SEMESTER-I				
Subject Category	**Paper Title**	**Credits**	**Hours/week**	**Contact Hours**
Major (Mandatory)-Zoology DSC-I	Paper-I: Animal Diversity	4	4	60
Major (Mandatory)-Zoology **Practical-I**	**Practical-I** Animal Diversity	2	4 (hours/week/batch)	60
Zoology OE-I	Global Climate Change **(For Arts)**	2	2	30
Zoology OE-I-P	**Practical OE-I** Global Climate Change **(For Arts)**	2	4 (hours/week/batch)	60
Zoology IKS	Indian Natural History: An Overview of Fauna	2	2	30
Zoology CC-I	Visual Arts-I: Nature and Wildlife Photography: Introduction	1	1	15
Zoology CC-I-P	**Practical CC-I** Nature and Wildlife Photography: Introduction	1	2 (hours/week/batch)	30
SEMESTER-II				
Major (Mandatory)-Zoology DSC-II	Paper-II: Comparative Anatomy of Vertebrates & Developmental Biology of Vertebrates	4	4	60
Major (Mandatory)-Zoology **Practical-II**	**Practical-II:** Comparative Anatomy of Vertebrates & Developmental Biology of Vertebrates	2	4 (hours/week/batch)	60
Zoology OE-II	Food, Nutrition and Health (For Arts)	2	2	30
Zoology OE-II-P	**Practical OE-II** Food, Nutrition and Health (For Arts)	2	4 (hours/week/batch)	60
Zoology VEC	Environmental Education	2	2	30
Zoology CC-II:	**Visual Arts-II:** Nature and Wildlife Photography: Camera as a Tool	1	1	15
Zoology CC-II-P	**Practical CC-II** Nature and Wildlife Photography: Camera as a Tool	1	2 (hours/week/batch)	30

Outline of Examination

THEORY:

- For four credits: 100 Marks;
- For two credits: 50 Marks;
- For one credit: 25 Marks

1) Internal Evaluation (IE): Internal evaluation will consist of **40 % marks** per semester per paper. It may be held as **per the following scheme** per semester **(Annexure: I & II)**

Credits	Marks for Attendance	Classroom Test	Home Assignment	Marks for Presentation/Group Discussion/ Participation/Field work/Study visit	Total Marks
02	05	10	05	---	20
04	05	20	05	10	40

2) End Semester Examination (ESE): The detailed question paper pattern (**60 % marks per paper)** is given as in **Annexure- III; Annexure- IV and Annexure- V**

PRACTICAL:

1) Internal Evaluation (IE): Internal evaluation will carry **40 % marks** and may consist of:

Credits	Marks for Attendance	Internal Practical Exam	Journal	Total Marks
02	05	10	05	20

2) **End Semester Examination (ESE):** Practical examination **60 % marks** shall be conducted at the end of each semester. The detailed scheme is given in **Annexure-VI, VII and Annexure-VIII**

Walchand College of Arts and Science, Solapur (Autonomous)
B. SC. Part – I Semester I (w.e.f. June, 2023)
Sub- Major (Mandatory): Animal Diversity (DSC-I)

Semester-I: Theory Syllabus (Major: Mandatory)

Marks: 100 **Credits: 04 (Contact Hours-60)**

Unit Number	Title of the Unit	Contact Hours	No. of Credits
1	**Invertebrates:** **A) Kingdom Protista** • General characters and classification up to classes; • Locomotory organelle and locomotion in protozoa, • Nutrition in protozoa. **B) Phylum Porifera** • General characters and classification up to classes; • Canal system in *Sycon* **C) Phylum Cnidaria** • General characters and classification up to classes; • Polymorphism in hydrozoa **D) Phylum Platyhelminthes** • General characters and classification up to classes; • Life history of *Taenia solium* **E) Phylum Nemathelminthes** • General characters and classification up to classes; • Life history of *Ascaris lumbricoides* and its parasitic adaptations	15	1

2	**F) Phylum Annelida** • General characters and classification up to classes; Metamerism in annelid • Economic importance of annelids with reference to earthworm and leech **G) Phylum Arthropoda** • General characters and classification up to classes; • Vision in arthropoda, Metamorphosis in insects • Economic importance of insects. **H) Phylum Mollusca** • General characters and classification up to classes; • Torsion in gastropods • Economic importance of molluscs **I) Phylum Echinodermata** • General characters and classification up to classes; • Water-vascular system in Asteroidea **J) Investigating Invertebrates** • Overview of invertebrate diversity in India, Invertebrates in IUCN category from India • Introduction to basic survey methodologies for invertebrates.	15	1
3	**Vertebrates:** **A) Protochordates** • General features and phylogeny of protochordata **B) Agnatha** • General features of agnatha and classification of cyclostomes up to classes **C) Pisces** • General features and classification of Elasmobranchi (for e.g., *Scoliodon, Sphyrna, Stegostoma, sting ray, electric ray, Chimera*), Osteichthyes (for e.g., *Latimeria*-'a living	15	1

	fossil', Neoceratodus, Protopterus, Lepidosiren, Salmon, Carps, Anguilla, Sea horse, Anabas, *Echenis*, *Tetrodon*); • Economic importance of fishes **D) Amphibia** • General features and classification up to orders of: Apoda: for e.g.- *Icthyophis* Urodela: for e.g.- ex- *Ambystoma* (tiger salamaner), Mud-puppy (*Necturus*), *Siren*, *Amphiuma* Anura/Salientia: for e.g.- Grass frogs, tree frogs and toads • Parental care in amphibian with examples		
4	**E) Reptiles** • General features and classification up to orders of: Chelonia: turtles and tortoise Rhynchocephalia: *Sphenodon* (a living fossil) Crocodilia: gharial, alligator and crocodile Squamata: Lizard, snakes • Venomous and non-poisonous snakes • Types of snake venom, symptoms and treatments of snake bite **F) Aves** • General features and classification up to orders of: i) Archaeopterygiformes: *Archaeopteryx*; ii) Sphenisciformes: Penguin; iii) Casuariformes: Cassowary, Emu; iv) Apterygiformes: Kiwi; v) Struthioniformes: Ostrich; vi) Psittaciformes: Parakeet vii) Columbiformes: Pigeon; viii) Anseriformes: Duck; ix) Galliformes: Fowl, peacock x) Passeriformes: Sparrow xi) Falconiformes: Eagle • Flight adaptations in birds **G) Mammals** • General features and classification up to orders of: i) Monotremata: *Ornithorhynchus, Echidna;* ii) Marsupiialia: *Macropus* iii) Insectivoara: Shrew iv) Chiroptera: Bat v) Pholidota: Pangolin vi) Rodentia: Rat, Squirrel	15	1

	vii) Cetacea: Dolphin, blue whale viii) Sirenia: Dugong (sea cow) ix) Carnivora: Tiger x) Proboscidea: Elephant xi) Perrisodactyla: Horse xii) Artiodactyla: sheep, camel xiii) Primates: Humans, Chimpanzees, Gorillas, Monkeys **H) Investigating Vertebrates:** • Concept of diversity, species richness, species abundance & diversity indices • Basics of survey methodology for vertebrates: Line transect, point count & quadrat		

About the course

The course deals with study of megadiverse invertebrate group. Invertebrate diversity is rich and complex. Overall invertebrate study is a must for a Zoology core course as they are fundamental to understand phylogeny, structural and functional ecology, ecosystem services and applied ecology. The diversity of invertebrates is bewildering and understanding these creatures is essential to have a holistic application of subject for sustainability of resources. Looking at their varied applications to mankind in fields like soil enrichment, nutrient recycling, water catchment, apiculture, sericulture, agro-ecosystem etc. the study of invertebrate is a necessary component as an introductory component during graduation.

The course is a walk for the Bachelor's entrant through the amazing diversity of living forms from simple to complex one. It enlightens how each group of organisms arose and how did they establish themselves in the environment with their special characteristics. It also deals with the differences and similarities between organisms on the basis of their morphology and anatomy which led to their grouping into taxa and clades.

Course outcomes:

After successfully completing the course, the students will be able to

- Develop critical understanding of diversity of invertebrates
- The method employed to classify invertebrate fauna
- Unique adaptations of invertebrates
- Economic importance of invertebrate fauna
- Methods used to study invertebrate fauna in the wild
- Significance of invertebrate fauna in research and development
- Develop understanding on the diversity of life with regard to protists, non chordates and chordates.
- Group animals on the basis of their morphological characteristics/ structures.
- Develop critical understanding how animals changed from a primitive cell to a collection of simple cells to form a complex body plan.
- Understand how morphological change due to change in environment helps drive evolution over a long period of time.
- The project assignment will also give them a flavour of research to find the process involved in studying biodiversity and taxonomy besides improving their writing skills. It will further enable the students to think and interpret individually due to different animal species chosen.

- Learning outcomes: National extent, status & threat to biodiversity, global concern to invertebrates, filed based methods to study invertebrates
- Learning Outcomes: National extent, status & threat to biodiversity, global concern to invertebrates, filed based methods to study invertebrates

References:

1) Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.
2) Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
3) Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford University Press.
4) Pough H. Vertebrate life, VIII Edition, Pearson International.
5) Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.
6) Invertebrate surveys for conservation: T.R.New (Oxford University Press, USA)
7) Field and Laboratory Techniques in Vertebrate Biology: Jim Ryan (Lulu Press)

Walchand College of Arts and Science, Solapur (Autonomous)
B. SC. Part – I Semester-I (w.e.f. June, 2023)
Sub- Major (Mandatory): Animal Diversity

Semester-I: Practical-I

Marks: 50 **Credits: 02 (Contact Hours- 60)**

Sr.No.	Name of Practical
1	**Invertebrates:** Study of the following specimens (General characters and classification) **CD/Model/Chart/Slides/Virtual** • *Amoeba, Euglena, Plasmodium, Paramecium* • *Sycon, Hyalonema, and Euplectella* • *Obelia, Physalia, Aurelia, Metridium* • *Taenia,, Ascaris, Fasciola* • *Aphrodite, Nereis, Pheretima, Hirudinaria* • *Peripatus, Palaemon, Crab, Limulus, Scolopendra, Julus, Periplaneta* • *Chiton, Dentalium, Pila, Unio, Sepia, Octopus* • *Pentaceros, Ophiura, Echinus, Cucumaria and Antedon,* • *Balanoglossus, Herdmania, Branchiostoma*
2	**Vertebrates:** Study of the following specimens (General characters and classification) **CD/Model/Chart/Slides/Virtual** • *Petromyzon, Sphyrna, Pristis, Torpedo, Labeo, Exocoetus, Anguilla* • *Ichthyophis, Salamandra, Bufo, Hyla* • *Chelone,Hemidactylus, Chamaeleon, Draco, Vipera, Naja, Crocodylus, Gavialis* • **Any six** common birds from different orders • *Ornithorhynchus, Pteropus, Rattus, Loris, Funambulus*
3	**Study of the following permanent slides/lab.specimens:** • T.S. and L.S. of *Sycon,*

	• *Taenia*- Scolex, mature & gravid proglottid • Whole mount of male and female *Ascaris* and Liverfluke • Observation and identification of protozoans, helminthes, arthropod vectors • Collection, staining, observation, identification and explanation of planktons
4	**Key for Identification of venomous and non-venomous snakes: Cobra & Rat Snake** (An "**animal album**" containing photographs, cut outs, with appropriate write up about the above mentioned taxa. Different taxa/ topics may be given to different sets of students for this purpose.)
5	**Osteology**: **CD/Model/Chart/Slides/Virtual CD** a) Disarticulated skeleton of frog: Skull, Atlas vertebra, Typical Vertebra, Pectoral and Pelvic Girdle b) Study of mammalian skulls: One herbivorous and one carnivorous animal
6	Visit to local ecosystem to study invertebrate and vertebrate fauna and prepare a mini report based on observations for submission in final practical examination

Walchand College of Arts and Science, Solapur (Autonomous)
B. SC. Part – I Semester I (w.e.f. June, 2023)

Sub- Open Elective-I: Global Climate Change

Semester-I: Theory Syllabus (OE-I)

Marks: 50 **Credits: 02 (Contact Hours-30)**

Unit Number	Title of the Unit	Contact Hours	No. of Credits
1	**Earth System & Ozone Layer Depletion** • Issues of global Environmental change • Paleoclimate-what can we learn from the past? • Stratospheric ozone layer: Evolution of ozone layer • Greenhouse gases and their sources; Greenhouse effects; • Causes of depletion of ozone layer and consequences; • Climate change: Effects of enhanced UV-B on plants, animals, human health and materials • Global energy infrastructure and GHG emissions	15	1
2	**Climate Change and Mitigation:** • Acid rain and its effects on plants, animals and ecosystems • Consequences of climate change on oceans, agriculture, natural vegetation and humans • El Niño and the Southern Oscillation -El Niño and its Effects • National efforts on climate change issues • Global efforts for mitigating ozone layer depletion • International Agreements: the United Nations Framework Convention on Climate Change (UNFCC), Kyoto Protocol and Paris Agreement	15	1

About the course

This course provides an overview of the Earth's climate system, the various forcing and feedbacks controlling the Earth's climate variability in short and long timescale. It will give a brief introduction to the atmosphere and ocean circulation.

Learning outcomes

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

- Develop understanding on the concept and issues of global environmental change.
- Analyse the causes and effects of depletion of stratospheric ozone layer.
- Examine the climate change and its effect on living beings.
- Understand the physical basis of natural green gashouse effect on man and materials.
- Evaluate human influenced driver of our climate system and its applications.

Recommended readings:

1. Adger, N.; Brown, K. and Conway, D. (2012). Global Environmental Change: Understanding the Human Dimensions. The National Academic Press.

2. Turekian, K.K. (1996). Global Environmental Change-Past, Present, and Future. Prentice-Hall.

3. Matthew, R.A.; Barnett, J. and McDonald, B. (2009). Global Environmental Change and Human Security. MIT Press., USA.

4. Hester, R.E. and Harrison, R.M. (2002). Global Environmental Change. Royal Society of Chemistry.

Walchand College of Arts and Science, Solapur (Autonomous)
B. SC. Part – I Semester-I (w.e.f. June, 2023)
Sub- Open Elective-I: Global Climate Change
Semester-I: Practical Course (OE-I-P)

Marks: 50 **Credits: 02 (Contact Hours-60)**

Sr.No.	Name of Practical
1	Study of data on past temperature variation at the global level (based on web-based information)
2	Study of data on past CO_2 concentration at the global level (based on web-based information)
3	Preparation of graph on temperature and CO_2 variation to draw inference on global climate change
4	Study of rainfall pattern at national level to understand the El Niño effect (based on web-based information)
5	Collection and interpretation of data on greenhouse gases from local sources
6	To study examples of impact of UV-B radiation on human and other animals (based on web-based information)
7	To prepare a small report on : measures taken by Government of India to mitigate climate change OR To perform a small project based on Global Climate Change

Walchand College of Arts and Science, Solapur (Autonomous)
B. SC. Part – I Semester-I (w.e.f. June, 2023)
Sub- Indian Knowledge System: 'Indian Natural History: An Overview of Fauna'

Semester-I: Theory Syllabus (IKS)

Marks: 50 **Credits: 02 (Contact Hours -30)**

Unit Number	Title of the Unit	Contact Hours	No. of Credits
1	a) Concept of forest and biodiversity in ancient Indian texts: Kautilya's Arthasastra, Caraka and Susruta-Samhita: The Vedas; Ramayana, Mahabharata, Bhagabat Gita and Abhigyan Shakuntalam b) Issues of- Environment, Forest and biodiversity in Indus-valley civilization c) Knowledge of animal keeping in ancient India: Animal husbandry in:- Harappan culture, Vedic age, Animal Ayurveda during Vedic period, Mauryan age, Ashoka period and other relevant examples d) Jainism, Buddhism and animal ethics	15	1
2	a) History of Animal Keeping in Ancient India and it's Socio-Economic, Scientific applicability in 21st Century b) Animals revered in Indian culture; Conservation values inscribed in Ashoka pillar edicts c) History of portrayal of 'Hunting' in Environmental History of India d) Wildlife represented in Indian mythology, Indus valley civilization, Vedic period, Maurya period, Chalukya period, Mughal period, Jahangir period and British rule	15	1

About the course: The course intends to provide a general overview of faunal knowledge in ancient India. India, with its rich history and cultural heritage has contributed immensely in understanding and perpetuating knowledge about wild animals in its scriptures and sculptures. Understanding this rich store of knowledge may help us in better conservation of wild animal through theory and practice.

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

- To understand rich natural heritage of India with respect to animals
- To gain insights on depiction of animals in Indian tradition in various socio-economical contexts
- To learn about the significance given to wild fauna and their ethical considerations for their role in nature and ecosystem services

Recommended readings:

1) Sensharma P., Indian journal of history of science 33(4) (1998) 267-272.
2) Ray P., Zoology in Ancient and Medieval India. In: Ray, P. Sen, S.N. (Eds.) The Cultural Heritage of India, Vol.VI. The Ramakrishna Mission Institute of Culture, Calcutta, India (1978)
3) Swarnendu Chakraborty., History of Animal Keeping in Ancient India and it's Socio-Economic, Scientific Applicability in 21st Century-British Journal of Philosophy, Sociology and History, BJPSH 3(1): 06-102023
4) Sayan LODH., Portrayal of 'Hunting' in Environmental History of India. ALTRALANG Journal Volume 02 Issue 02 / December 2020
5) Sayan Bhattacharya., Forest and biodiversity conservation in ancient Indian culture: A review based on old texts and archaeological evidences, International Letters of Social and Humanistic Sciences Online: 2014-06-16 ISSN: 2300-2697, Vol. 30, pp 35-46

Walchand College of Arts and Science, Solapur (Autonomous)
B. SC. Part – I Semester I (w.e.f. June, 2023)
Subject- Visual Arts-I: Nature and Wildlife Photography: Introduction

Semester-I: Theory Syllabus Co-curricular Course (CC-I)

Marks: 25 **Credits: 01 (Contact Hours-15)**

Unit Number	Title of the Unit	Contact Hours	No. of Credits
1	a) Introduction to history of photography b) Photography as visual art: Aesthetic dimension of nature and wildlife c) Introduction to well known nature and wildlife photographers in India and at global level d) Case studies of successful nature and wildlife documentaries in the world e) Self employment and job opportunities in Nature and wildlife photography f) Introduction to Camera as a tool is science in context of Nature and Wildlife g) Themes in Nature and Wildlife Photography: i) Landscapes ii) Plants and animals (invertebrates and vertebrates) iii) Environment: Climate and surrounding iv) People and nature: issues and challenges v) Human and wildlife: issues and challenges vi) Introduction to conservation through photography	15	1

About the course:

The course intends to make the students to observe and describe visual qualities represented in nature and wildlife. The course aims to focus on innate qualities of students to look a nature and wildlife in scientific perspective for communicating great ideas visually and aesthetically. The course also aims to develop expertise in handling basic camera as a tool to present stories that can convey right stories for conservation and education.

Learning outcomes:

After completing this course, the student will be able to:
a) Understand basics of photography

b) Using camera for scientific purpose
c) To use basic camera for conveying great stories as documentaries on nature and wildlife issues and challenges

Recommended readings:

1) Craven, Roy C. 'Indian Art: A Concise History' . London: Thames and Hudson. 1976 2.
2) Flexner, Stuart B. et al. [ed]. 'The Random House Library pf Painting and Sculpture' [4 volumes]. New York: Random House.1981
3) Wilkins, David G and Bernard Schultz, ' Art Past, Art Present'. New York: Harry N Abrams inc 1990.
4) Woods, Gerald, et al [Ed]. 'Art without boundaries' - 1950 - 70. London. Thames and Hudson. 1972

Walchand College of Arts and Science, Solapur (Autonomous)
B. SC. Part – I Semester I (w.e.f. June, 2023)
Subject- Visual Arts-I: Nature and Wildlife Photography: Introduction

Semester-I: Practical Syllabus Co-curricular Course (CC-I-P)

Marks: 25 **Credits: 01 (Contact Hours-30)**

Sr.No.	Name of Practical
1	Understanding camera settings in basic digital camera
2	Understanding settings in basic mobile camera
3	Experimenting with Wildlife Photography within campus: Landscapes, patterns and texture
4	Experimenting with Wildlife Photography within campus: Flowers and Leaves
5	Experimenting with Wildlife Photography within campus: macro with invertebrates
6	Mini Project on: creative photography, photo-story on nature and wildlife in the surrounding

SEMESTER-II

Walchand College of Arts and Science, Solapur (Autonomous)
B. SC. Part – I Semester-II (w.e.f. June, 2023)
Subject- Major (Mandatory)

Semester-II: Comparative Anatomy of Vertebrates and Developmental Biology of Vertebrates (DSC-II)

Marks: 100 **Credits: 04 (Contact Hours-60)**

Unit Number	Title of the Unit	Contact Hours	No. of Credits
1	**Comparative Anatomy of Vertebrates:** **A) Integumentary System** • Integument of: Skin of *Scoliodon*, frog, *Calotes*, Pigeon, Rat **B) Skeletal System** • Pectoral girdle of: frog, Calotes, pigeon, rat **C) Digestive System** • Alimentary canal of: Calotes, Pigeon, Rat **D) Respiratory System** • Brief account of skin, gills, lungs, air sacs and swim bladder	15	1
2	**E) Circulatory System** • Structure of heart of: *Scoliodon*, frog, *Calotes*, Pigeon, Rat **F) Urinogenital System** • Brief account of Kidney: Pronephros, Mesonephros, Metanephros **G) Nervous System**	15	1

	• Brief comparative account of brain of: Pigeon, Rat **H) Tools to Investigate Human Anatomy** • Introduction to Endoscopy, Ultrasound, Computer Tomography (CT) & Magnetic Resonance Imaging (MRI)		
3	**Developmental Biology of Vertebrates:** **A) Gametogenesis:** • Spermatogenesis and oogenesis with reference to mammals • Vitellogenesis in birds and structure of hen's egg **B) Fertilization** • External fertilization in amphibians • Internal fertilization in mammals • General mechanism of fertilization in mammals **C) Early Embryonic Development up to Gastrulation** • Cleavage, blastulation and gastrulation in frog • Cleavage, blastulation and gastrulation in human • Fate map of blastula in frog and human **D) Placenta in mammal** • Implantation of blastocyst in human, human placenta and functions • Types of placenta on the basis of histology	15	1
4	**E) Development and its Regulation** • Cellular differentiation: Definition, mechanism of differentiation • Cellular movements: Epiboly, emboly and its significance in development • Apoptosis: Definition, general mechanism and significance **F) General Topics in Embryology** • Metamorphosis in frog tadpole and its hormonal regulation • Types of twins in human	15	1

	G) Recent Developments in Human Embryology • Principles and applications of ultrasound • Causes of miscarriages **H) Tools to Investigate Embryo** • Introduction and definition of ART, ICSI, IVF and • Legal & ethical aspects of IVF		

About the course

The course makes a detailed comparison of the anatomy of the different taxa of non-chordates. It also highlights how in the taxonomic hierarchy, there is an increase in the complexity of structure and function. The course explains the sequence of events starting with a single cell to the production of a very complex organism. The course not only describes how embryos develop (embryology), but also highlights how the processes of development are brought about by changing individual cells into specialized cells with specific functions (the cellular level). It also deals with a comparative account of development in some select groups of animals.

Course outcomes

After successfully completing this course, the students will be able to

- Develop an understanding of the characters used to classify besides being able to differentiate the organisms belonging to different taxa.
- Acquire knowledge of the coordinated functioning of complex human body machine.
- Have hands on experience of materials demonstrating the diversity of protists and non-chordates.
- Understand the relative position of individual organs and associated structures through dissection of the invertebrate representatives.
- Realize that very similar physiological mechanisms are used in very diverse organisms.
- Get a flavor of research by working on project besides improving their writing skills. It will further enable the students to think and interpret individually.
- Undertake research in any aspect of animal physiology in future.
- Understand poultry management, the breeds and diseases of poultry birds and learn the testing of meat & egg quality.
- Maintenance of laboratory specimens, importance of studying anatomy & recent imaging tools used to decipher deeper understanding of anatomy and evolution.
- Develop critical understanding how a single-celled fertilized egg becomes an embryo and then a fully formed adult by going through three important processes of cell division, cell differentiation and morphogenesis.
- Understand how developmental processes and gene functions within a particular tissue or organism can provide insight into functions of other tissues and organisms.
- Understand how the field of developmental biology has changed since the beginning with different phases of developmental research predominating at different times.
- Learning Outcomes: Challenges and opportunities of newer fertility techniques in India.

REFERENCES:

1) Kardong, K.V. (2005) Vertebrates' Comparative Anatomy, Function and Evolution. IV Edition. McGraw-Hill Higher Education.
2) Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies.

3) Hilderbrand, M and Gaslow G.E. Analysis of Vertebrate Structure, John Wiley and Sons. 4) Walter, H.E. and Sayles, L.P; Biology of Vertebrates, Khosla Publishing House.
5) Gilbert, S. F. (2006). Developmental Biology, VIII Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.
6) Balinsky, B.I. (2008). An introduction to Embryology, International Thomson Computer Press.
7) Carlson, Bruce M (1996). Patten's Foundations of Embryology, McGraw Hill, Inc.
8) A Textbook of Clinical Embryology: Elizer Girsh (Cambridge Publishers)
9) Anatomy and physiology: Ross & Wilson (Elsevier)

Walchand College of Arts and Science, Solapur (Autonomous)
B. SC. Part – I Semester-II (w.e.f. June, 2023)
Sub- Major (Mandatory): Comparative Anatomy of Vertebrates and Developmental Biology of Vertebrates

Semester-II: Practical-II

Marks: 50 **Credits: 02 (Contact Hours-60)**

Sr.No.	Name of Practical
1	**Developmental Biology of Vertebrates:** **Frog** - Study of developmental stages - whole mounts and sections through permanent slides – cleavage, blastula, gastrula, tadpole external and internal gill stages. **(CD/Model/Chart/Slides/Virtual CD)**
2	**Chick embryology:** Demonstration of internal structure chick egg (unfertilized/fertilized)
3	**Chick Embryology:** W.M. of embryonic stages: 24hrs, 33hrs, 48hrs, 72 hrs
4	**Placenta:** Study of the different types of mammalian **placenta-** histological sections using permanent slides or Intact placenta of Rat/Human using laboratory material/ photomicrographs./**CD/Model/Chart/Slides/Virtual CD**
5	**Examination of gametes-** frog/rat - sperm and ova through permanent slides or photomicrographs./**CD/Model/Chart/Slides/Virtual CD**
6	**Field Studies:** Documentation of insect eggs and developmental stages from campus
7	**Mini Project:** Submission of mini project report on eggs and developmental stages of insects and other species
8	**Comparative anatomy**: Integument (L.S.), Hearts, Brain, Kidney, Lungs, Gills (Pisces to Mammals)
9	**Comparative anatomy**: Pectoral and pelvic girdles from amphibians to mammals
10	**Study Tour-**Visit to any suitable museum and laboratory: IVF and hospital Facility / Research Centre and submission of report. **All necessary precautions must be taken while organizing study tour with reference to the safety of students.**

Course outcomes: About the course:

The practical course at B.Sc.-I Zoology aims to give a broad outline based on the study of invertebrates, vertebrates, anatomy, histology, cell biology, embryology & filed based investigations of diversity.

Learning Outcomes:

- Observational understanding of diversity of invertebrate & vertebrates
- Recording of notes on museum specimens
- Microscopic investigation specimens, cellular organization & record keeping
- Observation of developmental stages of vertebrates
- Practical based on fundamentals of cell and cellular architecture
- Field based learning involving exploration using scientific methods

Walchand College of Arts and Science, Solapur (Autonomous)
B. SC. Part-I Semester-II (w.e.f. June, 2023)
Subject: Open Elective-II: Food, Nutrition and Health

Semester-II: Theory Syllabus (OE-II)

Marks: 50 **Credits: 02 (Contact Hours-30)**

Unit Number	Title of the Unit	Contact Hours	No. of Credits
1	**Nutrition and Dietary Nutrients:** • Basic concept of Food: Components and nutrients • Concept of balanced diet • Nutrient requirements and dietary pattern for different groups:- adults and elderly people • Nutritional Biochemistry: Macronutrients:-Carbohydrates, Lipids, Proteins- dietary source and role. • Micronutrients. Vitamins-Water-soluble and Fat-soluble vitamins- their sources and importance • Important minerals *viz*., Iron, Calcium, Phosphorus, Iodine, Selenium and Zinc: their biological functions	15	1
2	**Malnutrition and Nutrient Deficiency Diseases:** • Definition and concept of health • Common nutritional deficiency diseases- Protein Malnutrition (e.g., Kwashiorkor and Marasmus), Vitamin A deficiency, Iron deficiency and Iodine deficiency disorders • Life style dependent diseases- Introduction to hypertension, diabetes mellitus, and obesity- their causes and prevention • Social health problems- smoking, alcoholism, narcotics. Acquired Immuno-deficiency Syndrome (AIDS): causes, treatment and prevention, Junk food and its consequence on health • Food and Water-borne infections: Bacterial diseases: cholera, dysentery; typhoid fever,	15	1

About the course

The course covers the basic concepts of balanced diet for people of different ages besides focusing on the consequences of malnutrition and the deficiency diseases and the diseases caused due to poor hygiene.

Learning outcomes

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

1) Understand the role of food and nutrients in health and disease.
2) Provide culturally competent nutrition services for diverse individuals.
3) Implement strategies for food access, procurement, preparation, and safety that are relevant for the culture, age, literacy level, and socio-economic status of clients and groups.
4) Perform food system management and leadership functions that consider sustainability in business, healthcare, community, and institutional arenas.

Recommended readings:

1. Mudambi, S.R. and Rajagopal, M.V. (2007). Fundamentals of Foods, Nutrition and Diet Therapy; Fifth Ed;; New Age International Publishers
2. Srilakshmi, B. (2002). Nutrition Science; New Age International (P) Ltd.
3. Srilakshmi, B. (2007). Food Science; Fourth Ed; New Age International (P) Ltd.
4. Swaminathan, M. (1986). Handbook of Foods and Nutrition; Fifth Ed; BAPPCO.
5. Bamji, M.S.; Rao, N.P. and Reddy, V. (2009). Text Book of Human Nutrition; Oxford & IBH Publishing Co. Pvt Ltd.
6. Wardlaw, G.M. and Hampl, J.S. (2007). Perspectives in Nutrition; Seventh Ed; McGraw Hill.

Walchand College of Arts and Science, Solapur (Autonomous)
B. SC. Part -I Semester II (w.e.f. June, 2023)
Sub- Open Elective-II: Food, Nutrition and Health
Semester-II: Practical Syllabus (OE-II-P)

Marks: 50 **Credits: 02 (Contact Hours-60)**

Sr. No.	Name of Practical
1	To study the composition of milk and egg as a balanced food
2	To study the nutritional value of common Indian vegetables
3	To study the nutritional value of common Indian fruits
4	To collect data from hospital on nutritional deficiency diseases
5	To study the prevalence of diabetes mellitus and various obesity related diseases
6	To perform Blood Pressure measurement using BP apparatus
7	To perform measurement of BMI and draw conclusion based on result
8	To prepare graphs using MS-Excel based on BMI, height and weight data

Walchand College of Arts and Science, Solapur (Autonomous)
B. SC. Part-I Semester-II (w.e.f. June, 2023)
Subject: Value Education Course-I: Environmental Education

Semester-II: Theory Syllabus (VEC)

Marks: 50 **Credits: 02 (Contact Hours -30)**

Unit Number	Title of the Unit	Contact Hours	No. of Credits
1	a) Definition, scope and importance; Multidisciplinary nature of environmental education; Need for public awareness b) Renewable and non-renewable resources: forest resources, water resources, mineral resources, food resources, energy and land resources c) Sustainable Lifestyles: Lifestyle for the Environment (Life) (COP-26)-Mission lifestyle and Indian culture and living traditions for sustainability d) Water conservation, rain water harvesting, watershed management; Urban heat islands; Global climate change; Concept of smart city	15	1
2	a) Concept of ecosystem; producers, consumers and decomposers; Food chains, food webs and ecological pyramids b) Types of ecosystems: Forest, grassland, desert and aquatic ecosystems c) Biodiversity and its conservation: Definition: genetic, species and ecosystem diversity; Biogeographical classification of India; India as a mega-diversity nation; Hot-spots of biodiversity in India; sacred groves in India; Wildlife Protection Act d) Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; In-situ and Ex-situ conservation of biodiversity; Project Tiger; Reintroduction of Cheetah in India e) Environmental pollution: Cause, effects and control measures of :-Air, water and soil pollution; Solid waste Management : Causes, effects and control measures of urban	15	1

	and industrial wastes; Pollution case studies in India and world (Minamata disease; Bhopal Gas Tragedy)		

About the Course:

The course aims to impart fundamental education related to environment and its association with other living creatures including animals. The course will cover types, structure and functioning of various ecosystems. The students will be introduced about natural resources, biodiversity, threats, pollutions and the role of individuals, community and nation in sustaining these resources for future generation

Learning Outcomes: After completing the course, the student will able to:
Understand the meaning of ecosystem, Types of ecosystems, Natural resources Causes of depletion of resources, biodiversity, Pollution and its impact and measures for mitigation and Urban challenges and smart city.

Recommended Readings:

1) Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2) Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India.
3) Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p d) Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
4) Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
5) De A.K., Environmental Chemistry, Wiley Eastern Ltd.
6) Down to Earth, Centre for Science and Environment (R)
7) Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
8) Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
9) Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
10) Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.

Walchand College of Arts and Science, Solapur (Autonomous)
B. SC. Part -I Semester II (w.e.f. June, 2023)
Subject- Visual Arts-II: Nature and Wildlife Photography: Camera as a Tool

Semester-II: Theory Syllabus Co-curricular Course (CC-II)

Marks: 25 **Credits: 01 (Contact Hours -15)**

Unit Number	Title of the Unit	Contact Hours	No. of Credits
1	a) Evolution of Camera- From film to digital era b) History and importance of film technology c) Basics of nature and wildlife photography: lenses, filters, aperture, shutter-speed, perspectives, lighting, depth of field d) Basics of nature and wildlife photography: Macro, color, contrast and movement e) Basics of nature and wildlife photography: Using ISO and introduction to image formats-RAW, TIFF, JPEG f) Approaches to wildlife photography: general considerations in zoos, in parks and local park g) Equipment for wildlife photography: Camera selection, sensor size, lens selection, examples of equipment h) Analyzing the image: frame filling, rule of thirds, framing examples i) Secrets of better wildlife photography: Understanding, patience, persistence, endurance, approaching wildlife	15	1

About the course:

The course intends to make the students to observe and describe visual qualities represented in nature and wildlife. The course aims to focus on innate qualities of students to look a nature and wildlife in scientific perspective for communicating great ideas visually and aesthetically. The course also aims to develop expertise in handling basic camera as a tool to present stories that can convey right stories for conservation and education.

Learning outcomes:

After completing this course, the student will be able to:
a) Understand basics of photography
b) Using camera for scientific purpose
c) To use basic camera for conveying great stories as documentaries on nature and wildlife issues and challenges

Recommended Readings:

1) Craven, Roy C. 'Indian Art: A Concise History' . London: Thames and Hudson. 1976 2.
2) Flexner, Stuart B. et al. [ed]. 'The Random House Library pf Painting and Sculpture' [4 volumes]. New York: Random House.1981
3) Wilkins, David G and Bernard Schultz, ' Art Past, Art Present'. New York: Harry N Abrams inc 1990.
4) Woods, Gerald, et al [Ed]. 'Art without boundaries' - 1950 - 70. London. Thames and Hudson. 1972
5) The essential guide to wildlife photography by Nina Bailey (www.eos-magazine.com/ebooks/es/)

Walchand College of Arts and Science, Solapur (Autonomous)
B. SC. Part – I Semester II (w.e.f. June, 2023)
Subject- Visual Arts-II: Nature and Wildlife Photography: Camera as Tool

Semester-II: Practical Syllabus Co-curricular Course (CC-II-P)

Marks: 25 **Credits: 01 (Contact Hours-30)**

Sr.No.	Name of Practical
1	To handle macro and zoom lenses for nature and wildlife photography
2	To take pictures of nature and wildlife photography with varying ISO settings
3	Understanding habitat and behavior of animals for better nature and wildlife photography
4	Taking pictures to understand frame filling, rule of thirds
5	To understand significance of patience and perseverance for getting rare images of wild animals
6	Mini Field Project on nature and wildlife photography

Annexure: I

Walchand College of Arts and Science, Solapur (Autonomous)
B. SC. Part – I Semester II (w.e.f. June, 2023)

Question Paper for Class Room Test (IE)
(02 Credit Theory Course)

Marks: 10

Q.No.1 Multiple choice questions - 04 marks.

Q.No.2 Attempt any two - 6 marks.

a)
b)
c)

Annexure: II:

Walchand College of Arts and Science, Solapur (Autonomous)
B. SC. Part – I Semester II (w.e.f. June, 2023)

Question Paper for Class Room Test (IE)
(04 Credit Theory Course)

Marks: 20

Q.No.1 Multiple choice questions - 08 marks.

Q.No.2 Attempt any two - 12 marks.

a)
b)
c)

Annexure: III

Walchand College of Arts and Science (Autonomous), Solapur

Theory question paper Pattern for **4 credit** course as per NEP 2020 **(ESE)**

w. e. f. 2023-24

Examination:_____

Class: B. Sc. Semester:
Subject: Paper:
Time: 2.5 hrs Marks: 60

Instructions:

1. All questions are compulsory
2. Figures to the right indicate full marks
3. Draw neat labeled drawings wherever necessary

Q. No.1 Choose the correct alternative from the following 08

i)

a) b) c) d)

ii)
iii)
iv)
v)
vi)
vii)

viii)

Q. No.2 Answer the following questions (Any six) 12

i)
ii)
iii)
iv)
v)
vi)
vii)
viii)

Q. No.3 Answer the following questions (Any two) 12

i)
ii)
iii)

Q. No.4 Answer the following questions (Any two) 12

i)
ii)
iii)

Q. No.5 Answer the following questions (Any two) 16

i)
ii)
iii)

Annexure IV

Walchand College of Arts and Science (Autonomous), Solapur

Theory question paper Pattern for **2 credit** course as per NEP 2020 **(ESE)**

w. e. f. 2023-24

Examination:_____

Class: B. Sc. Semester:

Subject: Paper:

Time: 1.5 hrs Marks: 30

Instructions:

4. All questions are compulsory
5. Figures to the right indicate full marks
6. Draw neat labeled drawings wherever necessary

Q. No.1 Select the correct alternative of the following 06

i)

a) b) c) d)

ii)
iii)
iv)
v)
vi)

Q. No.2 Attempt the following (Any three) 06

i)

ii)
iii)
iv)
v)

Q. No.3 Attempt the following (Any two) 06

i)
ii)
iii)

Q. No.4 Attempt the following (Any two) 06

i)
ii)
iii)

Q. No.5 Attempt the following (Any one) 06

i)
ii)

Annexure-V

Walchand College of Arts and Science (Autonomous), Solapur

Theory question paper Pattern for **1 credit** course as per NEP 2020 **(ESE)**

w. e. f. 2023-24

Examination:_____

Class: B. Sc. Semester:

Subject: Paper:

Time: 1.5 hrs Marks: 25

Instructions:

7. All questions are compulsory
8. Figures to the right indicate full marks
9. Draw neat labeled drawings wherever necessary

Q. No.1 Select the correct alternative of the following 05

i)

a) b) c) d)

ii)
iii)
iv)
v)

Q. No.2 Attempt the following (Any five) 05

i)

ii)
iii)
iv)
v)
vi)
vii)

Q. No.3 A) Attempt the following (Any one) 03

i)
ii)

B) Attempt the following (Any one) 02

i)
ii)

Q. No.3 A) Attempt the following (Any one) 03

i)
ii)

B) Attempt the following (Any one) 02

i)
ii)

Q. No.5 Attempt the following (Any one) 05

i)
ii)

Annexure-VI

Scheme of Marking for End Semester Examination (ESE)
(02 Credit Practical Course)
Semester-I

Time: 3 hours **Total Marks: 30**

Q.1 Perform temporary mount of plankton(s) from given sample & discuss result 06

Q.2 Identification and explanation on vertebrate and invertebrate specimens **(Five spots)** 10

(a) Identify & classify giving reasons: Any 01 specimen from invertebrates
(b) Identify, sketch & label: Any 01 of *Amoeba/Euglena/Obelia/Paramecium*
(c) Identify & discuss morphology: Any 01 specimen from vertebrates
(d) Identify & give evolutionary significance: Any 01 of *Peripatus/Balanoglossus/Ornithorhynchus*
(e) Identify & classify giving reasons: Any 01 specimen from vertebrates

Q.3 Identification and explanation **(Four spots)** 04

(a) Identify & explain (Any one) parasite: protozoan/helminth/arthropod vector
(b) Identify & discuss (Any one): *Ascaris*/Liverfluke
(c) Identify & describe (Any one): Venomous / non-venomous snake
(d) Identify & sketch and label (Any one):T.S., L.S. of *Sycon*/*Taenia* (scolex/proglottids)

Q.4	Submission of mini project report based on local tour	05
Q.5	Laboratory Record (Journal)	05

Annexure-VII

Scheme of Marking for End Semester Examination (ESE)
(01 Credit Practical Course for CC)

Time: 3 hours **Total Marks: 25**

Practical examination will be at the end of the semester. Every candidate has to perform one Practical.

a) Practical : 20 Marks

b) Journal/Report : 05 Marks

The breakup of 20 marks should be given in the practical slip

Annexure-VIII

Scheme of Marking for End Semester Examination (ESE)
(02 Credit Practical Course)
Semester-II

Time: 3 hours **Total Marks: 30**

Q.1	Observation of internal structure of chick egg (in group of 5 students)/ Identification and explanation of type(s) of egg	06
Q.2.	Identification and explanation **(Five spots)**	10

(a) Identify & explain:	Any one developmental stage of Frog
(b) Identify, sketch & label:	Cleavage, blastula, gastrula of Frog
(c) Identify & describe (Any one):	Chick W.M.
(d) Identify & explain:	Lungs/gills comparative anatomy
(e) Identify & explain:	Gametes of Frog/Rat

Q.3.	Identification and explanation **(Four spots)**	04

(a) Any one bone: Identify & explain:	Pectoral/Pelvic Girdle of Frog
(b) Identify & explain (Any one):	Heart, Kidney (Comparative anatomy)
(c) Identify & explain (Any one):	Brain (Comparative anatomy)
(d) Identify & explain (Any one):	Pectoral/Pelvic Girdle of Mammal

Q.4.	Submission of mini project report based on local tour	05
Q.5.	Laboratory Record (Journal)	05

Chairman BOS
BoS in Zoology

॥शिक्षणहाचधर्म॥

Shri Aillak Pannalal Digambar Jain Pathashala's

(Jain Minority Institute)

WALCHAND COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS), SOLAPUR

(Affiliated to PunyashlokAhilyadevi Holkar Solapur University, Solapur)

Syllabus

Name of the Faculty: Science and Technology

New Choice Based Credit System
(According to NEP 2020)

Name of the Course: B.Sc.- First Year

Subject: Mathematics

With effect from 2023-24

Walchand College of Arts & Science, Solapur

(Autonomous)

About National Education Policy (NEP) - 2020

With the directions and guidelines issued by **Government of Maharashtra resolution dated 20th April 2023 and 16th May, 2023** regarding the implementation of NEP at UG and PG level, the Walchand College of Arts & Science (Autonomous), Solapur has taken decision to implement NEP 2020 with Choice Based Credit System (CBCS) at Undergraduate level and Post Graduate level. This has been done to achieve the goals and objectives set in NEP-2020 such as - worldwide recognition, acceptability, horizontal as well as vertical mobility for students completing undergraduate and post-graduate degree.

The CBCS provides an opportunity for the students to select from the prescribed courses comprising core, elective/minor or skill based. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations.

Outline of NEP:

The structure of the Three/Four-year bachelor's degree programme allows the opportunity to the students to experience the full range of holistic and multidisciplinary education in addition to a focus on the chosen major and minors as per their choices and the feasibility of exploring learning in different institutions. The structure allows students to learn various components like:

(a) Major (Core) Subject (DSC): This comprises of Mandatory and Elective Courses that require students to achieve:

- Minimum 50% of total credits corresponding to Three/Four - year UG Degree- Mandatory Courses are offered in all four years;
- 2 credit course on Major Specific IKS shall be included under Major;
- Elective courses of Major will be offered in the third and/or final year;
- Vocational Skill Courses, Internship/ Apprenticeship, Field Projects, Research Projects are related to Major

(b) Minor Subject (18-20 Credits)

- The Minor subjects may be from the different disciplines of the same faculty of DSC Major (Core) or they can be from different faculty altogether;
- The credits of Minor subjects shall be completed in the first three years of UG Programme

(c) Generic/ Open Elective Courses (OE) (10-12 credits)

- GE/OE are to be offered in I and/or II year;
- Faculty-wise baskets of OE shall be prepared by Autonomous College.
- OE/GE is to be chosen compulsorily from faculty other than that of the Major or as per the directions issued by NEP-Steering Committee

(d) Vocational and Skill Enhancement Courses (VSEC)

i) Vocational Skill Courses (VSC): (8-10 credits): Includes Hands on Training corresponding to the Major and/or Minor Subjects:

- To be offered in first three years;
- Wherever applicable vocational courses will include skills based on advanced laboratory practicals' of Major

ii) Skill Enhancement Courses (SEC): (06 credits)

- To be offered in I and II year;
- To be selected from the basket of Skill Courses approved by Autonomous College

(e) Ability Enhancement Courses (AEC), Indian Knowledge System (IKS) and Value Education Courses (VEC): (14 Credits)

i) AEC: (08 credits)

- To be offered in I and II year
- English: 04 Credits
- Modern Indian Language: 04 credits
- To be offered from the Basket approved by Autonomous College;

The focus for both languages should be on linguistic and communication skills.

ii) IKS: (2 Credits)

- To be offered in I Year
- Courses on IKS to be selected from the basket of IKS courses approved by Autonomous College

iii) VEC: 04 Credits

- To be offered in I year
- Value Education Courses (VEC) such as Understanding India, Environmental Science/Education, and Digital and Technological Solutions.

(f) Field Projects/ Internship/ Apprenticeship/ Community Engagement and Service corresponding to the Major (Core) Subject, Co-curricular Courses (CC) and Research Project

- Internship/Apprenticeship corresponding to the Major (Core) Subject: (8 Credits)
- Field Projects/Community Engagement and Service (CEP) corresponding to the Major (Core) Subject (minimum 4-6 credits)
  -To be offered in II and III years of UG Degree Programmes.
- Co-curricular Courses (CC) such as Health and Wellness, Yoga education, sports and fitness, Cultural Activities, NSS/NCC and Fine/ Applied/Visual/ Performing Arts: (8 credits)
  -To be offered in I and/or II year
- Research Projects: (12 credits)
  -To be offered in the final year for 4 yearHonours with Research UG Degree

➢ **CREDIT:**

- Credit is a numerical value that indicates students work load (Lectures, Lab work, Seminar, Tutorials, Field work etc.) to complete a course unit. The contact hours are transformed into credits. Moreover, the grading system of evaluation is introduced for B.Sc. course wherein process of Continuous Internal Evaluation is ensured.
- **Theory: '**15 contact hours' for theory course constitute 'one credit'
- **Practical/Tutorial: '**30 contact hours' for practical course constitute 'one credit'.
- **Workshop based activities/Skill based activities:** Minimum 30 contact hours per credit in a semester is required
- **Internship/On-Job Training: '**30 contact hours' per credit in a semester is required (1 credit/week)
- **Community Engagement and Service-CEP/Field Project:'**30 contact hours' per credit in a semester is required

- **Credit Framework under Three/Four Years UG Programme with Multiple Entry and Multiple Exit Options:**

The minimum and maximum credit structure for different levels under three or four year UG programme with multiple entry and multiple exit options are as given below:

Levels	Code	Qualification Titles	Credit Requirements		Semester	Year
			Minimum	Maximum		
4.5	100-199	UG Certificate	40	44	2	1
5.0	200-299	UG Diploma	80	88	4	2
5.5	300-399	Three Year Bachelor's Degree	120	132	6	3
6.0	400-499	Bachelor's Degree Honours **OR** Bachelor's Degree-Honours with Research	160	176	8	4
	500-599	First Year PG & or PG Diploma	40	44	2	1
6.5	600-699	PG Degree	80	88	4	2
8.0	700-799	Ph.D.	16+ Ph.D. Work		---	---

Multiple Exit Options

Year	Exit Option	Reentry
First Year	Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/Internship OR Continue with Major and Minor	Students opting for exits at any level 'will have the option to reenter' the programme from where they had left off, in the same or in different higher educational institution 'within three years of exits' and complete the degree program within the stipulated maximum period of 07 years from the date admission of first year of UG.
Second Year	Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF Course/Internship OR Continue with Major and Minor	
Third Year	Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor	
Fourth Year Honours	Four Year UG Honours Degree in Major and Minor with160-176 credits	
Fourth Year Honours with Research	Four Year UG Honours with Research Degree in Major and Minor with160-176 credits	
Post-Graduation Degree		
Post-Graduation: First Year	PGDiploma(44Credits)after ThreeYear UGDegree	Reentry to complete the PG degree after taking exit option will be permissible up to 5 years from the date admission to PG programme

- **Academic Bank of Credit (ABC):**

It is mandatory for all admitted students to get enrolled on ABC Portal and create ABC ID and share ABC-ID with academic institutions where they are enrolled. Credits earned by the students will be reflected in the students ABC account. This will allow students smooth transition during multiple entry and exit.

Program Specific Outcomes: At the end of the programme

- A student should be able to recall basic facts about mathematics and should be able to display knowledge of conventions such as notations, terminology.
- A student should get adequate exposure to global and local concerns that explore them many aspects of mathematical sciences.
- Student is equipped with mathematical modeling ability, problem solving skills, creative talent and power of communication necessary for various kinds of employment.
- Student should be able to apply their skills and knowledge that is translate information presented verbally into mathematical form, select and use appropriate mathematical formulae or techniques in order to process the information and draw the relevant conclusion.
- Enabling students to develop a positive attitude towards mathematics as an interesting and valuable subject of study.

Walchand College of Arts and Science (Autonomous), Solapur

Department of Mathematics

B.Sc. First Year

Mathematics

Semester I & II

CBCS (Choice Based Credit System)

With effect from 2023-24

Preamble:

B.Sc.- I Mathematics is framed to provide the tools to get the easy and precious outcomes to various applications of science and technology. Also, logical development of various algebraic statements can be made to develop the innovative approach of various concepts and it can be applied to various abstract things. In the theory courses of Algebra and Calculus, Differential calculus and Differential equations. Various deductions of theorems, corollaries and lemmas will be acquired by students. Change is the Universal truth of the nature. So our aim is that students should learn various techniques to find solutions.

Objectives of the Course:

- To design the syllabus with specific focus on key learning areas.
- To equip student with necessary fundamental concept and knowledge base.
- To develop specific problem-solving skills.
- To import training on abstract concepts, analysis, deductive techniques.
- To prepare students for demonstrating the acquired knowledge.
- To encourage the student to develop skills fie developing innovative ideas.
- A student be able to apply their skill and knowledge that is translate information presented verbally into mathematical form select and use appropriate mathematical formulae or techniques in order to process the information and draw the relevant conclusion.
- Student should get adequate exposure to global and local concerns that explore them many aspects of mathematical sciences.

Eligibility and Admission:

A Candidate passing 10+2 with Mathematics as subject and passed from state syllabus / CBSE / ICSE equivalent with minimum passing percentage of as per the directives of the higher education. The duration of the B.Sc.-I course is of 1 year (comprising 2 semesters).

Duration:

The duration of the B.Sc.-I course is of 1 year (comprising 2 semesters) and the B.Sc. entire program is of 3 years (06 Semesters) and/or 4 years (08 semester comprising Bachelors Degree-Honours and/or Bachelors Degree-Honours with Research degree) with multiple entry and exit options.

Medium of Instruction: English

Pattern of the Course: The autonomous college follows semester pattern.

Structure of Course for B.Sc.-I MATHEMATICS according to NEP
(Semester-I & II)
Choice Based Credit System (CBCS) Structure (2023-24)
(Theory and Tutorial)

SEMESTER-I				
Subject	**Paper Title**	**Credits**	**Hours/week**	**Total Contact Hours**
Major (Mandatory) Mathematics DSC- I	Paper-I: Algebra and Calculus	4	4	60
Major (Mandatory) Mathematics Tutorial-I	Tutorial-I: Mathematics	2	4 (hours/week/batch)	60
SEMESTER-II				
Major (Mandatory) Mathematics DSC- II	Paper-II: Differential Calculus and Differential Equations	4	4	60
Major (Mandatory) Mathematics Tutorial-II	Tutorial-II: Mathematics	2	4 (hours/week/batch)	60

Outline of Examination

THEORY:

1) Internal Evaluation (IE): Internal evaluation will consist of **40 % marks** per semester per paper. It may be held as **per the following scheme** per semester **(Annexure: I)**

Credits	Marks for Attendance	Classroom Test	Home Assignment	Marks for Presentation/Group Discussion/ Participation/Field work/Study visit	Total Marks
04	05	20	05	10	40

2) End Semester Examination (ESE): The detailed question paper pattern (**60% marks per paper)** is given as in **Annexure- II**

TUTORIAL:

1) Internal Evaluation (IE): Internal evaluation will carry **40 % marks** and may consist of:

Credits	Marks for Attendance	Internal Tutorial Exam	Journal	Total Marks
02	05	10	05	20

2) **End Semester Examination (ESE):** End Semester Examination **60 % marks** shall be conducted at the end of each semester.

Semester – I

Paper- I: Algebra and Calculus

Marks:100 **Credits-4.0 (Contact Hours- 60)**

Unit Number	Title	Contact Hours	Credit
1	**Matrices** Symmetric and skew symmetric,Elementary transformations, Rank of Matrix (Echelon and Normal form),Characteristics equation of a matrix,Cayley- Hamilton theorem and its use in finding the inverse of a matrix,Application of matrices to a system of linear (both Homogenous and non-homogenous) equations, Eigen values and Eigen vectors.	**15**	**1**
2	**Complex Number** Modules and Argument of a Complex Number, DeMoivreo's Theorem and its applications, Roots of Unity, Root of Complex Numbers,Circular functions and their inverse, Hyperbolic function of a complex variable with their inverse.	**15**	**1**
3	**Successive differentiation** Successive differentiation,n^{th} derivative of standard functions, Leibnitz's rule, Taylor's theorem and Maclaurine's theorem (Only Statements), Series expansions of e^x, cos x, sin x, $(1+x)^n$, log(1+x), Darboux's Theorem, Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem (Only statements).	**15**	**1**
4	**Functions of two variables and vector calculus** Limit and Continuity of function of two variables,ϵ-δ definition of limit of real valued function, Continuity of a real valued function, Partial derivatives, Partial derivatives of higher orders, Homogeneous functions, Euler's Theorem on Homogenous function and it's corollaries, Scalar point function, Vector point function, Directional derivatives, Gradient, Divergence and Curl and its properties.	**15**	**1**

Course Outcomes: At the end of the course students will be able to

- Understand the consequences of various mean value theorems for differentiable functions.
- Learn to find partial derivative, successive derivative of given function.
- Learn conceptual various variations while advancing from one variable to several variable in calculus.

Learning outcomes: The course will enable the students to

1) Find eigenvalues and corresponding eigenvectors for a square matrix.
2) Solve the system of homogeneous and non-homogeneous linear equations.
3) Employ De Moivre's theorem in a number of applications to solve numerical problems.
4) Identify and apply intermediate value theorem, mean value theorem.
5) Find limit, continuity and partial derivatives of function of two variable.

Reference Books:

1. A text book of Matrices by Shantinarayan, S.Chand Co., (Pvt.) Ltd. New Delhi.
2. Modern Algebra by Vashishtha, Krishna Prakashan, Meerut.
3. Algebra B.Sc.I(Sem-I)Mathematics Paper-I by Prof.S.J.Alandkar, Prof.N.I.Dhanshetti, Prof.A.S.Dhone, Prof.R.D.Mahimkar, Nirali Prakashan.
4. Algebra B.Sc.I(Sem-I)Mathematics Paper-I by Dr. B.P.Jadhav, Prof. A.M.Mahajan, Prof. S.P.Gade, Prof. B.D.KokarePhadakePrakashan.

5. Algebra and Geometry B.Sc.- part I by Mr. L. G. Kulkarni, Dr. B. P. Jadhav, Dr. M.K. Kubde Dr.Mrs. P.D. Patwardhan Phadke Prakashan.
6. Differential Calculus by ShantinarayanS.Chand and Co., New Delhi.
7. A Text Book of Vector Calculus by Shantinarayan and KapoorS.Chand and Co., New Delhi.
8. Calculus B.Sc.-I (Sem-II) Mathematics Paper-II by Prof. S.J. Alandkar, Prof. N.I. Dhanshetti, Prof. Dhone A.S., Prof. R.D.Mahimakar, Nirali Prakashan.
9. Calculus B.Sc.I (Sem-II) Mathematics paper-II by Prof.Dr. B.P.Jadhav, Prof. A.M. Mahajan, Prof.Dr. S.P.Gade, Prof. B.D.Kokare, Phadke Prakashan.

Tutorial-I: Mathematics

Marks:50 **Credits-2.0 (Contact Hours- 60)**

Title	Contact Hours	Credits
Tutorial 1 –To find inverse of matrix by Cayley-Hamilton Method. Tutorial 2 – Problems on system of linear homogenous equation. Tutorial 3 – Problems on system of non-linear homogenous equation. Tutorial 4 – Problems on n^{th} roots of a complex number. Tutorial 5 – Problems on circular functions and hyperbolic function. Tutorial 6 – To find n^{th} order derivative by Leibnitz Rule. Tutorial 7 - Problems on Higher Order Partial Derivatives. Tutorial 8 - Numerical Problems based on function of two variables. Tutorial 9 - Numerical Problems on directional derivative, gradient. Tutorial 10 – Numerical Problems on divergence, curl.	**60**	**2.0**

Course Outcomes: At the end of the course students will be able to

- Find inverse of matrix.
- Find n^{th} roots of a complex number.
- Calculate higher order partial derivatives.

Learning outcomes: The course will enable the students to

1) Learn to solve system of linear equation.
2) Solve the system of homogeneous and non-homogeneous linear equations.
3) Be familiar with the techniquesof limit, continuity and derivative of function of two variables.
4) Find directional derivative, gradient, divergence, curl.

Semester-II

Paper-II: Differential Calculus and Differential Equations

Marks:100 **Credits-4.0 (Contact Hours- 60)**

Unit Number	Title of the unit	Contact Hours	Credit
1	**Maxima, Minima and Jacobians** Definition of Maximum value and minimum value of a function of one, two variables, Necessary condition for extreme values (Statements only), sufficient condition for extreme values (Statements only), Use of second order derivatives. Maxima and Minima of a function of two variables, Lagrange's Method of undetermined multipliers of two variables and three variables. Definition of a Jacobian, Jacobian of a function of function, Jacobian of implicit function, Condition of dependent functions (statement only).	**15**	**1**
2	**Curvature** Definition of Curvature, Length of arc as a function, Radius of curvature, Cartesian Equation, Parametric Equations, Polar Equations, Pedal Equations.	**15**	**1**
3	**Differential equations of first order and first degree** Exact differential equations, Necessary and sufficient condition for exactness, Integrating Factor with four rules, Linear differential equations of the form $dy/dx+Py=Q$, Bernoulli's Equation $dy/dx+Py=Qy^n$	**15**	**1**
4	**Linear differential equations with constant coefficients** Complementary function and particular integral, General solution of $f(D)y=X$, Solution of $f(D)y=0$ for non-repeated, repeated, real and complex root, Solution of $f(D)y=X$ where X is of the form e^{ax}, $\sin(ax)$, $\cos(ax)$, x^m, $e^{ax}V$, xV	**15**	**1**

Course Outcomes: At the end of the course students will be able to

- Calculate maximum and minimum value of function of one variable and two variables, Jacobian
- Find curvature of given curve.
- Understand the genesis of ordinary differential equations.
- Learn various techniques of getting exact solutions of solvable first order differential equations and linear differential equations of higher order.

Learning outcomes: The course will enable the students to

1) Calculate extreme value of function.
2) Calculate curvature of given curve.
3) Solve exact differential equation, Bernoulli's equation.
4) Solve linear differential equation with constant coefficient.

Reference Books:

1. Differential Calculus by Shanti Narayan and P.K.Mittal S.Chand Publication Revised Edition 2005.
2. Dr. Alandkar S. J., Prof. Dhanshetti N. I., Prof. Dhone A. S. and Prof. Mahimkar R. D., B. Sc. – II (Mathematics) Semester-III, Paper –V Differential Calculus, Nirali Prakashan Pune.
3. Dr. Jadhav B. P, Prof. Mahajan A. M., Prof. Gade S. P. and Prof. Kokare B. D., B.Sc. – II (Mathematics) Semester-III, Paper –V Differential Calculus, Phadke PrakashanKolhapur.
4. Gorakh Prasad, Differential Calculus, Pothishala Pvt. Ltd., Allahabad

5. N. Piskunov, Differential and Integral Calculus, Peace Publishers, Moscow
6. P. N. Wartikar and J. N. Wartikar, A Text Book of Applied Mathematics, Vol. I, Poona Vidyarthi GrihaPrakashan, Poona 30.
7. Tom M. Apostol, Calculus Vol I and II, Wiley Publication.
8. Introductory Course on Differential Equation by Murray D.A. Orient Longmart India.
9. Ordinary and Partial Differential Equations by Raisinghania M.D. S.Chand and Co. Pvt. Ltd. New Delhi.
10. Differential Equation B.Sc.-I (Sem-II) Mathematics Paper-IV. By Prof.Dr. B.P. Jadhav, Prof. A.M.Mahajan, Prof. Dr.S.P.Gade, Prof. B.D.Kokare, Phadke Prakashans First Edition-2019.
11. Differential Equation B.Sc.-I(Sem-II) Mathematics Paper-IV by Prof. S.J.Alandkar, Prof. N.I.Dhanshetti, Prof. Dhone A.S., Prof. R.D.Mahimkar, Nirali Prakashan,Pune.

Tutorial-II: Mathematics

Marks:50 **Credits-2.0 (Contact Hours- 60)**

Title of the tutorial	Contact Hours	Credits
Tutorial 1 – Problems on Maxima and Minima. Tutorial 2 – Problems on Jacobians of a function of function. Tutorial 3 – Problems on Jacobians of implicit function. Tutorial 4 – Numerical Problems on Curvature part-I. Tutorial 5 –Numerical Problems on Curvature part-II. Tutorial 6 –Problems on Exact differential equation. Tutorial 7 –Problems on Linear Differential equation. Tutorial 8 -Particular integral by short method when X = e^{ax} or x^m. Tutorial 9 - Particular integral by short method when X = $sinax$ and $cosax$. Tutorial 10 - Particular integral by short methods when X = $e^{ax}V,\ XV$.	**60**	**2**

Course Outcomes: At the end of the course students will be able to

- Calculate Jacobian of given function.
- Calculate extreme values of function.
- Enable to solve ordinary differential equations.
- Learn to find particular integral.

Learning outcomes: The course will enable the students to

1) Calculate maximum and minimum of given function.
2) Calculate curvature of given curve.
3) Solve differential equation of first order and first degree.
4) Solve linear differential equation with constant coefficient.

Annexure: I:

Walchand College of Arts and Science, Solapur(Autonomous)
B. SC. Part – I Semester II (w.e.f. June, 2023)

Question Paper for Class Room Test (IE)

(04 Credit Theory Course)

Marks: 20

Q.No.1 Multiple choice questions - 08 marks.

Q.No.2 Attempt any two - 12 marks.

a)
b)
c)

Annexure: II

Walchand College of Arts and Science (Autonomous), Solapur

Theory question paper Pattern for **4 credit**course as per NEP 2020 **(ESE)**

w. e. f. 2023-24

Examination:_____

Class: B. Sc. Semester:

Subject: Paper:

Time: 2.5 hrs Marks: 60

Instructions:

1. All questions are compulsory
2. Figures to the right indicate full marks
3. Draw neat labeled drawings wherever necessary

Q. No.1 Choose the correct alternative from the following 08

i)

a) b) c) d)

ii)

iii)

iv)

v)

vi)

vii)

viii)

Q. No.2 Answer the following questions (Any six) 12

i)

ii)

iii)

iv)

v)

vi)

vii)

viii)

Q. No.3 Answer the following questions (Any two) 12

i)

ii)

iii)

Q. No.4 Answer the following questions (Any two) 12

i)

ii)

iii)

Q. No.5 Answer the following questions (Any two) 16

i)

ii)

iii)

‘Shikshan Haach Dharma’

S. A. P. D. Jain Pathashala’s
(Jain Minority Institute)

WALCHAND COLLEGE OF ARTS AND SCIENCE SOLAPUR

Autonomous College

(Affiliated to P.A.H. Solapur University, Solapur)

Name of Faculty: Science and Technology

Choice Based Credit System

According to National Education Policy (NEP) - 2020 framework

B.Sc. I, (Semester I – II)

Subject: Botany

With effect from: 2023-24

Walchand College of Arts & Science, Solapur
(Autonomous)

About National Education Policy (NEP) - 2020

With the directions and guidelines issued by **Government of Maharashtra resolution dated 20th April 2023 and 16th May, 2023** regarding the implementation of NEP at UG and PG level, the Walchand College of Arts & Science (Autonomous), Solapur has taken decision to implement NEP 2020 with Choice Based Credit System (CBCS) at Undergraduate level and Post Graduate level. This has been done to achieve the goals and objectives set in NEP-2020 such as- worldwide recognition, acceptability, horizontal as well as vertical mobility for students completing undergraduate and post-graduate degree.

The CBCS provides an opportunity for the students to select from the prescribed courses comprising core, elective/minor or skill based. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations.

Outline of NEP:

The structure of the Three/Four-year bachelor's degree programme allows the opportunity to the students to experience the full range of holistic and multidisciplinary education in addition to a focus on the chosen major and minors as per their choices and the feasibility of exploring learning in different institutions. The structure allows students to learn various components like:

(a) Major (Core) Subject (DSC): This comprises of Mandatory and Elective Courses that require students to achieve:

- Minimum 50% of total credits corresponding to Three/Four - year UG Degree- Mandatory Courses are offered in all four years;
- 2 credit course on Major Specific IKS shall be included under Major;
- Elective courses of Major will be offered in the third and/or final year;
- Vocational Skill Courses, Internship/ Apprenticeship, Field Projects, Research Projects are related to Major

(b) Minor Subject (18-20 Credits)

- The Minor subjects may be from the different disciplines of the same faculty of DSC Major (Core) or they can be from different faculty altogether;
- The credits of Minor subjects shall be completed in the first three years of UG Programme

(c) Generic/ Open Elective Courses (OE) (10-12 credits)

- GE/OE are to be offered in I and/or II year;
- Faculty-wise baskets of OE shall be prepared by Autonomous College.
- OE/GE is to be chosen compulsorily from faculty other than that of the Major or as per the directions issued by NEP-Steering Committee

(d) Vocational and Skill Enhancement Courses (VSEC)

i) Vocational Skill Courses (VSC): (8-10 credits): Includes Hands on Training corresponding to the Major and/or Minor Subjects:

- To be offered in first three years;
- Wherever applicable vocational courses will include skills based on advanced laboratory practicals' of Major

ii) Skill Enhancement Courses (SEC): (06 credits)

- To be offered in I and II year;
- To be selected from the basket of Skill Courses approved by Autonomous College

(e) Ability Enhancement Courses (AEC), Indian Knowledge System (IKS) and Value Education Courses (VEC): (14 Credits)

i) AEC: (08 credits)

- To be offered in I and II year
- English: 04 Credits
- Modern Indian Language: 04 credits
- To be offered from the Basket approved by Autonomous College;

The focus for both languages should be on linguistic and communication skills.

ii) IKS: (2 Credits)

- To be offered in I Year
- Courses on IKS to be selected from the basket of IKS courses approved by Autonomous College

iii) VEC: 04 Credits

- To be offered in I year
- Value Education Courses (VEC) such as Understanding India, Environmental Science/Education, and Digital and Technological Solutions.

(f) Field Projects/ Internship/ Apprenticeship/ Community Engagement and Service corresponding to the Major (Core) Subject, Co-curricular Courses (CC) and Research Project

- Internship/Apprenticeship corresponding to the Major (Core) Subject: (8 Credits)

- Field Projects/Community Engagement and Service (CEP) corresponding to the Major (Core) Subject (minimum 4-6 credits)
  -To be offered in II and III years of UG Degree Programmes.
- Co-curricular Courses (CC) such as Health and Wellness, Yoga education, sports and fitness, Cultural Activities, NSS/NCC and Fine/ Applied/Visual/ Performing Arts: (8 credits)
  -To be offered in I and/or II year
- Research Projects: (12 credits)
  -To be offered in the final year for 4 year Honours with Research UG Degree

➢ **CREDIT:**

- Credit is a numerical value that indicates students work load (Lectures, Lab work, Seminar, Tutorials, Field work etc.) to complete a course unit. The contact hours are transformed into credits. Moreover, the grading system of evaluation is introduced for B.Sc. course wherein process of Continuous Internal Evaluation is ensured.
- **Theory: '**15 contact hours' for theory course constitute 'one credit'
- **Practical/Tutorial: '**30 contact hours' for practical course constitute 'one credit'.
- **Workshop based activities/Skill based activities:** Minimum 30 contact hours per credit in a semester is required
- **Internship/On-Job Training: '**30 contact hours' per credit in a semester is required (1 credit/week)
- **Community Engagement and Service-CEP/Field Project:'**30 contact hours' per credit in a semester is required

➢ **Credit Framework under Three/Four Years UG Programme with Multiple Entry and Multiple Exit Options:**

The minimum and maximum credit structure for different levels under three or four year UG programme with multiple entry and multiple exit options are as given below:

Levels	**Code**	**Qualification Titles**	**Credit Requirements**		**Semester**	**Year**
			Minimum	**Maximum**		
4.5	100-199	UG Certificate	40	44	2	1
5.0	200-299	UG Diploma	80	88	4	2
5.5	300-399	Three Year Bachelor's Degree	120	132	6	3
6.0	400-499	Bachelor's Degree Honours **OR** Bachelor's Degree-Honours with Research	160	176	8	4
	500-599	First Year PG & or PG Diploma	40	44	2	1
6.5	600-699	PG Degree	80	88	4	2
8.0	700-799	Ph.D.	16+ Ph.D. Work		---	---

Multiple Exit Options

Year	Exit Option	Reentry
First Year	Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/Internship OR Continue with Major and Minor	Students opting for exits at any level 'will have the option to reenter' the programme from where they had left off, in the same or in different higher educational institution 'within three years of exits' and complete the degree program within the stipulated maximum period of 07 years from the date admission of first year of UG.
Second Year	Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF Course/Internship OR Continue with Major and Minor	
Third Year	Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor	
Fourth Year Honours	Four Year UG Honours Degree in Major and Minor with160-176 credits	
Fourth Year Honours with Research	Four Year UG Honours with Research Degree in Major and Minor with160-176 credits	
Post-Graduation Degree		
Post-Graduation: First Year	PG Diploma (44Credits) after Three Year UG Degree	Reentry to complete the PG degree after taking exit option will be permissible up to 5 years from the date admission to PG programme

- **Academic Bank of Credit (ABC):**

It is mandatory for all admitted students to get enrolled on ABC Portal and create ABC ID and share ABC-ID with academic institutions where they are enrolled. Credits earned by the students will be reflected in the students ABC account. This will allow students smooth transition during multiple entry and exit.

Program Outcomes:

Botany course aims to emphasize holistic learning of the life sciences so that a graduate student must employ his knowledge in various domains ranging from core studies from microscopic organisms to giant angiosperms living in diverse ecosystems. He must use his knowledge in addressing the challenges of global concern such as environmental catastrophes, climate change, species extinctions, pandemics, sustainable economy and their utilization. A graduate in Botany must use his knowledge to instill a sense of responsibility towards everything that is natural and try to inculcate his knowledge to solve the problems faced by nation and common public. His understanding on microbial world, species behavior, plant ecology, plant physiology and the way they interact with other species and their environments must be of unique value not just for wild animals but for entire humanity. The program in Botany must enable him/her to constantly endeavour to undertake further studies in the plant sciences and in multidisciplinary areas that involve advanced or modern biology and help develop a range of generic skills that are relevant to wage employment, self-employment and entrepreneurship.

Program Specific Outcomes:

Botany students are expected to learn fundamentals of plant sciences that mostly include:

1. The morphological types and species diversity, classification and interactions among them.
2. Plants anatomy, physiology & cell biology: Looking inside the complex architecture of cells in varied species, the way they operate and peeping through complexity of cells, tissues & organs to gain an understanding from lowest to highest organization.
3. The relationship between plant and microbes.
4. The various laboratory techniques and standards in the areas of Plant Anatomy, Physiology, Metabolism, Ecology and Taxonomy.
5. Applied, allied & contemporary approaches: The science of plants has manifold applications ranging from- agriculture, forestry, nursery techniques, horticulture, pharmacy, ethenobotany, biotechnology, anatomy, biological compounds, nanotechnology, vaccine plant economics, biodiversity conservation etc.

The program of Botany aims to integrate all these concepts so that a student is prepared to contribute his skills and knowledge as demanded in his future endeavors.

Walchand College of Arts & Science, Solapur

(Autonomous)

Faculty of Science: Choice Based Credit System (CBCS)

(w.e.f. July 2023)

Preamble:

This course provides a broad overview of Botany and to produces expert hands that would have sufficient knowledge and expertise to solve the urgent problems of the region by using Botany. The course structure is basic science centric where students learn core science and are taught necessary fundamental subject for that purpose.

Objectives of the course:

1. To provide an intensive and in depth learning to the students in field of Botany.
2. Beyond simulating, learning, understanding techniques the course also addresses the underlying recurring problems of disciplines in today scientific and changing world.
3. To develop awareness and knowledge of different organization requirement and subject knowledge through varied branches and research methodologies in students.
4. To train the students to take up wide variety of roles like researchers, scientists, consultants, entrepreneurs, academicians, industry leaders and policy.

Learning outcomes:

1. Subject Botany has immense scope for job opportunities and to generate self employment using knowledge in the field of applied Botany.
2. The students will be able to establish research organizations with the help of agriculture, forest departments, government organizations and also their own industry for gardening, plant nurseries, plant pathology labs, organic farming and counseling.
3. They will join research institutes, universities, wildlife institutes, forest department for the research in the field of Botany.
4. They can join colleges, universities, GOs and NGOs in India and aboard.
5. They have opportunity to work with various departments like forest, agricultural, administrative jobs related to biodiversity and wildlife management etc.

Eligibility and Admission:

A candidate must be passed 10+2 with science streams and passed from state syllabus /CBSE / ICSE equivalent with minimum passing percentage of as per the directives of the higher education.

Duration:

The duration for the B.Sc.-I course is of 1 year (comprising two semesters) and the B.Sc. entire program is of 3 years (with six semesters)

Mode of Instruction: English/Marathi

Pattern of the Course: The autonomous college follows semester pattern.

NEP Structure for Department of Botany

	BOTANY			
	SEMESTER-I			
Subject	**Paper title**	**Credits**	**Hours/week**	**Total contact hours**
Botany GE/OE-I	Bonsai techniques	2	2	30
	Practical –I:GE/OE- Bonsai techniques	2	4 (hours/week/batch)	60
Botany VSC-I	Nursery Technique	1	1	15
	Practical –I:VSC- Nursery Technique	1	2 (hours/week/batch)	30
Botany SEC-I	Microbes	1	1	15
	Practical –I:SEC- Microbes	1	2 (hours/week/batch)	30
Botany VEC- I	Economic Botany -I	2	2	30
Botany IKS	Ethnobotany	2	2	30
	SEMESTER-II			
Botany Minor-I	Fungi	2	2	30
Botany GE/OE-II	Mushroom Culture	2	2	30
	Practical –II: GE/OE- Mushroom Culture	2	4 (hours/week/batch)	60
Botany VSC-II	Garden Techniques	1	1	15
	Practical –II: VSC- Garden Techniques	1	2 (hours/week/batch)	30
Botany SEC-II	Archegoniates	1	1	15
	Practical –II: SEC- Archegoniates	1	2 (hours/week/batch)	30
Botany VEC - II	Economic Botany -II	2	2	30
	SEMESTER-III			
Botany Minor II	Taxonomy of Angiosperms	2	2	30
	Practical –II: Minor- Taxonomy of Angiosperms	2	4 (hours/week/batch)	60
Botany GE/OE-III	Plant metabolism	2	2	30
Botany VSC-III	Plant Ecology	1	1	15
	Practical –III: VSC- Plant Ecology	1	2 (hours/week/batch)	30

	SEMESTER-IV			
Botany Minor III	Plant Anatomy	2	2	30
	Practical –III: Minor- Plant Anatomy	2	4 (hours/week/batch)	60
Botany GE/OE- IV	Reproductive biology of Angiosperms	2	2	30
Botany SEC-III	Plant Physiology	1	1	15
	Practical –III: SEC- Plant Physiology	1	2 (hours/week/batch)	30
	SEMESTER-V			
Botany Minor -IV	Plant Cytology and genetics	2	2	30
	Practical –IV: Minor- Plant Cytology and genetics	2	4 (hours/week/batch)	60
	SEMESTER-VI			
Botany Minor -V	Plant Systematics	2	2	30
	Practical –V: Minor- Plant Systematics	2	4 (hours/week/batch)	60

- Major (Core): -Mandatory course offered in four years +
  -IKS (2 credit, Major specific) +
  -Elective Courses (offered in 3rd & or final year) +
  -VSC, Internship/Apprenticeship, Field Projects, Research Project related to Major
- Minor: Subjects from different disciplines of the same faculty or they can be from different faculty altogether
- VSC: Vocational Skill Courses including hands on training corresponding to the Major/Minor subjects
- VEC: Value Education Courses such as Understanding India, Environmental Science/Education & Digital and Technological Solutions
- SEC: Skill Enhancement Courses. To be selected from basket of skill courses approved by Autonomous College
- IKS: Indian Knowledge System - Generic / Subject specific (major)
- OE: Open Elective- to be chosen compulsorily from faculty other than that of the major.
- AEC: Ability Enhancement Courses- 08 Credits (4 Credits for English + 04 Credits for Modern Indian Language)
- CEP: Community Engagement and Services related to MAJOR
- OJT: On-Job Training (Internship/ Apprenticeship)

Walchand College of Arts and Science (Autonomous), Solapur

Department of Botany

B.Sc. NEP-2020 Credit Structure

Level	Semester	Major		Minor	GE/OE	VSC,SEC (VSEC)	AEC, VEC, IKS	OJT, FP,CEP, CC,RP	Cum. Cr./Sem.	Degree/Cum. Cr.
		Mandatory	Electives							
4.5	I	-	-	-	**GE/OE-I (2T+2P)** Bonsai techniques (2 hrs) Practical- Botany GE/OE-I (4 hrs)	**VSC-I (1T+1P)** Nursery Technique (1hr) Practical- Botany (2 hrs) **SEC-I (1T+1P)** Microbes (1hr) Practical- Botany SEC-I (2 hrs)	**VEC-I (2T)** Economic Botany –I (2 hrs) **IKS (Generic) (2T)** Ethnobotany (2 hrs)	-		**UG Certificate40-44**
	II	-	-	**Minor-I (2T)** Fungi (2 hrs)	**GE/OE-II (2T+2P)** Mushroom Culture (2hrs)	**VSC-II (1T+1P)**	**VEC-II (2T)**			

					Practical- Botany GE/OE-II (4 hrs)	Garden Techniques (1hr) Practical- Botany VSC-II (2 hrs) **SEC-II (1T+1P)** Archegoniates (1hr) Practical- Botany SEC-II (2 hrs)	Economic Botany –II (2hrs)			
	Cum Cr.			**2**	**8**	**8**	**6**		**24**	
Exitoption:AwardofUGCertificateinMajorwith40-44 credits and an additional l4 credit score NSQF course/Internship OR Continue withMajor and Minor										
5.0	**III**		-	**Minor-II (2T+2P)** Taxonomy of Angiosperms (2hrs) Practical- Botany Minor-I (4 hrs)	**GE/OE-III (2T)** Plant metabolism (2hrs)	**VSC-III (1T+1P)** Plant Ecology (1hr) Practical- Botany VSC-III (2 hrs)				**UG Diploma80-88**

	IV		--	**Minor-III (2T+2P)** Plant Anatomy (2hrs) Practical-Botany Minor -II (4 hrs)	**GE/OE-IV (2T)** Reproductive biology of Angiosperms (2hrs)	**SEC-III (1T+1P)** Plant Physiology (1hr) Practical-Botany SEC-III (2 hrs)				
	CumCr.			**10**	**12**	**12**	**6**		**40**	
Exit option: Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credit score NSQF Course/Internship OR Continue with Major and Minor										
5.5	**V**			**Minor-IV (2T+2P)** Plant Cytology and genetics (2hrs) Practical-Botany Minor -III (4 hrs)			--			**UG Degree120-132**
	VI			**Minor-V (2T+2P)** Plant Systematics (2hrs) Practical Botany Minor -IV (4 hrs)						

	CumCr.			**18**	**12**	**12**	**6**		**48**	
Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor										
6.0	**VII**									**UG Honours Degree160-176**
	VIII									
	CumCr.									
Four Year UG Honours Degree in Major and Minor with 160-176 credits										
6.0	**VII**									**UG Honor's withResearchDegree 160-176**
	VIII									
	CumCr.									
Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits										

Outline of Examination:

Internal Theory Examination:

Internal examination will consist of **20 marks** per semester per paper (for 2 credits) and **for 01 Credit Course: No Internal Evaluation.**. Annexure-I.

a) Attendance (05 marks)
b) Class Room Test (10 marks)
c) Home Assignments (05 marks)

Internal Evaluation (IE) (Practical):

Internal examination will consist of 20 marks.

End Semester Examination (Theory):

The detailed question paper pattern is given as Annexure-II & III.

End-semester Practical Examination:

Practical examination shall be conducted at the end of academic year. Certified journal is compulsory for appearing in the examination. The detailed question paper pattern is given as Annexure-IV&V.

Walchand College of Arts and Science, Solapur (Autonomous)

B. Sc. Botany: Part- I, Semester- I

Theory Syllabus (GE/OE-I) based on Choice Based Credit System – NEP-2020

Paper :- Open Elective-I : Bonsai technique

Credits: 2 (30 Contact Hours) **Marks:** 50

Unit	Title of the Unit	No. of Lectures	No. of Credits
1	**Introduction, tools and collection:** A. Definition, history, aim, scope and importance of bonsai, basic tools. B. Identification and collection of suitable plants for bonsai making (material from the Ground, Buying Material, Propagating Bonsai Material by Seeds, Cuttings, Grafting and Layering)	**15**	**01**
2	**Bonsai training, care and maintenance:** A. Training for Upright style, formal upright, informal upright style, slanting style windswept style, broom style, root over rock, forest style bonsai. B. Pruning techniques, irrigation, pest and disease management, care and maintenance.	**15**	**01**

About the Course

The course deals with study to get the knowledge about introduction, scope and importance of bonsai, tools used for making bonsai and the selection of bonsai material. The preparation of various types of bonsai and their style. It will give the knowledge about bonsai preparation, pruning techniques, irrigation, pest and disease management and care and maintenance.

Learning outcomes:

After successful completion of this course students will be able to:

- To understand the history, scope and importance of bonsai.
- To understand the identification and collection of suitable plant materials for bonsai preparation.

- To understand the various types and styles of bonsai.
- To understand the basic tools and techniques of bonsai preparation, maintenance and care.
- To understand the pruning techniques.

Reference Books

1. Lesniewicz, P. 1994. *Bonsai in your home*. Sterling publishing Co, New York.
2. Randhawa, G.S. and A. Mukhopadhyay. 2000. *Floriculture in India*, Allied publishers, India.
3. Biles, R.E. 2003. The complete Book of Gardening. Biotech Books, Delhi - 35.
4. Bhattacharjee, S.K. 2006. Advances in Ornamental Horticulture. Pointer Publication, Jaipur.
5. Singh, D.B. and Wazir P. 2002. *Bonsai - An art*. Scientific Publishers, Jodhpur.
6. काळे, प्राजक्ता. बोन्साय प्राचीन भारतीय वामनवृक्ष कला (मराठी आवृत्ती) .
7. पाटील, ए.बी. बोन्साय (मराठी आवृत्ती). ॲमेझॉन ईबुक, मेहता प्रकाशन.

Walchand College of Arts and Science, Solapur (Autonomous)

B. Sc. Botany: Part- I, Semester- I

Practical Course Syllabus (OE-I) based on Choice Based Credit System – NEP-2020

Paper :- Open Elective-I -Practical: Bonsai technique

Credits: 2 (60 Contact Hours) **Marks:** 50

Sr. No.	Name of Practical
1.	To study the selection of materials for bonsai preparation
2.	Preparation of pots for bonsai
3.	Preparation of bonsai a. from natural material b. by grafting c. by budding
4.	Bonsai care and maintenance.
5.	To study the types of bonsai: a. upright style b. formal upright c. informal upright style d. slanting style windswept style e. broom style f. root over rock g. forest style bonsai
6.	Report on Bonsai

Walchand College of Arts and Science, Solapur (Autonomous)

B. Sc. Botany: Part- I, Semester- I

Theory Syllabus (VSC-I) based on Choice Based Credit System – NEP-2020

Paper :- VSC-I: Nursery Techniques

Credits: 1 (15 Contact Hours) **Marks:** 25

Unit	Title of the Unit	No. of Lectures	No. of Credits
1	**Nursery Techniques:** A. Definition, objectives and scope B. Infrastructure for nursery, planning and seasonal activities. C. Potting and repotting D. Planting - direct from seeds and transplants. E. Vegetative propagation: cuttings- stem, leaf and root, Air-layering, grafting F. Selection of cutting, treatment of cutting, rooting medium and plantation of cuttings. G. Care and maintenance	**15**	**01**

About the Course:

The course is aimed to teach students the basic knowledge required to develop entrepreneurship skills in the development of Nursery and its techniques. This course would train students to initiate a remunerative enterprise owing to a high demand of skilled professionals in this field.

Learning Outcomes:

After successful completion of course the students will be able to know:

- To develop nursery on commercial scale.
- Nursery operations.
- Selection of material for development of seedlings.
- Artificial methods of plant propagation.

Suggested Readings

1. Bose, T.K. & D. Mukherjee. 1972. *Gardening in India*, Oxford & IBH Publishing Co., New Delhi.
2. Sandhu, M.K. 1989. *Plant Propagation*. Wile Eastern Ltd., Bangalore, Madras.
3. Kumar, N. 1997. *Introduction to Horticulture*, Rajalakshmi Publications, Nagercoil.
4. E. Musser & Andres. *Fundamentals of Horticulture*, McGraw Hill Co., New Delhi.
5. Agrawal, P.K. 1993. *Hand Book of Seed Technology*, Dept. of Agriculture and Cooperation, National Seed Corporation Ltd., New Delhi.
6. Jules, J. 1979. *Horticultural Science*. (3rd Ed.), W.H. Freeman and Co., USA.

Walchand College of Arts and Science, Solapur (Autonomous)

B. Sc. Botany: Part- I, Semester- I

Practical Course Syllabus (VSC-I) based on Choice Based Credit System – NEP-2020

Paper :- VSC-I -Practical: Nursery Techniques

Credits: 1 (30 Contact Hours) **Marks:** 25

Sr. No.	Name of Practical
1.	To study instruments required for plant nursery: secateurs, garden shear, tree pruner, knife, watering can, digger and shovel.
2.	Natural methods of vegetative propagation: bulbs, rhizomes, tubers, bulbils, runners, suckers, stolons, and offsets.
3.	Artificial methods of vegetative propagation: cutting, air-layering, budding, grafting.
4.	To study the effect of IBA/GA/PGR on seed germination
5.	Horticulture term paper

Walchand College of Arts and Science, Solapur (Autonomous)

B. Sc. Botany: Part- I, Semester- I

Theory Syllabus (SEC-I) based on Choice Based Credit System – NEP-2020

Paper :- SEC-I : Microbes

Credits: 1 (15 Contact Hours) **Marks:** 25

Unit	Title of the Unit	No. of Lectures	No. of Credits
1	**Microbes: Viruses, Bacteria and cyanobacteria** A. Introduction and types of microbes. B. General characters, structure of TMV virus. C. General characters of bacteria and its morphological types D. Economic importance of bacteria. E. Cynobacteria: Introduction, general characters, outline of classification of cyanobacteria. F. Study of life cycle of *Nostoc* and *Anabaena*. G. Economic importance of cyanobacteria	**15**	**01**

About the course

The course deals with study to get the knowledge about the basic concepts in microbiology, classification, general characters, forms, structure and economic importance of viruses, bacteria and cyanobacteria. The diversity of viruses, bacteria and cyanobacteria is also important to know the plant science and for understanding the various microbes.

Learning outcomes:

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

- Understand the basic knowledge of microbes and cyanobacteria.
- Understand the morphology of viruses, bacteria and cyanobacteria.
- Understand about the economic importance of microbes.
- Students will be learned the life cycle of cyanobacteria: *Nostoc* and *Anabaena*.

Suggested readings:

1. Lee, R.E. 2008. *Phycology*, Cambridge University Press, Cambridge. 4th ed.
2. Kumar, H.D. 1999. *Introductory Phycology*. Affiliated East-West Press, Delhi.

3. Sahoo, D. 2000. *Farming the ocean: seaweeds cultivation and utilization*. Aravali International, New Delhi.
4. Alexopoulos, C.J., Mims, C.W., Blackwell, M. 1996. *Introductory Mycology*, John Wiley & Sons (Asia) Singapore. 4th edition.
5. Webster, J. and R. Weber. 2007. *Introduction to Fungi*, Cambridge University Press, Cambridge. 3rd edition.
6. Sethi, I.K. and Walia, S.K. 2011. *Text book of Fungi and Their Allies*, Macmillan Publishers India Ltd.
7. Sharma, P.D. 2011. *Plant Pathology*, Rastogi Publication, Meerut, India.
8. Lee, R.E. 2008. *Phycology*, Cambridge University Press, Cambridge. 4th edition.

Walchand College of Arts and Science, Solapur (Autonomous)

B. Sc. Botany: Part- I, Semester- I

Practical Course Syllabus (SEC-I) based on Choice Based Credit System – NEP-2020

Paper :- SEC-I -Practical: Microbes

Credits: 1 (30 Contact Hours) **Marks:** 25

Sr. No.	Name of Practical
1.	Electron micrographs/photographs/models of viruses- TMV.
2.	Preparation of slides by Gram staining technique
3.	Study of types of bacteria (slides preparation)
4.	To study the *Nostoc.*
5.	To study the *Anabaena.*

Walchand College of Arts and Science, Solapur (Autonomous)

B. Sc. Botany: Part- I, Semester- I

Theory Syllabus (VEC-I) based on Choice Based Credit System – NEP-2020

Paper :- VEC-I- Economic Botany -I

Credits: 2 (30 Contact Hours) **Marks:** 50

Unit	Title of the Unit	No. of Lectures	No. of Credits
1	**Introduction to Economic Botany:** A. Origin of Cultivated Plants. B. Concept of Centers of Origin. C. Crop domestication and loss of genetic diversity.	**15**	**01**
2	**Important crops:** A. Cereals: Green revolution; general account on Wheat and Rice; brief account of millets and their importance. B. Legumes: General account on chief pulses grown in Maharashtra- red gram, green gram, chick pea, soybean. C. Cash crops and fruits: Origin, cultivation of Sugar cane, Mango, Banana, Grapes and Citrus. D. Introduction to collection of Natural Rubber	**15**	**01**

About the course

The course deals with study to get the knowledge about the basics of economic botany and important crops. Student will understand various uses of plants and their domestication.

Learning outcomes:

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

- Know importance of crop domestication and the loss of genetic diversity.
- Learn the green revolution with special reference to the Wheat and Rice.
- Understand the importance of millets in healthy life.
- Learn about the pulses grown in Maharashtra- red gram, green gram, chick pea, soybean.

- Learn the origin, cultivation, processing and uses of cash crops, fruits and collection processes of Natural Rubber

Suggested Readings

1. Krishnamurthy, K.V. (2004). An Advanced Text Book of Biodiversity - Principles and Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi
2. Kochhar, S.L. (2012). Economic Botany in Tropics. New Delhi, India: MacMillan & Co.
3. Wickens, G.E. (2001). Economic Botany: Principles & Practices. The Netherlands: Kluwer Academic Publishers.
4. Chrispeels, M.J. and Sadava, D.E. (1994) Plants, Genes and Agriculture. Jones & Bartlett - Publishers.

Walchand College of Arts and Science, Solapur (Autonomous)

B. Sc. Botany: Part- I, Semester- I

Theory Syllabus (IKS) based on Choice Based Credit System – NEP-2020

Paper :- IKS- Ethnobotany

Credits: 2 (30 Contact Hours) **Marks:** 50

Unit	Title of the Unit	No. of Lectures	No. of Credits
1	**Ethnobotany and Folk medicines:** A. Introduction, scope and objectives of ethnobotany. B. Introduction to ethnic communities of Maharashtra. C. Introduction to folk medicines.	**15**	**01**
2	**Role of ethnobotany and conservation of medicinal plants:** A. Medico-ethnobotanical sources in Maharashtra. B. Plants used in ethnobotanical practices- *Azadiractha indica*, *Ocimum sanctum*, *Vitex negundo*, *Tribulus terrestris*, *Pongamia pinnata*, *Eclipta alba* (name, plant parts used, diseases). C. Role of ethnic groups in conservation of plant genetic resources. D. Rare medicinal plants and possible methods for its conservation.	**15**	**01**

About the course

The course deals with study to get the knowledge about the ancient and traditional practices of plant based medicines to cure various aliments and ethnic groups of Maharashtra, importance of folk medicines and role of ethnic knowledge in conservation of medicinal plant.

Learning outcomes:

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

- Understand ethnic groups of India and Maharashtra.
- Understand traditional herbal medicines.
- Understand ancient techniques to cure aliments.

Suggested Readings

1. Jain, S.K. 1995. Manual of Ethnobotany, Scientific Publishers, Jodhpur.
2. Jain, S.K. (ed.). 1981. Glimpses of Indian. Ethnobotny, Oxford and I B H, New Delhi.
3. Jain, S.K. 1990. Contributions of Indian ethnobotny. Scientific publishers, Jodhpur.
4. Colton, C.M. 1997. Ethnobotany– Principles and applications. JW & Sons, Chichester
5. Rama Ro, N and Henry, A.N. (1996). The Ethnobotany of Eastern Ghats in Andhra Pradesh, India. Botanical Survey of India. Howrah.
6. Sinha, R.K. – Ethnobotany The Renaissance of Traditional Herbal Medicine – INA – Shree Publishers, Jaipur-19969)

SEMESTER II

Walchand College of Arts and Science, Solapur (Autonomous)

B. Sc. Botany: Part- I, Semester- II

Theory Syllabus (Minor-I) based on Choice Based Credit System – NEP-2020

Paper:- Minor-I- Fungi

Credits: 2 (30 Contact Hours) **Marks:** 50

Unit	Title of the Unit	No. of Lectures	No. of Credits
1	**Introduction and Classification of Fungi:** A. General characters, occurrence, mode of nutrition. B. Economic importance of fungi. C. Classification of fungi up to class (as per Ainsworth). D. Study of *Mucor* and *Yeast:* occurrence, thallus organization, classification and life cycle (excluding developmental stages).	**15**	**01**
2	**Symbiotic association and Plant diseases caused by fungi** A. Liechens: General characteristics, classification, thallus structure morphology. B. Mycorrhiza: General characteristics, ectomycorrhiza and endomycorrhiza and their significance. C. Plant diseases : Symptoms, Causes and effects and control measures- blights, wilting, smut, rust, mildews etc.	**15**	**01**

About the course

The course deals with study to get the knowledge about the fungi, importance of fungi and diseases caused by fungi.

Learning outcomes:

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

- Understand morphology, general characters and classification of fungi.
- Understand symbiotic association of fungi with lichens and mycorrhiza.
- Understand plant diseases caused by fungi.

Suggested reading

1. Tortora, G.J., Funke, B.R., Case, C.L. (2010). Microbiology: An Introduction, Pearson Benjamin Cummings, U.S.A. 10th edition.
2. Seth, I.K. and Walia, S.K. (2011). Text book of Fungi & Their Allies, MacMillan Publishers Pvt. Ltd., Delhi.
3. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley and Sons (Asia), Singapore. 4th edition.
4. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R., (2005). Biology. Tata McGraw Hill, Delhi, India.

Walchand College of Arts and Science, Solapur (Autonomous)

B. Sc. Botany: Part- I, Semester- II

Theory Syllabus (OE-II) based on Choice Based Credit System – NEP-2020

Paper :- GE/OE-II- Mushroom Culture

Credits: 2 (30 Contact Hours) **Marks:** 50

Unit	Title of the Unit	No. of Lectures	No. of Credits
1	A. History, types of edible mushrooms available in India - *Volvariella volvacea, Pleurotus citrinopileatus, Agaricus bisporus*. B. Infrastructure (tools) for mushroom culture: substrates (locally available), polythene bag, vessels, inoculation hook, inoculation loop, low cost stove, sieves, culture rack, mushroom unit (thatched house) water sprayer, tray.	**15**	**01**
2	A. Mushroom culture techniques: Pure culture: Medium, sterilization, preparation of spawn, multiplication. Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves. B. Composting technology in mushroom production. C. Storage and care: Short-term storage (refrigeration – up to 24 hours), long term storage (canning, pickels, papads), drying, storage in salt solutions.	**15**	**01**

About the course

The course deals with study to get the knowledge about the fungi, importance of fungi and diseases caused by fungi.

Learning outcomes:

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

- Understand morphology, general characters and classification of fungi.
- Understand symbiotic association of fungi with lichens and mycorrhiza.
- Understand plant diseases caused by fungi.

Suggested Readings

1. Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R (1991) Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
2. Swaminathan, M. (1990) Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
3. Tewari, P.Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi.
4. Nita Bahl (1984-1988) Hand book of Mushrooms, II Edition, Vol. I & Vol. II.

Walchand College of Arts and Science, Solapur (Autonomous)

B. Sc. Botany: Part- I, Semester- II

Practical Course Syllabus (GE/OE-II) based on Choice Based Credit System – NEP-2020

Paper :- GE/OE-II – Practical: Mushroom Culture

Credits: 2 (60 Contact Hours) **Marks:** 50

Sr. No.	Name of Practical
1.	To study the principle and operation of Autoclave, Incubator, Laminar Air Flow.
2.	Preparation of various types of compost and media which can be used for cultivation of mushroom.
3.	Preparation of spawn and cultivation of paddy straw (Oyster) mushroom
4.	To study the cultivation technique of mushroom culture.
5.	Collection of pure culture of mushroom
6.	To study the common fungal, bacterial, viral, and insect borne diseases of mushrooms (any 2 from each)
7.	To study the harvesting technology
8.	To study the post-harvest technologies like packaging and preservation.

Walchand College of Arts and Science, Solapur (Autonomous)

B. Sc. Botany: Part- I, Semester- II

Theory Syllabus (VSC-II) based on Choice Based Credit System – NEP-2020

Paper :- VSC-II - Gardening Techniques

Credits: 1 (15 Contact Hours) **Marks:** 25

Unit	Title of the Unit	No. of Lectures	No. of Credits
1	**Gardening Techniques** A. Definition, objectives and scope B. Types of gardens- indoor and outdoor. C. Instruments for gardening. D. Selection of plants as per environmental conditions. E. Artificial methods of plant propagation. F. Seed treatment, planting direct from seeds, rooting hormones and transplants. G. Care and maintenance	**15**	**01**

About the Course:

The course is aimed to teach students the basic knowledge required to develop entrepreneurship skills in the development of gardens and its techniques. This course would train students to initiate a remunerative enterprise owing to a high demand of skilled professionals in this field of plant gardening.

Learning Outcomes:

After successful completion of course the students will be able:

- To develop gardens on commercial scale.
- To know plant gardening operations.
- To know selection of plants material for development of seedlings and different methods for propagation of plants.
- To know artificial methods of plant propagation.

Suggested Readings

1. Bose, T.K. & Mukherjee D. 1972. Gardening in India, Oxford & IBH Publisher, Delhi.

2. Sandhu, M.K. 1989. Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.

3. Kumar, N. 1997. Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.

4. E. Musser & Andres. Fundamentals of Horticulture, McGraw Hill Co., New Delhi.

5. Agrawal, P.K. 1993. Hand Book of Seed Technology, Dept. of Agriculture and Cooperation, National Seed Corporation Ltd., New Delhi.

6. Jules, J. 1979. Horticultural Science. (3rd Ed.), W.H. Freeman and Co., USA.

Walchand College of Arts and Science, Solapur (Autonomous)

B. Sc. Botany: Part- I, Semester- II

Practical Course Syllabus (VSC-II) based on Choice Based Credit System – NEP-2020

Paper :- VSC-II – Practical: Gardening Techniques

Credits: 1 (30 Contact Hours) **Marks:** 25

Sr. No.	Name of Practical
1.	Methods of preparation of beds and sowing of seeds.
2.	To study the different methods of vegetative propagation viz., cutting, layering, division, grafting and budding.
3.	To study the horticultural herbs, shrubs, hedge plants, avenue trees, climbers, lianas, epiphytes, creepers, trailers and aquatic plants.
4.	To study the succulents
5.	To study the lawn grasses
6.	To study the common weeds.

Walchand College of Arts and Science, Solapur (Autonomous)

B. Sc. Botany: Part- I, Semester- II

Theory Syllabus (SEC-II) based on Choice Based Credit System – NEP-2020

Paper :- SEC-II- Archegoniates

Credits: 1 (15 Contact Hours) **Marks:** 25

Unit	Title of the Unit	No. of Lectures	No. of Credits
1	**Archegoniates:** A. Introduction. B. Bryophytes: General characters; Study of *Riccia* occurrence, classification, thallus structure and reproduction (excluding development). C. Pteridophytes: General characters; Study of *Sellaginella*- occurrence, classification, morphology of sporophyte, stem anatomy and reproduction (excluding development) D. Gymnosperms: General characters; Study of *Cycas*- occurrence, classification, morphology (sporophyte, coralloid root), anatomy of leaflet and reproduction of *Cycas* (structure of male and female reproductive structures excluding development)	**15**	**01**

About the course

The course is a walk for the first year students through the diversity of Archegoniates. It deals with the differences and similarities between bryophytes, pteredophytes and gymnosperms on the basis of their morphological and anatomical characters with the suitable examples.

Course outcomes

After successful completion of syllabus the students will be able to:

- Learn about the lower plants.
- Learn about the life cycle of *Riccia*, *Selaginella* and *Cycas.*
- Economic importance of Bryophytes, Pteridophytes and Gymnosperms.

Suggested readings:

1. Vashistha, P.C., Sinha, A.K., Kumar, A. (2010). Pteridophyta. S. Chand. Delhi, India.
2. Bhatnagar, S.P. & Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
3. Parihar, N.S. (1991). An introduction to Embryophyta: Vol. I. Bryophyta. Central Book Depot. Allahabad.
4. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R. (2005). Biology. Tata McGraw Hill, Delhi.
5. Vander-Poorteri 2009 Introduction to Bryophytes. COP.

Walchand College of Arts and Science, Solapur (Autonomous)

B. Sc. Botany: Part- I, Semester- II

Practical Course Syllabus (SEC-II) based on Choice Based Credit System – NEP-2020

Paper :- SEC-II – Practical: Archegoniates

Credits: 1 (30 Contact Hours) **Marks:** 25

Sr. No.	Name of Practical
1.	Study of *Riccia* thallus structure
2.	Study of *Riccia* anatomy and reproductive structure
3.	Study of *Selaginella*- Morphology of sporophyte
4.	Study of *Selaginella*- anatomy of stem, Strobilus.
5.	Study of *Cycas*- morphology of sporophyte and anatomy of leaflet.
6.	Study of *Cycas*- Reproductive structure: male cone, microsporophyll, microspore and megasporophyll, L. S. of ovule (by permanent slide).

Walchand College of Arts and Science, Solapur (Autonomous)

B. Sc. Botany: Part- I, Semester- II

Theory Syllabus (VEC-I) based on Choice Based Credit System – NEP-2020

Paper :- VEC-II- Economic Botany -II

Credits: 2 (30 Contact Hours) **Marks:** 50

Unit	Title of the Unit	No. of Lectures	No. of Credits
1	A. **Spices:** Introduction, botanical names, general characters and parts used (ginger, capsicum and black pepper) B. **Oils crops:** Introduction, botanical names, parts used; essential and nonessential oils; oil extraction methods. C. Biofuel: Introduction, list of biofuel yielding plants.	**15**	**01**
2	**Medicinal and essential important plants:** …… A. Medicinal plants: Botanical names, general characters and parts used (*Withania, Tinospora*, *Emblica* and Vasaka) B. Perfumes and insect repellent plants. C. Fibre yielding plants: Botanical names, general characters, parts used and processing (cotton, jute and coir). D. Dye yielding plants: Introduction, economic importance	**15**	**01**

About the course

The course deals with study to get knowledge about the basics of economic botany and important plant species which are used as spices, oil crops, biofuel plants, medicinal plants and plants of essential oils.

Learning outcomes:

After successful completion of course the students will be able:

- To know the spices and condiments.
- To know oil crops and biofuel plants.
- To know plant sources of essential oils.
- Understand the importance of millets in healthy life.

Suggested Readings

1. Krishnamurthy, K.V. (2004). An Advanced Text Book of Biodiversity - Principles and Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi
2. Kochhar, S.L. (2012). Economic Botany in Tropics. New Delhi, India: MacMillan & Co.
3. Wickens, G.E. (2001). Economic Botany: Principles & Practices. The Netherlands: Kluwer Academic Publishers.
4. Chrispeels, M.J. and Sadava, D.E. (1994) Plants, Genes and Agriculture. Jones & Bartlett - Publishers.

Walchand College of Arts and Science (Autonomous), Solapur

Program wise Pattern for Internal Evaluation as per NEP 2020 w. e. f 2023-24

N.B.- For 01 Credit Course: No Internal Evaluation.

Sr. No.	Program	Credits	Marks for Attendance	Marks for Class Room Test	Marks for Home Assignment	Marks for Presentation/Group Discussion/ Participation/Field work/Study visit	Total Marks
1	B. Sc.	02	05	10	05	-	20
		04	05	20	05	10	40

Annexure: I

Walchand College of Arts and Science,
Solapur(Autonomous)

Question Paper for Class Room Test (IE)

(02 Credit Theory All Courses)

Marks: 10

Q.No.1 Multiple choice questions **- 04 marks.**

i)

a) b) c) d)

ii)

iii)

iv)

Q.No.2 Attempt any two **- 06 marks.**

a)

b)

c)

Annexure - II

Scheme of Marking for End Semester Examination (ESE) (Theory)

Walchand College of Arts and Science (Autonomous), Solapur

Theory question paper Pattern for **2 credit** as per NEP 2020 (ESE)

w. e. f 2023-24

Examination:----------

Class: -------- **Semester:----------**

Subject:-------- Paper:----------

Time: 1.5 hrs **Marks: 30**

Instructions: a) All questions are compulsory
b) Figures to the right indicate full marks
c) Draw neat & well labeled diagram wherever necessary

Q. No.1 Select the correct alternative of the following **06**

i)

a) b) c) d)

ii)

iii)

iv)

v)

vi)

Q. No.2 Attempt the following (Any three) **06**

i)

ii)

iii)

iv)

v)

Q. No.3 Attempt the following (Any two) **06**

i)

ii)

iii)

Q. No.4 Attempt the following (Any two) **06**

i)

ii)

iii)

Q. No.5 Attempt the following (Any one) **06**

i)

ii)

Annexure- III

Scheme of Marking for End Semester Examination (Theory)

Walchand College of Arts and Science (Autonomous), Solapur

Theory question paper Pattern for **1 credit** as per NEP 2020(ESE)

w. e. f 2023-24

Examination:----------

Class: **B.Sc./B.Sc. Biotech** Semester:----------

Subject:-------- Paper:----------

Time: 1.5 hrs **Marks: 25**

Instructions: a) All questions are compulsory
b) Figures to the right indicate full marks
c) Draw neat & well labeled diagram wherever necessary

Q. No.1 Select the correct alternative of the following **05**

i)

a) b) c) d)

ii)

iii)

iv)

v)

Q. No.2 Attempt the following (Any five) **05**

i)

ii)

iii)

iv)

v)

vi)

vii)

Q. No.3 A) Attempt the following (Any one) **03**

i)

ii)

B) Attempt the following (Any one) **02**

i)

ii)

Q. No.4 A) Attempt the following (Any one) **03**

i)

ii)

B) Attempt the following (Any one) **02**

i)

ii)

Q. No.5 Attempt the following (Any one) **05**

i)

ii)

Annexure- IV

Walchand College of Arts and Science, Solapur (Autonomous)

B. Sc. Botany: Part- I

Choice Based Credit System – NEP-2020

Model question paper for Practical Examination

(Credits : 02)

Centre: ……... **Batch: ……...**

Date: ……... **Total Marks -30**

N. B. *1. Draw neat and labeled diagrams wherever necessary.*
2. Do not write about points of theoretical information unless asked specifically.
3. Perform the experiment as per instructions given by the examiners.

Q.1. Identify and show/write about the important structures observed by you in the given specimen- A & B (**Written answer**) **06 marks**

Q.2. To study given sample **C** and prepare a slide from it and show the slide to the examiner (**No written answer**) **06 marks**

Q.3. Set up the experiment D assigned to you and record your observations, submit the report to the examiner (**written answer**) **06 marks**

Q.4. Identification **06 marks**

E- Identify & Describe

F- Identify & Describe

G- Identify & Describe

Q.5. A) Journal **3 marks**

B) Excursion Report **3 marks**

Annexure- V

Walchand College of Arts and Science, Solapur (Autonomous)

B. Sc. Botany: Part- I

Choice Based Credit System – NEP-2020

Model question paper for Practical Examination

(Credits : 01)

Centre: ……... **Batch: ……...**

Date: ……... **Total Marks -25**

N. B. *1. Draw neat and labeled diagrams wherever necessary.*
2. Do not write about points of theoretical information unless asked specifically.
3. Perform the experiment as per instructions given by the examiners.

Q.1. Identify and show/write about the important structures observed by you in the given specimen- A & B (**Written answer**) **06 marks**

Q.2. To study given sample **C** and prepare a slide from it and show the slide to the examiner (**No written answer**) **04 marks**

Q.3. Set up the experiment D assigned to you and record your observations, submit the report to the examiner (**written answer**) **04 marks**

Q.4. Identification **06 marks**

E- Identify & Describe

F- Identify & Describe

G- Identify & Describe

Q.5. A) Journal **3 marks**

B) Excursion Report **2 marks**

Shikshan Haach Dharma

S. A. P. D. Jain Pathashala's
(Jain Minority Institute)

Walchand College of Arts & Science, Solapur

Autonomous College

(Affiliated to P.A.H. Solapur University, Solapur)

।। शिक्षण हाच धर्म ।।

Name of Faculty: Science & Technology

Choice Based Credit System
(According to NEP-2020)

B.Sc. Part-I
Subject: Microbiology

Syllabus

With Effect from: 2023-24

Walchand College of Arts & Science, Solapur

(Autonomous)

About National Education Policy (NEP) - 2020

With the directions and guidelines issued by **Government of Maharashtra resolution dated 20th April 2023 and 16th May, 2023** regarding the implementation of NEP at UG and PG level, the Walchand College of Arts & Science (Autonomous), Solapur has taken decision to implement NEP 2020 with Choice Based Credit System (CBCS) at Undergraduate level and Post Graduate level. This has been done to achieve the goals and objectives set in NEP-2020 such as- worldwide recognition, acceptability, horizontal as well as vertical mobility for students completing undergraduate and post-graduate degree.

The CBCS provides an opportunity for the students to select from the prescribed courses comprising core, elective/minor or skill based. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations.

Outline of NEP:

The structure of the Three/Four-year bachelor's degree programme allows the opportunity to the students to experience the full range of holistic and multidisciplinary education in addition to a focus on the chosen major and minors as per their choices and the feasibility of exploring learning in different institutions. The structure allows students to learn various components like:

(a) Major (Core) Subject (DSC): This comprises of Mandatory and Elective Courses that require students to achieve:

- Minimum 50% of total credits corresponding to Three/Four - year UG Degree-Mandatory Courses are offered in all four years;
- 2 credit course on Major Specific IKS shall be included under Major;
- Elective courses of Major will be offered in the third and/or final year;
- Vocational Skill Courses, Internship/ Apprenticeship, Field Projects, Research Projects are related to Major

(b) Minor Subject (18-20 Credits)

- The Minor subjects may be from the different disciplines of the same faculty of DSC Major (Core) or they can be from different faculty altogether;
- The credits of Minor subjects shall be completed in the first three years of UG Programme

(c) Generic/ Open Elective Courses (OE) (10-12 credits)

- GE/OE are to be offered in I and/or II year;
- Faculty-wise baskets of OE shall be prepared by Autonomous College.
- OE/GE is to be chosen compulsorily from faculty other than that of the Major or as per the directions issued by NEP-Steering Committee

(d) Vocational and Skill Enhancement Courses (VSEC)

i) Vocational Skill Courses (VSC): (8-10 credits): Includes Hands on Training corresponding to the Major and/or Minor Subjects:

- To be offered in first three years;
- Wherever applicable vocational courses will include skills based on advanced laboratory practicals' of Major

ii) Skill Enhancement Courses (SEC): (06 credits)

- To be offered in I and II year;
- To be selected from the basket of Skill Courses approved by Autonomous College

(e) Ability Enhancement Courses (AEC), Indian Knowledge System (IKS) and Value Education Courses (VEC): (14 Credits)

i) AEC: (08 credits)

- To be offered in I and II year
- English: 04 Credits
- Modern Indian Language: 04 credits
- To be offered from the Basket approved by Autonomous College;

The focus for both languages should be on linguistic and communication skills.

ii) IKS: (2 Credits)

- To be offered in I Year
- Courses on IKS to be selected from the basket of IKS courses approved by Autonomous College

iii) VEC: 04 Credits

- To be offered in I year
- Value Education Courses (VEC) such as Understanding India, Environmental Science/Education, and Digital and Technological Solutions.

(f) Field Projects/ Internship/ Apprenticeship/ Community Engagement and Service corresponding to the Major (Core) Subject, Co-curricular Courses (CC) and Research Project

- Internship/Apprenticeship corresponding to the Major (Core) Subject: (8 Credits)
- Field Projects/Community Engagement and Service (CEP) corresponding to the Major (Core) Subject (minimum 4-6 credits)

  -To be offered in II and III years of UG Degree Programmes.
- Co-curricular Courses (CC) such as Health and Wellness, Yoga education, sports and fitness, Cultural Activities, NSS/NCC and Fine/ Applied/Visual/ Performing Arts: (8 credits)

  -To be offered in I and/or II year
- Research Projects: (12 credits)

  -To be offered in the final year for 4 year Honours with Research UG Degree

➢ **CREDIT:**

- Credit is a numerical value that indicates students work load (Lectures, Lab work, Seminar, Tutorials, Field work etc.) to complete a course unit. The contact hours are transformed into credits. Moreover, the grading system of evaluation is introduced for B.Sc. course wherein process of Continuous Internal Evaluation is ensured.
- **Theory: '**15 contact hours' for theory course constitute 'one credit'
- **Practical/Tutorial: '**30 contact hours' for practical course constitute 'one credit'.
- **Workshop based activities/Skill based activities:** Minimum 30 contact hours per credit in a semester is required
- **Internship/On-Job Training: '**30 contact hours' per credit in a semester is required (1 credit/week)
- **Community Engagement and Service-CEP/Field Project: '**30 contact hours' per credit in a semester is required

➢ **Credit Framework under Three/Four Years UG Programme with Multiple Entry and Multiple Exit Options:**

The minimum and maximum credit structure for different levels under three or four year UG programme with multiple entry and multiple exit options are as given below:

Levels	Code	Qualification Titles	Credit Requirements		Semester	Year
			Minimum	Maximum		
4.5	100-199	UG Certificate	40	44	2	1
5.0	200-299	UG Diploma	80	88	4	2
5.5	300-399	Three Year Bachelor's Degree	120	132	6	3
6.0	400-499	Bachelor's Degree Honours **OR** Bachelor's Degree-Honours with Research	160	176	8	4
	500-599	First Year PG & or PG Diploma	40	44	2	1
6.5	600-699	PG Degree	80	88	4	2
8.0	700-799	Ph.D.	16+ Ph.D. Work		---	---

Multiple Exit Options

Year	Exit Option	Reentry
First Year	Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/Internship OR Continue with Major and Minor	Students opting for exits at any level 'will have the option to reenter' the programme from where they had left off, in the same or in different higher educational institution 'within three years of exits' and complete the degree program within the stipulated maximum period of 07 years from the date admission of first year of UG.
Second Year	Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF Course/Internship OR Continue with Major and Minor	
Third Year	Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor	
Fourth Year Honours	Four Year UG Honours Degree in Major and Minor with160-176 credits	
Fourth Year Honours with Research	Four Year UG Honours with Research Degree in Major and Minor with160-176 credits	
Post-Graduation Degree		
Post-Graduation: First Year	PG Diploma (44 Credits) after Three Year UG Degree	Reentry to complete the PG degree after taking exit option will be permissible up to 5 years from the date admission to PG programme

- **Academic Bank of Credit (ABC):**

It is mandatory for all admitted students to get enrolled on ABC Portal and create ABC ID and share ABC-ID with academic institutions where they are enrolled. Credits earned by the students will be reflected in the students ABC account. This will allow students smooth transition during multiple entry and exit.

Program Outcomes:

Microbiology subject aims to emphasize holistic learning of the natural sciences so that a graduate student must employ his knowledge in various domains ranging from core studies from introduction of microorganisms to its role in diverse ecosystems. Students must use their knowledge in addressing the challenges of global concern such as environmental pollution, industrial applications, pandemics, vaccine production and economy. A graduate in Microbiology must use their knowledge to solve the problems faced by nation using bioremediation, biodegradation of waste, bio- fertilizers, bio-pesticide development, antibiotic productions, and vaccine development etc.

Students understanding on different types of microorganisms, pathogenic and nonpathogenic species, population dynamics, physiology, and the way they interact with other species and their role in environment. The program in microbiology must enable him/her to constantly endeavor to undertake further studies in microbiology and in multidisciplinary areas that involve advanced or modern microbiology which help develop an employment in various industries, self-employment, and entrepreneurship.

Program Specific Outcomes:

A student specializing in Microbiology is expected to learn fundamentals of natural sciences that mostly include:

a) Types of microorganisms: Bacteria, Fungi, Algae, protozoa, and viruses

b) Classification of microorganisms, nutritional requirements of microorganisms, microbial physiology.

c) Staining techniques, isolation techniques, instrumentation needed to isolate, cultivate and observation of microorganisms

d) Molecular biology & biotechnology: To understand the blueprint of life: DNA, RNA & Protein. How these molecules form a cell, the way they control structure & function from viruses to bacteria.

e) Applied, allied & contemporary approaches: The science of microbiology has manifold applications ranging from-agriculture, environment, food and dairy, pharmaceutical industries, mining industries, nanotechnology, sociology, economics etc.

The program of microbiology aims to integrate all these concepts so that a student is prepared to contribute his/her skills and knowledge as demanded in future endeavor

Walchand College of Arts & Science, Solapur (Autonomous)

Faculty of Science: NEP Choice Based Credit System (CBCS)

(w.e.f. 2023-24)

Preamble: This course provides a broad overview of microbiology and to produce expert hands that would have sufficient knowledge of microbiology. The course structure is basic science centric where students learn core science and are taught necessary fundamental and applied subject for that purpose.

Objectives of the course: The objectives of B. Sc.-I Microbiology course are:

- To provide an intensive and in-depth learning to the students in field of Microbiology.
- Beyond stimulating learning, understanding the techniques, the course also addresses the underlying recurring problems of disciplines in today's scientific and changing world.
- To develop awareness & knowledge of different organizational requirements and subject knowledge through varied branches in students.
- To train the students to take up wide variety of roles like researchers, scientists, consultants, entrepreneurs, academicians, industry leaders and policy.

Eligibility for Admission:

A Candidate passing 10+2 with biology, MLT, Dairy Science, Fisheries, Agricultural science as one of the subjects and passed from State Board / CBSE / ICSE or equivalent with minimum passing percentage of as per the directives of the higher education is eligible for admission.

Duration:

The duration of the B.Sc.-I course is of 1 year (comprising 2 semesters).

Medium of Instruction: English

Pattern of the Course: The autonomous college follows semester pattern.

NEP Structure B.Sc. Microbiology

	SEMESTER-I			
Subject	**Paper Title**	**Credits**	**Hours/week**	**Total Contact Hours**
Microbiology VSC- I	Microbial techniques	1	1	15
Microbiology VSC-I P	Practical - Microbial techniques VSC- I	1	2 (hours/week/batch)	30
Microbiology VEC	Microbial World and Principles of Microbiology	2	2	30
	SEMESTER-II			
Microbiology Minor -I	Bacterial Physiology	2	2	30
Microbiology VSC- II	Applied Microbiology	1	1	15
Microbiology VSC-II P	Practical -Applied Microbiology VSC- II	1	2 (hours/week/batch)	30

Outline of Examination:

THEORY:

1) Internal Evaluation (IE): Internal evaluation will consist of **40 % marks** per semester per paper. It may be held as **per the following scheme** per semester **(Annexure: I)**

Credits	Marks for Attendance	Classroom Test	Home Assignment	Total Marks
02	05	10	05	20

2) End Semester Examination (ESE): The detailed question paper pattern (**60 % marks per paper)** is given as in **Annexure- II and Annexure- III**

PRACTICAL:
End Semester Examination (ESE): (01 Credit Practical Course). The detailed scheme is given in Annexure-IV.

Credits	Practicals	Journal	Total Marks
01	20	05	25

SEMESTER – I

Microbiology VSC-I: Microbial Techniques

Credits: 01 **Total Marks: 25** **Contact hours: 15**

Unit No.	Content of Unit	Contact hours
I	**Microscopy** Basic concepts in Microscopy: Image formation, magnification, Numerical aperture, resolving power, and working distance. Types and functions of optical parts of compound microscope, Principle, working and ray diagram of compound microscope. **Staining Technique** Definition of Stains and dyes. Classification of stains – Acidic, Basic & Neutral with examples. Principle, procedure, mechanism, and applications of following staining procedures – Simple, Negative, Differential: - Gram Staining, Acid fast staining, Spore staining and Flagella staining. **Cultivation techniques of microorganisms** **Culture Media:** Concept of growth medium. In vivo –Living media – Embryonated egg, Animal Tissue Culture. In vitro: Non-living media- Natural, Synthetic, semisynthetic Differential, Enriched, Selective, Indicator medium. **Methods of Pure culture:** Definition of Pure culture. Streak Plate, Serial dilution: - Spread Plate and Pour Plate	**15**
	References: 1. Pelezar MJ, Chan ECS and Krieg NR. (1993). Microbiology. 5th edition. McGraw Hill Book Company. 2. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR. (2005). General Microbiology. 5th edition. McMillan. 3. General Microbiology Vol I and II –Pawar and Daginawala 4. Dubey, R.C and Maheswari, D.K. (2000) General Microbiology. S. Chand, New Delhi 5. Atlas RM (1997): Principles of Microbiology;2nd edition W.M.T. Brown Publishers	

About the course: The course is aimed to provide knowledge for observation, isolation, and cultivation of microorganisms.

Course outcomes: After successfully completing this course, the students will be able to:

- Get knowledge of observation, isolation, and study of microorganisms.
- Develop critical understanding of Microscopy.

Practical- Microbial Techniques VSC-I

Credits: 01 **Total Marks: 25** **Contact hours: 30**

Title of Practical	Contact hours
1.Good microbiology laboratory practices and Biosafety 2.Principle, working, applications and calibration of Common laboratory instruments a. Autoclave b. Hot Air Oven c. Incubator d. Colony Counter e. Seitz filter f. Laminar Air flow g. Weighing balance 3.Handling and Care of compound Microscope 4.Preparation of Saline and culture media a. Peptone Water b. Nutrient Broth c. Nutrient agar d. Mac Conkey's agar e. Sabouraud's agar 5.Staining Procedures a. Monochrome b. Gram staining 6. Isolation of microorganisms from natural sources- Soil/Water/Sewage by four quadrant method. Study of Colony Characters, Gram Staining and Motility of a. *Bacillus Spp.* b. *Escherichia coli* 7. Observation of fungi by lactophenol cotton blue staining.	30
References: 1. Dubey, R.C. and Maheswari, D.K. (2002). Practical Microbiology, S. Chand & Co., New Delhi 2. K. R. Aneja, Pranay Jain, Raman Aneja (2008). A Textbook of Basic and Applied Microbiology, New Age International Publisher 3. Cappuccino, J.G. and Sherman, N. (2005). Microbiology – A Laboratory Manual. 7th Edition. Pearson Education. Published by Dorling Kindersley (India) Pvt. Ltd.	

About the course: The course is aimed to provide theoretical as well as practical knowledge for observation, isolation, and cultivation of microorganisms This practical course also aims to give a broad outline based on instrumentation and bio-safety

Course outcomes: After successfully completing this course, the students will be able to:

- Develop understanding on the diversity of microorganisms
- Get knowledge of observation, isolation, and study of microorganisms
- Develop critical understanding of Microscopy.

Microbiology VEC: Microbial World and Principals of Microbiology

Credits: 02 **Total Marks: 50** **Contact hours: 30**

Unit No.	Content of Unit	Contact Hours
I	**History of Microbiology:** Development of microbiology as a discipline, Spontaneous generation vs. biogenesis. Contributions of Antony von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Paul Ehrlich, Alexander Fleming, John Tyndall, Edward Jenner, Elie Metchnikoff, Role of microorganisms in fermentation, Germ theory of disease. Contributions of Martinus W. Beijerinck and Sergei N. Winogradsky in soil microbiology. Harmful and Beneficial activities of Microorganisms **Diversity of microbial world:** Bacterial Taxonomy: General principles of Bacterial nomenclature Criteria for bacterial classification – Morphological, Cultural and Biochemical Characters, 16S rRNA sequencing. Difference between Prokaryotic & Eukaryotic cell.	**15**
II	**General characters of different groups of microorganisms** **Cellular microorganisms:** Bacteria- Size, Shape, arrangement of bacteria Structure of typical Bacterial cell, Structure and function of Cell Wall, Cell Membrane, Capsule & Slime layer, Flagella and pili. General characters, structure, and economic importance of– Algae, Fungi and protozoa, **Acellular microorganisms -** Definition, General properties of Viruses. viroid and prions **General characteristics of various microorganisms:** Archaebacteria, Rickettsia, Actinomycetes, Chlamydia, Mycoplasma	**15**

	References: 1.Pelezar MJ, Chan ECS and Krieg NR. (1993). Microbiology. 5th edition. McGraw Hill Book Company. 2. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR. (2005). General Microbiology. 5th edition. McMillan. 3.General Microbiology Vol I and II –Pawar and Daginawala 4.Dubey, R.C and Maheswari, D.K. (2000) General Microbiology. S. Chand, New Delhi 5.Atlas RM (1997): Principles of Microbiology;2nd edition W.M.T. Brown Publishers	

About the course: The course is aimed to provide knowledge history, types, morphology, and cytology of microorganisms.

Course outcomes:

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

- Gain basic knowledge of microorganisms, characters of microorganisms.
- Group the organisms based on their morphological, cultural characteristics.
- Develop understanding on the diversity of microorganisms.

SEMESTER – II

Microbiology Minor paper I- Bacterial Physiology

Credits: 02 **Total Marks: 50** **Contact hours: 30**

Unit No.	Content of Unit	Contact Hours
I	**Macromolecules:** Structure & Functions of –a) Carbohydrates b) Proteins c) Lipids d) DNA e) RNA **Microbial Enzymes:** Definition, basic structure-Apoenzyme, coenzymes, cofactors and prosthetic groups **Types of enzymes:** Extra and intracellular, constitutive and induced enzymes- with example. a) Mechanism of action- active site b) Lock and Key hypothesis, induced fit hypothesis	**15**
II	**Microbial Metabolism:** Definition: Anabolism, Catabolism, Metabolism, components of metabolism and High energy compounds. Structure & energy content of ATP Catabolism of Glucose – EMP, Fate of Pyruvate, Pathways alternative to glycolysis: Pentose phosphate pathway, and Entner Doudoroff pathway. TCA Cycle and Electron transport chain **Microbial Nutrition and Growth:** **Microbial Nutrition** Nutritional requirements of microorganisms Common components-Peptone, Meat extract, NaCl, Agar-agar Selective and differential components: Vitamins, Sugar, Sodium taurocholate, milk, starch, Blood and Serum. Nutritional types of Microorganisms based on Carbon & Energy Source. Introduction to extremophiles.	**15**
	References: 1. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (1993). Microbiology. 5th Edition, Tata Mc Graw Hill Publishing Co., Ltd., New Delhi 2. Dubey, R.C and Maheswari, D.K. (2000) General Microbiology. S. Chand, New Delhi 3. Lehninger -Principles of biochemistry 8 th edition 4.U.Satyanarayan- Biochemistry 5. Cooper,G.M. and Hausman,R.E.2009. The Cell: A Molecular Approach. 5th edition. ASM Press and Sunderland, Washington, D.C.;Sinauer Associates, MA.	

About the course:

The course gives a detailed knowledge of microbial metabolism. It also highlights on macromolecules, microbial enzymes its role in microbial metabolism and nutrition

Course outcomes:

After successfully completing this course, the students will be able to

- Acquire knowledge of structure and coordinated function of macromolecules in bacterial cell
- Realize role of various enzymes that are important in metabolic activities of bacterial cells and bacterial nutrition
- Undertake research in many aspects of microbial physiology in future.
- Understand basic concept of microbial nutrition and Growth.

Microbiology VSC-II Applied Microbiology

Credits: 01 **Total Marks: 25** **Contact hours: 15**

Unit No.	Content of Unit	Contact Hours
I	**Water Microbiology:** Sources of microorganisms in water, Fecal pollution of water & its indicator Routine bacteriological analysis of water Tests for coliforms : Qualitative (Presumptive, Confirmed & Completed) Differentiation of coliforms: IMViC & Eijkman test. Quantitative – MPN Municipal Water purification: Coagulation, Sedimentation, Filtration, Disinfection WHO guidelines for drinking water **Milk Microbiology:** Definition and Composition of Milk Sources of contamination Microbiological examination of Milk: -DMC, SPC, MBRT test, Acid degree value test. Resazurin test Pasteurization –Definition and types of pasteurization, Phosphatase test.	**15**
	References: 1. Wiley JM, Sherwood LM and Woolverton CJ. (2013) Prescott's Microbiology. 9th Edition. McGraw Hill International. 2. Powar C.B. and Daginawala H.F. (1986). General Microbiology Vol. I & II (2ndEdition), Himalaya Publishing House, Mumbai. 3. Dubey, R.C and Maheswari, D.K. (2000) General Microbiology. S. Chand, New Delhi 4. Prescott, M.J., Harley, J.P. and Klein, D.A. (2002). Microbiology. 5th Edition, WCB Mc GrawHill, New York. 5.Public health and environment ,WHO Geneva 2009:WHO guidelines for drinking water 6.FSSAI Ministry of Health and Family Welfare GOI, New Delhi 2016:FSSAI Manual of methods of analysis of Food and Water	

About the course: The course explains different branches of microbiology including water and milk microbiology.

Course outcomes: After successfully completing the course, the students will be able to

- Understand how these applied microbiology branches are important in routine life of human beings.
- Develop critical understanding water pollution, methods of bacteriological analysis of water and concept of water purification. Students can gain the knowledge of milk microbiology, concept of pasteurization of milk and related products.

Practical -Applied Microbiology VSC- II

Credits: 01 **Total Marks: 25** **Contact hours: 30**

Name of the Practical	Contact Hours
1. Presumptive test for coliform group of bacteria 2. Confirmed test for coliform bacteria 3. Completed test for coliform bacteria 4. Enumeration of bacteria in given milk by standard plate count /DMC 5. Determination of Most Probable Number of coliforms in given water sample. 6.Methylene Blue Reduction Time test	30
References: 1. Dubey, R.C. and Maheswari, D.K. (2002). Practical Microbiology, S. Chand & Co., New Delhi 2. K. R. Aneja, Pranay Jain, Raman Aneja (2008). A Textbook of Basic and Applied Microbiology, New Age International Publisher 3. Cappuccino, J.G. and Sherman, N. (2005). Microbiology – A Laboratory Manual. 7th Edition. Pearson Education. Published by Dorling Kindersley (India) Pvt. Ltd.	

About the course:

This course aims to give practical knowledge of water quality analysis and determination of milk quality**.**

Course Outcomes:

After successfully completing the course, the students will be able to

- Students can get knowledge of bacteriological analysis of water.
- Learn the techniques applicable in dairy industry.

Annexure I

Question Paper Pattern for Class Room Test (IE)

(02 Credit Theory Course)

Marks 10

Q.No.1 Multiple choice questions - 04 marks.

Q.No.2 Attempt any two - 06 marks.
a)
b)
c)

Annexure II
Scheme of Marking for End Semester Examination (ESE) (Theory)

Walchand College of Arts and Science (Autonomous), Solapur

Theory question paper Pattern for 2 credit course as per NEP 2020
(w. e. f. 2023-24)

Examination: ----------

Class: ---------- Semester: ----------
Subject: -------- Paper: ----------

Time: 1.5 hrs Marks: 30

Instructions: a) All questions are compulsory
b) Figures to the right indicate full marks
c) Draw neat & well labeled diagram wherever necessary

Q. No.1 Select the correct alternative of the following 06

i)

a) b) c) d)

ii)
iii)
iv)
v)
vi)

Q. No.2 Attempt the following (Any three) 06

i)
ii)
iii)
iv)
v)

Q. No.3 Attempt the following (Any two) 06

i)
ii)
iii)

Q. No.4 Attempt the following (Any two) 06

i)
ii)
iii)

Q. No.5 Attempt the following (Any one) 06

i)
ii)

Annexure III

Scheme of Marking for End Semester Examination (ESE) (Theory)

Walchand College of Arts and Science (Autonomous), Solapur
Theory question paper Pattern for 1 credit course as per NEP 2020
(w. e. f. 2023-24)

Examination: ----------
Class: ---------- Semester: ----------
Subject: -------- Paper:----------
Time: 1.5 hrs Marks: 25

Instructions: a) All questions are compulsory
b) Figures to the right indicate full marks
c) Draw neat & well labeled diagram wherever necessary

Q. No.1 Select the correct alternative of the following 05

i)

a) b) c) d)

ii)

iii)

iv)

v)

Q. No.2 Attempt the following (Any five) 05

i)

ii)

iii)

iv)

v)

vi)

vii)

Q. No.3 A) Attempt the following (Any one) 03

i)

ii)

B) Attempt the following (Any one) 02

i)

ii)

Q. No.4 A) Attempt the following (Any one) 03

i)

ii)

B) Attempt the following (Any one) 02

i)

ii)

Q. No.5 Attempt the following (Any one) 05

i)

ii)

Annexure IV

Scheme of Marking for End Semester Examination (ESE)
(01 Credit Practical Course)

Time: 3 hours **Total Marks: 25**

Practical examination will be at the end of the semester. Every candidate has to perform one Practical.

a) Practical : 20 Marks

b) Journal/Report : 05 Marks

Shikshan Haach Dharma
S. A. P. D. Jain Pathashala's
(Jain Minority Institute)

Walchand College of Arts & Science, Solapur

Autonomous College

(Affiliated to P.A.H. Solapur University, Solapur)

।। शिक्षण हाच धर्म ।।

Name of Faculty: Science & Technology

Choice Based Credit System
(According to NEP-2020)

B.Sc. Part-I

Subject: Physics

Syllabus

With Effect from: 2023-24

Walchand College of Arts & Science, Solapur

(Autonomous)

About National Education Policy (NEP) - 2020

With the directions and guidelines issued by **Government of Maharashtra resolution dated 20th April 2023 and 16th May, 2023** regarding the implementation of NEP at UG and PG level, the Walchand College of Arts & Science (Autonomous), Solapur has taken decision to implement NEP 2020 with Choice Based Credit System (CBCS) at Undergraduate level and Post Graduate level. This has been done to achieve the goals and objectives set in NEP-2020 such as- worldwide recognition, acceptability, horizontal as well as vertical mobility for students completing undergraduate and post-graduate degree.

The CBCS provides an opportunity for the students to select from the prescribed courses comprising core, elective/minor or skill based. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations.

Outline of NEP:

The structure of the Three/Four-year bachelor's degree programme allows the opportunity to the students to experience the full range of holistic and multidisciplinary education in addition to a focus on the chosen major and minors as per their choices and the feasibility of exploring learning in different institutions. The structure allows students to learn various components like:

(a) Major (Core) Subject (DSC): This comprises of Mandatory and Elective Courses that require students to achieve:

- Minimum 50% of total credits corresponding to Three/Four - year UG Degree- Mandatory Courses are offered in all four years;
- 2 credit course on Major Specific IKS shall be included under Major;
- Elective courses of Major will be offered in the third and/or final year;
- Vocational Skill Courses, Internship/ Apprenticeship, Field Projects, Research Projects are related to Major

(b) Minor Subject (18-20 Credits)

- The Minor subjects may be from the different disciplines of the same faculty of DSC Major (Core) or they can be from different faculty altogether;
- The credits of Minor subjects shall be completed in the first three years of UG Programme

(c) Generic/ Open Elective Courses (OE) (10-12 credits)

- GE/OE are to be offered in I and/or II year;
- Faculty-wise baskets of OE shall be prepared by Autonomous College.
- OE/GE is to be chosen compulsorily from faculty other than that of the Major or as per the directions issued by NEP-Steering Committee

(d) Vocational and Skill Enhancement Courses (VSEC)

i) Vocational Skill Courses (VSC): (8-10 credits): Includes Hands on Training corresponding to the Major and/or Minor Subjects:

- To be offered in first three years;
- Wherever applicable vocational courses will include skills based on advanced laboratory practicals' of Major

ii) Skill Enhancement Courses (SEC): (06 credits)

- To be offered in I and II year;
- To be selected from the basket of Skill Courses approved by Autonomous College

(e) Ability Enhancement Courses (AEC), Indian Knowledge System (IKS) and Value Education Courses (VEC): (14 Credits)

i) AEC: (08 credits)

- To be offered in I and II year
- English: 04 Credits
- Modern Indian Language: 04 credits
- To be offered from the Basket approved by Autonomous College;

The focus for both languages should be on linguistic and communication skills.

ii) IKS: (2 Credits)

- To be offered in I Year
- Courses on IKS to be selected from the basket of IKS courses approved by Autonomous College

iii) VEC: 04 Credits

- To be offered in I year
- Value Education Courses (VEC) such as Understanding India, Environmental Science/Education, and Digital and Technological Solutions.

(f) Field Projects/ Internship/ Apprenticeship/ Community Engagement and Service corresponding to the Major (Core) Subject, Co-curricular Courses (CC) and Research Project

- Internship/Apprenticeship corresponding to the Major (Core) Subject: (8 Credits)
- Field Projects/Community Engagement and Service (CEP) corresponding to the Major (Core) Subject (minimum 4-6 credits)
  -To be offered in II and III years of UG Degree Programmes.
- Co-curricular Courses (CC) such as Health and Wellness, Yoga education, sports and fitness, Cultural Activities, NSS/NCC and Fine/ Applied/Visual/ Performing Arts: (8 credits)
  -To be offered in I and/or II year
- Research Projects: (12 credits)
  -To be offered in the final year for 4 year Honours with Research UG Degree

- **CREDIT:**

- Credit is a numerical value that indicates students work load (Lectures, Lab work, Seminar, Tutorials, Field work etc.) to complete a course unit. The contact hours are transformed into credits. Moreover, the grading system of evaluation is introduced for B.Sc. course wherein process of Continuous Internal Evaluation is ensured.
- **Theory: '**15 contact hours' for theory course constitute 'one credit'
- **Practical/Tutorial: '**30 contact hours' for practical course constitute 'one credit'.
- **Workshop based activities/Skill based activities:** Minimum 30 contact hours per credit in a semester is required
- **Internship/On-Job Training: '**30 contact hours' per credit in a semester is required (1 credit/week)
- **Community Engagement and Service-CEP/Field Project: '**30 contact hours' per credit in a semester is required

- **Credit Framework under Three/Four Years UG Programme with Multiple Entry and Multiple Exit Options:**

The minimum and maximum credit structure for different levels under three or four year UG programme with multiple entry and multiple exit options are as given below:

Levels	Code	Qualification Titles	Credit Requirements		Semester	Year
			Minimum	Maximum		
4.5	100-199	UG Certificate	40	44	2	1
5.0	200-299	UG Diploma	80	88	4	2
5.5	300-399	Three Year Bachelor's Degree	120	132	6	3
6.0	400-499	Bachelor's Degree Honours **OR** Bachelor's Degree-Honours with Research	160	176	8	4
	500-599	First Year PG & or PG Diploma	40	44	2	1
6.5	600-699	PG Degree	80	88	4	2
8.0	700-799	Ph.D.	16+ Ph.D. Work		---	---

Multiple Exit Options

Year	Exit Option	Reentry
First Year	Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/Internship OR Continue with Major and Minor	Students opting for exits at any level 'will have the option to reenter' the programme from where they had left off, in the same or in different higher educational institution 'within three years of exits' and complete the degree program within the stipulated maximum period of 07 years from the date admission of first year of UG.
Second Year	Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF Course/Internship OR Continue with Major and Minor	
Third Year	Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor	
Fourth Year Honours	Four Year UG Honours Degree in Major and Minor with160-176 credits	
Fourth Year Honours with Research	Four Year UG Honours with Research Degree in Major and Minor with160-176 credits	

Post-Graduation Degree		
Post-Graduation: First Year	PG Diploma (44 Credits) after Three Year UG Degree	Reentry to complete the PG degree after taking exit option will be permissible up to 5 years from the date admission to PG programme

- **Academic Bank of Credit (ABC):**

It is mandatory for all admitted students to get enrolled on ABC Portal and create ABC ID and share ABC-ID with academic institutions where they are enrolled. Credits earned by the students will be reflected in the students ABC account. This will allow students smooth transition during multiple entry and exit.

Walchand College of Arts & Science, Solapur (Autonomous)

Faculty of Science: Choice Based Credit System (According to NEP-2020)
(w.e.f. 2023-24)

Preamble: The syllabus for the B.Sc. Physics is designed to follow the UGC guidelines. The syllabus of Physics course is aimed to be more learning centric than teaching centric so that a student progressively develops a deeper understanding of various aspects in physics. Physics is learnt more through experimentation than only through classroom sessions. The experiments are designed to develop logical thinking and analytical ability.

Objectives of the course: The objectives of B. Sc. Physics course are:

1. To explore different areas of physics.
2. To develop theoretical foundation and experimental skills to study various natural phenomena.
3. To train students for in depth study of physics.
4. To encourage students to explore applications of physics in various walks of life.
5. To inculcate research culture by introducing projects at the final year of the course.

- **Program Outcomes:**

Physics course aims to learning of the basic sciences so that a graduate student must employ his knowledge in various domains consisting of very basic principles and phenomenon of physics. He must apply his knowledge of scientific theories related to various physical phenomena in meeting the challenges of the society in day-to-day life. A Physics graduate must use his knowledge with necessary facts and figures of physical science in the advancement of technology. The program in Physics must enable and encourage him/her to undertake further higher studies in Physics and related multidisciplinary areas. The successful students will be able to establish research organizations or join research and development organizations. .He can join colleges, universities, GOs and NGOs in India & aboard. Also have an opportunity to work in industry, administrative jobs.

Program Specific Outcomes:

- Attains a common level in basic mechanics, properties of matter.
- Get the knowledge of basic principles and phenomenon of optics and Laser
- Understand the principles of heat and thermodynamics
- Understand the fundamentals of electricity, basic laws of magnetism and the knowledge of basic electronic components and devices
- Acquire the skills in handling scientific instruments, performing in laboratory experiments
- Develop the experimental and data analysis skills through a wide range of experiments through practical at laboratories

Eligibility for Admission: A Candidate passing 10+2 with Physics as one of the subject and passed from State Board / CBSE / ICSE or equivalent with minimum passing percentage of as per the directives of the higher education is eligible for admission.

Duration: The duration of the B.Sc.-I course is of 1 year (comprising 2 semesters)

Medium of Instruction: English

Pattern of the Course: The autonomous college follows semester pattern.

NEP Structure: Physics B.Sc. I

SEMESTER-I				
Subject	**Paper Title**	**Credits**	**Hours/week**	**Contact Hours**
Physics GE-I (For Science)	**Electrical and Electronics Instruments**	2	2	30
Physics GE-I P (For Science)	**Practical -Physics GE-I**	2	4 (hours/week/batch)	60
Physics VSC-I	**Physics Workshop Skills**	1	1	15
Physics VSC-I P	**Practical -Physics VSC-I**	1	2 (hours/week/batch)	30
Physics SEC-I	**Mobile Repair and Maintenance**	1	1	15
Physics SEC-I P	**Practical -Physics SEC-I**	1	2 (hours/week/batch)	30
Physics VEC-I	**Renewable Energy and Energy Harvesting**	2	2	30
Physics IKS	**Indian Astronomy**	2	2	30
SEMESTER-II				
Physics Minor-I	**Mechanics and Properties of matter**	2	2	30
Physics GE-II (For Science)	**Applied Optics**	2	2	30
Physics GE- II P (For Science)	**Practical -Physics GE-II**	2	4 (hours/week/batch)	60
Physics VSC-II	**Electrical Circuit Skills**	1	1	15
Physics VSC-II P	**Practical -Physics VSC-II**	1	2 (hours/week/batch)	30
Physics SEC-II	**Solar Power Installation Operation and Maintenance**	1	1	15
Physics SEC-II P	**Practical -Physics SEC-II**	1	2 (hours/week/batch)	30
Physics-VEC-II	**Radiation Safety**	2	2	30

Outline of Examination:

THEORY:

1) Internal Evaluation (IE): Internal evaluation will consist of **40 % marks** per semester per paper. It may be held as **per the following scheme** per semester **(Annexure: I)**

Credits	Marks for Attendance	Classroom Test	Home Assignment	Total Marks
02	05	10	05	20

2) End Semester Examination (ESE): The detailed question paper pattern (**60 % marks per paper)** is given as in **Annexure- II and Annexure- III**

PRACTICAL:

1) Internal Evaluation (IE): Internal evaluation will carry **40 % marks** and may consist of:

Credits	Marks for Attendance	Internal Practical Exam	Journal	Total Marks
02	05	10	05	20

2) **End Semester Examination (ESE):** Practical examination **60 % marks** shall be conducted at the end of each semester. The detailed scheme is given in **Annexure-IV and Annexure-V**

Semester – I

Physics GE-I: Electrical and Electronics Instruments

Credits: 02 **Total Marks: 50** **Contact hours: 30**

Unit No.	Title of topic and content	Contact Hours
I	**1. Electrical Instruments:** a) Electromechanical instrument: Ammeters, Voltmeters, Ohmmeters, Wattmeter b) Measurements of Low, Medium and High resistance c) Potentiometers d) Impedance Measurement	**15**
II	**2. Electronic Instruments:** a) Digital Multimeter b) Regulated Power Supply c) Function Generator d) Cathode Ray Oscilloscope e) ADC and DAC	**15**

Practical- Physics GE-I

Credits: 02 **Total Marks : 50** **Contact hours: 60**

Title of Practical	Contact Hours
1. Study of front panel of: Digital Multimeter 2. Use of multimeter 3. Study of front panel of: Regulated Power Supply 4. Study of front panel of: Function Generator 5. Study of front panel of: Cathode Ray Oscilloscope 6. Use of CRO 7. Study of ADC 8. Study of DAC 9. Measurement of low resistance 10. Measurement of high resistance 11. Measurement of impedance 12. Measurement of Electrical Power	60

References:

1. A Course in Electrical and Electronics Measurements and Instrumentation by Sawhney A K, Dhantatrai and Co. 1978
2. Basic Electrical Engineering by Kulshreshtha D C , Mc Graw Hill Publication 2029
3. Electronic Instrumentation 3rd Edition, H S Kalsi, Tata Mc Graw Hill Publication 2011
4. https://drive.google.com/file/d/1vIjbQOtjEWiDBmolQNE2pwnc2BfUqNwD/view?usp=sharing

About the course:

The aim of this course is to enable the students to understand basic principles of working of electrical and electronics instruments.

Course outcomes:

After the completion of this course, students are able to:

1) Familiarize with electrical and electronics instruments.
2) Understand the basic principles of working of electrical and electronics instruments.
3) Use electrical and electronics instruments for measurements.

Physics VSC-I: PHYSICS WORKSHOP SKILLS

Credits: 01 **Total Marks: 25** **Contact hours: 15**

Unit No.	Title of topic and contents	Contact Hours
I	**1. Introduction :** Concept of workshop practice. Overview of manufacturing methods - casting, foundry, machining, forming welding and cutting. (In brief) **2. Measuring skills:** Familiarization with meter scale, Vernier calliper, Screw gauge and their utility. Measuring the dimension of a solid block, volume of cylindrical beaker/glass, diameter of a thin wire, thickness of metal sheet, etc. **3. Mechanical Skill**: Introduction to common machine tools like lathe, shaper, drilling, milling and surface machines, Cutting tools, lubricating oils. Cutting of a metal sheet using blade. Smoothening of cutting edge of sheet using file. Drilling of holes in metal sheet and wooden block. **4. Electrical and Electronic Skill**: Use of Multimeter. Soldering of electrical circuits having discrete components (R, L, C, diode) and ICs on PCB. Operation of oscilloscope, regulated power supply and function generator.	15

Practical -Physics VSC-I

Credits: 01 **Total Marks: 25** **Contact hours: 30**

Title of Practical	Contact Hours
1. Identification of given measuring instruments 2. Determination of least count of given instruments 3. Use of vernier calipers to determine the dimensions of given body 4. Use of Screw gauge to determine the dimensions of given body 5. Identification of given machine tools. 6.Use of blade and file 7.Use of drilling machine 8. Use of multimeter 9. Soldering of given electrical/electronic components 10. Study of front panel of given electronic equipment	**30**

Reference Books:

1. A text book in Electrical Technology - B L Theraja – S. Chand and Company.
2. Performance and design of AC machines – M.G. Say, ELBS Edn.
3. Mechanical workshop practice, K.C. John, 2010, PHI Learning Pvt. Ltd.
4. Workshop Processes, Practices and Materials, Bruce J Black 2005, 3rd Edn., Editor Newnes
5. New Engineering Technology, Lawrence Smyth/Liam Hennessy, The Educational Company Ireland

About the course:

The aim of this course is to enable the students to familiar and experience with various mechanical and electrical tools through hands-on mode

Course outcomes:

After successful completion of this course the students are able to

1) Understand basic concept of Workshop practice
2) Develop basic skills of measurements
3) Identify various Tools
4) Use Different tools and equipment

Physics SEC-I: Mobile Repair and Maintenance

Credits: 01 **Total Marks: 25** **Contact hours: 15**

Unit No.	Title of topic and content	Contact Hours
I	**1. Basic Electronics** Basics of mobile communication, Study of Digital Electronics, Networks, Assembling and disassembling of various models of mobile phones, Study of various tools and equipment used in mobile phone repairs, Use of DC Power Supply. **2. Mobile Phone** Working Principles of Mobile, block diagram of mobile, applications, advantages and disadvantages of mobile and Different Components. **3. Mobile Software** Importance of Software in working of Android Phones, Software available in internet, Flashing of various brands of Mobile. Removing virus from infected phones. **4. Basic and Advanced Troubleshooting** Fault finding, troubleshooting and repairing of various faults. Common repair procedure for hardware related faults. Troubleshooting through schematic diagrams. **5. Mobile Phone Repair** Introduction and study of Printed Circuit Board (Motherboard), Testing of various parts and components, Study of different ICs (chips) used on the motherboard, How to recognize various ICs, Soldering & de soldering of components by using a soldering iron and hot air gun, Reheating and mounting of various BGA and SMD chips.	**15**

Practical -Physics SEC-I

Credits: 01 **Total Marks: 25** **Contact hours: 30**

Title of Practical	Contact Hours
1. Fault finding (Hardware). 2. Fault finding (Software). 3. Soldering & de soldering of components. 4. Flashing of various brands of Mobile. 5. Removing virus from infected phones.	**30**

References:

1. Chukky Oparandu, "*Mobile Phones and Tablets Repairs"*, Mondraim Nig. Limited, 9 May 2016.
2. Ajay R. Mishra, "*Advanced Cellular Network Planning and Optimisation"***,** Wiley, 2007.
3. https://drive.google.com/file/d/13x-4SwKHLuWZ8G0Ugy2PCy2Bfk6coLHI/view?usp=sharing

About the course:

In the world of smart devices and on the go communication, mobile and allied gadgets are playing a very important role. The era of modern communication has changed every aspect of life from office to home, entertainment, day to day life, social life everything. The mobile devices are core electronics devices and if any problem occurs it needs to be immediately resolved. As more and more devices and technologies are there, requirement of trained and certified technicians is felt by the industry.

Course outcomes:

After completion of this course students will:

1. Understand the Working Principles of Handset and Different Components.
2. Be able to do Soldering, De-soldering and Troubleshooting.
3. Be able to Know the relation different between Hardware and Software.

Physics-VEC I – RENEWABLE ENERGY AND ENERGY HARVESTING

Credits: 02 **Total Marks: 50** **Contact hours: 30**

Unit No.	Title of topic and contents	Contact Hours
I	**1. An Introduction to Energy Sources** Fossil fuels and nuclear energy and their limitation, need of renewable energy, non-conventional energy sources. **2. Solar energy**: Solar energy, its importance, storage of solar energy, solar pond, non-convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. photovoltaic (PV) systems **3. Wind Energy harvesting**: Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines	**15**
II	**4. Ocean Energy**: Ocean Energy Potential against Wind and Solar, Wave Energy Devices **5. Geothermal Energy**: Geothermal Resources, Geothermal Technologies **6. Hydro Energy**: Hydropower resources, hydropower technologies, environmental impact of hydro power sources **7. Biomass energy:** Bio-mass conversion technologies, Bio-gas generation, Working of biogas plant, Bio-gas from plant wastes, Methods for obtaining energy from biomass. **8**. **Energy storage devices and electrical Vehicles:** Recent trends in batteries, super-capacitors, fuel cells. Applications of storage devices in Electrical Vehicles (EV)	**15**

References:

1) Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
2) Solar energy - M P Agarwal - S Chand and Co. Ltd.
3) Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004, Oxford University Press, in association with The Open University.
4) J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).
5) http://en.wikipedia.org/wiki/Renewable_energy

About the course:

The course deals with introduction of various types conventional and non-conventional energy sources along with their limitations, advantages and disadvantages. The course helps to understand present crisis, challenges and opportunities in conversion of energy.

Course outcomes:

After successful completion of this course the students are able to

1) Understand the comparative aspects, advantages and disadvantages of various sources of energy.

2) Learn the basic principles involved and technologies developed in the uses of solar energy, biomass energy, wind energy, fuel cells.

3) Get acquainted with challenges and recent trends in energy storage devices and they learn more about super-capacitors and batteries, electrical vehicles.

4) Imagine about future road maps in the fields of energy conversion and storage technologies.

Physics IKS: Indian Astronomy

Credits: 02 **Total Marks: 50** **Contact hours: 30**

Unit No.	Title of topic and content	Contact Hours
I	**1. Introduction:** Astronomy and Astrology, Basics of Observational Astronomy, Difference between a Star and a Planet, Paths of the Sun and the Moon in the Sky Waxing and Waning of the Moon, Eclipses, Some Well-known Stars and Stellar Constellations, Terms Specific to Indian Astronomy. **2. Astronomy in Vedic Era:** Vedas, Astronomical References in Vedas, Nav Greha, Amanant and Puranamant, Names of the Parts of a day, Tithi, Nakshatras, Names of Months, Calendrical Awareness.	**15**
II	**3. Indian Astronomers:** a) Arya Bhatta-I: Main Contents of Aryabhatti b) Varahamihira c) Bhaskar Acharya-II d) Jai Singh **4. Modern Era Astronomy:** Advent of Modern Astronomy in India, Physical Astronomy, Impact of Modern Astronomy on Traditional Indian Astronomy	**15**

References:

1. https://drive.google.com/file/d/1t1R7U_G9SRQAdcjWzT98jBA_JtsaThnv/view?usp=sharing
2. https://drive.google.com/file/d/1iy4tB7FHLSBlQGhgeSdYB_FWQDfc6iuM/view?usp=sharing
3. https://drive.google.com/file/d/1ryrbO3JSuyykAmmGAsRd9JlfzC4ewb9N/view?usp=sharing
4. https://drive.google.com/file/d/1eAUlRjQrKM0dyd9IJ26KuEpJrmDTT7B4/view?usp=sharing

About the course:

This course enables the students to feel connected to Indian heritage and help to contribute sustainable development.

Course outcomes:
After the completion of this course, students are able to:
1) Understand the ancient Indian astronomy.
2) Feel proud of the Indian heritage.

Semester - II

Physics Minor paper I – Mechanics and Properties of Matter

Credits: 02 **Total Marks: 50** **Contact hours: 30**

Unit No.	Title of topic and contents	Contact Hours
I	**1. Moment of Inertia** Review of M.I., Moment of Inertia of 1) Circular disc 2) Rectangular lamina 3) Spherical Shell 4) Fly wheel **2. Pendulums** Theory of compound pendulum, Kater's Pendulum, Bifilar pendulum (parallel suspensions of equal lengths), Torsional Pendulum **3. Precessional Motion** Precession, Gyroscope, Nutation, Lanchester's rule, Gyrostatic pendulum, Gyroscopic applications in brief	15
II	**1. Elasticity** Introduction, Theory of Poisson's ratio of rubber tube , Bending of a beam, Bending moment, Cantilever, Determination of Y for the material of cantilever by dynamical method, Centrally loaded beam, Y and η by Searle's method **2. Surface Tension** Review of S.T., relation between excess pressure and surface tension, excess pressure inside a liquid drop and soap bubble, Jaeger's method to determine Surface Tension **3. Viscosity and Fluid dynamics** Introduction, Newton's law of viscosity, streamline and turbulent flow, Equation of continuity, Energy possessed by liquid, Bernoulli's theorem and its applications to 1) Venturimeter 2) Atomizer. Viscosity of liquid by rotating cylinder method, Searle's viscometer	15

Reference Books:

1) Properties of matter- D.S. Mathur
2) A Text book of properties of matter- N.S. Khare & S.Kumar
3) Physics Vol.I –David & Robert Resnick
4) University Physics-Mechanics of a particle- Anvar Kamal
5) Physics for Degree students – C.L.Arora & P.S.Hemne

About the course:

The course deals with fundamentals of mechanics and properties of matter. It includes application of rotational dynamics in terms of moment of inertia of the different bodies. In this course it is tried to explore some fundamental properties of matter such as elasticity, surface tension and viscosity. .Some aspects of fluid dynamics are also considered.

Course outcomes:

After successful completion of this course the students are able to

1) Understand basic concepts in mechanics
2) Explain properties of matter
3) Describe methods used to determine surface tension and viscosity
4) Understand basic laws in fluid dynamics

Physics GE-II: Applied Optics

Credits: 02 **Total Marks: 50** **Contact hours: 30**

Unit No.	Title of topic and content	Contact Hours
I	**1. Lasers:** Spontaneous and stimulated emissions, Theory of laser action, Einstein's coefficients, Light amplification, Characterization of laser beam, He-Ne laser, Semiconductor lasers. **2. Detectors:** Photodiode, Phototransistor, Photocell and Light Dependent Resistor (LDR), IR detector.	**15**
II	**3. Holography:** Coherence, resolution, types of holograms, white light reflection hologram, application of holography in microscopy, interferometry, and character recognition. **4. Fibre Optics:** Optical fibres and their properties, Principal of light propagation through a fibre, The numerical aperture, Attenuation in optical fibre and attenuation limit, Single mode and multimode fibres.	**15**

Practical -Physics GE-II

Credits: 02 **Total Marks: 50** **Contact hours: 60**

Title of Practical	Contact Hours
1. Determination of the grating radial spacing of the Compact Disc (CD). 2. To find the width of the wire or width of the slit using diffraction pattern 3. To find the polarization angle of laser light using polarizer and analyzer 4. V-I characteristics of LED 5. Study the characteristics of solid state laser 6. Study the characteristics of LDR 7. Study the characteristics of Photovoltaic Cell 8. Characteristics of IR sensor 9. To measure the numerical aperture of an optical fibre 10. To study the variation of the bending loss in a multimode fibre.	**60**

References:

1. Fundamental of optics, F. A. Jenkins & H. E. White, 1981, Tata McGraw hill.
2. Fundamentals & applications, K.Thyagrajan & A.K.Ghatak, 2010, Tata McGraw Hill
3. Fibre optics through experiments, M.R.Shenoy, S.K.Khijwania, et.al. 2009, Viva Books
4. Nonlinear Optics, Robert W. Boyd, (Chapter-I), 2008, Elsevier.
5. https://drive.google.com/file/d/1XT5Zp4vj_NANZZNCVCZlmRuUhkjuxxgv/view?usp=sharing

About the course:

The aim of this course is to enable the students to understand the basic concepts and principles in applied optics.

Course outcomes:

After the completion of this course, students are able to:

1) Understand the basic concepts and principles in applied optics.
2) Use the lasers and detectors in different applications.

Physics VSC-II: Electrical Circuit Skills

Credits: 01 **Total Marks: 25** **Contact hours: 15**

Unit No.	Title of topic and content	Contact Hours
I	**1. Basic Electricity Principles:** Voltage, Current, Resistance, and Power. Ohm's law. Series, parallel, and series-parallel combinations. AC Electricity and DC Electricity. Familiarization with multimeter, voltmeter and ammeter. **2. Electrical Drawing and Symbols:** Drawing symbols. Blueprints. Reading Schematics. Ladder diagrams. Electrical Schematics. Power circuits. Control circuits. Reading of circuit schematics. Tracking the connections of elements and identify current flow and voltage drop. **3. Generators and Transformers:** DC Power sources. AC/DC generators. Inductance, capacitance, and impedance. Operation of transformers. **4. Solid-State Devices:** Resistors, inductors and capacitors. Diode and rectifiers. Components in Series or in shunt. Response of inductors and capacitors with DC or AC sources. **5. Electrical Protection:** Relays. Fuses and disconnect switches. Circuit breakers. Overload devices. Ground-fault protection. Grounding and isolating. Phase reversal. Surge protection. Interfacing DC or AC sources to control elements (relay protection device)	**15**

Practical -Physics VSC-II

Credits: 01 **Total Marks: 25** **Contact hours: 30**

Title of Practical	Contact Hours
1. Study of electrical wiring. 2. Build and test the extension board. 3. Determination of electric power consumption. 4. Study of series and parallel combinations. 5. Study of the circuit breakers. 6. Study of electrical circuit components.	**30**

References:

1. A text book in Electrical Technology - B L Theraja - S Chand & Co.
2. A text book of Electrical Technology - A K Theraja
3. Performance and design of AC machines - M G Say ELBS Edn.
4. https://drive.google.com/file/d/1kMoG6f4rLoN40S5rnqwG5uDS4EAnHoId/view?usp=sharing

About the course:

The aim of this course is to enable the students to design and trouble shoots the electrical circuits, networks and appliances through hands-on mode.

Course outcomes:

After the completion of this course, students are able to:

1) Familiarize with electrical components and networks.
2) Build and test circuit as per circuit diagram.
3) Install electrical appliances.

Physics SEC-II: Solar Power Installation, Operation and Maintenance

Credits: 01 **Total Marks: 25** **Contact hours: 15**

Unit No.	Title of topic and content	Contact Hours
I	**1. Solar Photovoltaic** Solar Cell and its function, Solar Technologies, Solar Cell Parameters, Efficiency of Solar Cell, Solar PV Module, Rating of Solar PV Module, PV Module Parameters, Efficiency of PV Module, Measuring Module Parameters. Connection of PV Module in Series and Parallel, Estimation and Measurement of PV Module Power, Selection of PV Module. **2. Batteries** Battery function, Types of Batteries, Battery parameters, Selection of Battery, Series Parallel combination of Batteries, Batteries for Photo voltaic System, Application of Batteries in Solar PV system, Battery Maintenance and Measurements, Battery Fault Detection and Test, Battery Installation for PV system. **3. Charge Controller, MPPT and Inverter** DC to DC power converter, DC to AC Converter, AC to DC Converter, Battery Charge controller, Maximum Power Point Tracking, Specification of Inverter and charger. Types of Wire, Wire Sizing, Junction Box, DC cabling, AC cabling. **4. Solar PV System Design and Integration** Solar tracking system, Solar Radiation Energy Measurements, Estimating Energy requirement, Design methodology for SPV system, Design and Development of Solar Street Light and Solar Lantern **5. Installation, Trouble Shooting and Safety** Installation and Trouble shooting of Standalone Solar PV System, Maintenance of Solar PV System, Safety in installation of Solar PV System.	**15**

Practical -Physics SEC-II

Credits: 01 **Total Marks: 25** **Contact hours: 30**

Title of Practical	Contact Hours
1. Characteristics of Solar Panel 2. Study of polar graph Solar Panel 3. Field visit (Solar Water Pumping System) 4. Field Visit (Solar Hybrid Power System)	**30**

References:

1. Rabindra Kumar Satpathy, Venkateswarlu Pamuru, "*Solar PV Power"*, Elsevier Science, 28 November 2020
2. Chetan Singh Solanki, "*Solar Photovoltaic Technology And Systems"*, PHI Learning, 11 January 2013
3. https://drive.google.com/file/d/1NdZUkCflhHe3ouWZ8Btm_qpZeP8pS3dL/view?usp=sharing
4. https://drive.google.com/file/d/1t1R7U_G9SRQAdcjWzT98jBA_JtsaThnv/view?usp=sharing

About the Course:

This is a skill oriented course in the study of solar photovoltaic (PV) cells, modules, and system components; electrical circuits; PV system design and sizing for use on homes, commercial building etc., understanding energy conversion from sunlight to electricity, and working with solar conversion equipment. This Course will give students the book knowledge and hands on experience needed to become entrepreneur/self employed.

Course Outcomes:

Upon completion of this course, the student will be able to

1) Demonstrate knowledge of and apply key solar electric system terms and concepts.
2) Test voltage generated by photovoltaic system Operate & Maintain of Solar Power.
3) Learn different types of solar PV module and batteries used in solar PV plant.
4) Design of solar PV Plant based on estimated loads.

Physics-VEC II – RADIATION SAFETY

Credits: 02 **Total Marks: 50** **Contact hours: 30**

Unit No.	Title of topic and contents	Contact Hours
I	**1. Basics of Atomic and Nuclear Physics:** Basic concept of atomic structure; X rays production; The composition of nucleus and its properties, mass number, isotopes of element, stable and unstable isotopes, law of radioactive decay, Mean life and half life, basic concept of alpha, beta and gamma decay, types of nuclear reaction, Fusion, fission. **2. Types of Radiation:** Alpha, Beta, Gamma and Neutron and their sources, sealed and unsealed sources.	15
II	**3. Radiation detection and monitoring devices:** Basic concept and working principle of gas detectors, Scintillation Detectors, Solid States Detectors and Neutron Detectors. Basic idea of different units of activity, KERMA, exposure, absorbed dose, equivalent dose, effective dose, collective equivalent dose, Annual Limit of Intake (ALI) and derived Air Concentration (DAC). **4. Radiation safety management:** Biological effects of ionizing radiation, radiation protection standards, introduction of safety and risk management of radiation. Nuclear waste and disposal management.	15

References:

1. W.E. Burcham and M. Jobes – Nuclear and Particle Physics – Longman (1995)
2. G.F.Knoll, Radiation detection and measurements
3. A. Martin and S.A. Harbisor, An Introduction to Radiation Protection, John Willey & Sons, Inc. New York, 1981.
4. Radiation Safety Handbook by Rafi Srebro

About the course:
The aim of this course is for awareness and understanding regarding radiation hazards and safety.

Course outcomes:
After successful completion of this course the students are able to
1) Understand the different types of radiation
2) Explain the effect of radiation
3) Get the idea of radiation safety management

Annexure I

Question Paper Pattern for Class Room Test (IE)

(02 Credit Theory Course)

Marks 10

Q.No.1 Multiple choice questions - 04 marks.

Q.No.2 Attempt any two - 06 marks.

a)
b)
c)

Annexure II

Scheme of Marking for End Semester Examination (ESE) (Theory)

Walchand College of Arts and Science (Autonomous), Solapur

Theory question paper Pattern for <u>2 credit</u> course as per NEP 2020
(w. e. f. 2023-24)

Examination: ----------

Class: ---------- **Semester: ----------**
Subject: -------- **Paper: ----------**

Time: 1.5 hrs **Marks: 30**

Instructions: a) All questions are compulsory
b) Figures to the right indicate full marks
c) Draw neat & well labeled diagram wherever necessary
d) Use of logarithm tables and calculator is allowed

Q. No.1 Select the correct alternative of the following **06**

i)

a) b) c) d)

ii)

iii)

iv)

v)

vi)

Q. No.2 Attempt the following (Any three) **06**

i)

ii)

iii)

iv)

v)

Q. No.3 Attempt the following (Any two) **06**

i)

ii)

iii)

Q. No.4 Attempt the following (Any two) **06**

i)

ii)

iii)

Q. No.5 Attempt the following (Any one) **06**

i)

ii)

Annexure III

Scheme of Marking for End Semester Examination (ESE) (Theory)

Walchand College of Arts and Science (Autonomous), Solapur

Theory question paper Pattern for **1 credit** course as per NEP 2020

(w. e. f. 2023-24)

Examination: ----------

Class: ---------- Semester: ----------

Subject: -------- Paper:----------

Time: 1.5 hrs Marks: 25

Instructions: a) All questions are compulsory
b) Figures to the right indicate full marks
c) Draw neat & well labeled diagram wherever necessary
d) Use of logarithm tables and calculator is allowed

Q. No.1 Select the correct alternative of the following **05**

i)

a) b) c) d)

ii)

iii)

iv)

v)

Q. No.2 Attempt the following (Any five) **05**

i)

ii)

iii)

iv)

v)

vi)

vii)

Q. No.3 A) Attempt the following (Any one) **03**

i)

ii)

B) **Attempt the following (Any one)** **02**

i)

ii)

Q. No.4 A) Attempt the following (Any one) **03**

i)

ii)

B) **Attempt the following (Any one)** **02**

i)

ii)

Q. No.5 Attempt the following (Any one) **05**

i)

ii)

Annexure-IV

Scheme of Marking for End Semester Examination (ESE)
(02 Credit Practical Course)

Time: 3 hours **Total Marks: 30**

Practical examination will be at the end of the semester. Every candidate has to perform one Practical.

a) Practical : 25 Marks

b) Certified Journal : 05 Marks

The breakup of 25 marks should be given in the practical slip.

Annexure V

Scheme of Marking for End Semester Examination (ESE)
(01 Credit Practical Course)

Time: 3 hours **Total Marks: 25**

Practical examination will be at the end of the semester. Every candidate has to perform one Practical.

a) Practical : 20 Marks

b) Journal/Report : 05 Marks

The breakup of 20 marks should be given in the practical slip.

Chairperson
BoS in Physics

Shikshan Haach Dharma
S. A. P. D. Jain Pathashala's
(Jain Minority Institute)

Walchand College of Arts & Science, Solapur

Autonomous College

(Affiliated to P.A.H. Solapur University, Solapur)

।। शिक्षण हाच धर्म ।।

Name of Faculty: Science & Technology

Choice Based Credit System
(According to NEP-2020)

B.Sc. Part-I

Subject: Electronics

Syllabus

With Effect from: 2023-24

Walchand College of Arts & Science, Solapur

(Autonomous)

About National Education Policy (NEP) - 2020

With the directions and guidelines issued by **Government of Maharashtra resolution dated 20th April 2023 and 16th May, 2023** regarding the implementation of NEP at UG and PG level, the Walchand College of Arts & Science (Autonomous), Solapur has taken decision to implement NEP 2020 with Choice Based Credit System (CBCS) at Undergraduate level and Post Graduate level. This has been done to achieve the goals and objectives set in NEP-2020 such as- worldwide recognition, acceptability, horizontal as well as vertical mobility for students completing undergraduate and post-graduate degree.

The CBCS provides an opportunity for the students to select from the prescribed courses comprising core, elective/minor or skill based. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations.

Outline of NEP:

The structure of the Three/Four-year bachelor's degree programme allows the opportunity to the students to experience the full range of holistic and multidisciplinary education in addition to a focus on the chosen major and minors as per their choices and the feasibility of exploring learning in different institutions. The structure allows students to learn various components like:

(a) Major (Core) Subject (DSC): This comprises of Mandatory and Elective Courses that require students to achieve:

- Minimum 50% of total credits corresponding to Three/Four - year UG Degree- Mandatory Courses are offered in all four years;
- 2 credit course on Major Specific IKS shall be included under Major;
- Elective courses of Major will be offered in the third and/or final year;
- Vocational Skill Courses, Internship/ Apprenticeship, Field Projects, Research Projects are related to Major

(b) Minor Subject (18-20 Credits)

- The Minor subjects may be from the different disciplines of the same faculty of DSC Major (Core) or they can be from different faculty altogether;
- The credits of Minor subjects shall be completed in the first three years of UG Programme

(c) Generic/ Open Elective Courses (OE) (10-12 credits)

- GE/OE are to be offered in I and/or II year;
- Faculty-wise baskets of OE shall be prepared by Autonomous College.
- OE/GE is to be chosen compulsorily from faculty other than that of the Major or as per the directions issued by NEP-Steering Committee

(d) Vocational and Skill Enhancement Courses (VSEC)

i) Vocational Skill Courses (VSC): (8-10 credits): Includes Hands on Training corresponding to the Major and/or Minor Subjects:

- To be offered in first three years;
- Wherever applicable vocational courses will include skills based on advanced laboratory practicals' of Major

ii) Skill Enhancement Courses (SEC): (06 credits)

- To be offered in I and II year;
- To be selected from the basket of Skill Courses approved by Autonomous College

(e) Ability Enhancement Courses (AEC), Indian Knowledge System (IKS) and Value Education Courses (VEC): (14 Credits)

i) AEC: (08 credits)

- To be offered in I and II year
- English: 04 Credits
- Modern Indian Language: 04 credits
- To be offered from the Basket approved by Autonomous College;

The focus for both languages should be on linguistic and communication skills.

ii) IKS: (2 Credits)

- To be offered in I Year
- Courses on IKS to be selected from the basket of IKS courses approved by Autonomous College

iii) VEC: 04 Credits

- To be offered in I year
- Value Education Courses (VEC) such as Understanding India, Environmental Science/Education, and Digital and Technological Solutions.

(f) Field Projects/ Internship/ Apprenticeship/ Community Engagement and Service corresponding to the Major (Core) Subject, Co-curricular Courses (CC) and Research Project

- Internship/Apprenticeship corresponding to the Major (Core) Subject: (8 Credits)
- Field Projects/Community Engagement and Service (CEP) corresponding to the Major (Core) Subject (minimum 4-6 credits)

-To be offered in II and III years of UG Degree Programmes.

- Co-curricular Courses (CC) such as Health and Wellness, Yoga education, sports and fitness, Cultural Activities, NSS/NCC and Fine/ Applied/Visual/ Performing Arts: (8 credits)

-To be offered in I and/or II year

- Research Projects: (12 credits)

-To be offered in the final year for 4 year Honours with Research UG Degree

➢ CREDIT:

- Credit is a numerical value that indicates students work load (Lectures, Lab work, Seminar, Tutorials, Field work etc.) to complete a course unit. The contact hours are transformed into credits. Moreover, the grading system of evaluation is introduced for B.Sc. course wherein process of Continuous Internal Evaluation is ensured.
- **Theory: '**15 contact hours' for theory course constitute 'one credit'
- **Practical/Tutorial: '**30 contact hours' for practical course constitute 'one credit'.

- **Workshop based activities/Skill based activities:** Minimum 30 contact hours per credit in a semester is required
- **Internship/On-Job Training: '**30 contact hours' per credit in a semester is required (1 credit/week)
- **Community Engagement and Service-CEP/Field Project: '**30 contact hours' per credit in a semester is required

➢ **Credit Framework under Three/Four Years UG Programme with Multiple Entry and Multiple Exit Options:**

The minimum and maximum credit structure for different levels under three or four year UG programme with multiple entry and multiple exit options are as given below:

Levels	Code	Qualification Titles	Credit Requirements		Semester	Year
			Minimum	Maximum		
4.5	100-199	UG Certificate	40	44	2	1
5.0	200-299	UG Diploma	80	88	4	2
5.5	300-399	Three Year Bachelor's Degree	120	132	6	3
6.0	400-499	Bachelor's Degree Honours **OR** Bachelor's Degree-Honours with Research	160	176	8	4
	500-599	First Year PG & or PG Diploma	40	44	2	1
6.5	600-699	PG Degree	80	88	4	2
8.0	700-799	Ph.D.	16+ Ph.D. Work		---	---

Multiple Exit Options

Year	Exit Option	Reentry
First Year	Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/Internship OR Continue with Major and Minor	Students opting for exits at any level 'will have the option to reenter' the programme from where they had left off, in the same or in different higher educational institution 'within three years of exits' and complete the degree program within the stipulated maximum period of 07 years from the date admission of first year of UG.
Second Year	Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF Course/Internship OR Continue with Major and Minor	
Third Year	Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor	
Fourth Year Honours	Four Year UG Honours Degree in Major and Minor with160-176 credits	
Fourth Year Honours with Research	Four Year UG Honours with Research Degree in Major and Minor with160-176 credits	
Post-Graduation Degree		
Post-Graduation: First Year	PG Diploma (44 Credits) after Three Year UG Degree	Reentry to complete the PG degree after taking exit option will be permissible up to 5 years from the date admission to PG programme

- **Academic Bank of Credit (ABC):**

It is mandatory for all admitted students to get enrolled on ABC Portal and create ABC ID and share ABC-ID with academic institutions where they are enrolled. Credits earned by the students will be reflected in the students ABC account. This will allow students smooth transition during multiple entry and exit.

Walchand College of Arts & Science, Solapur (Autonomous)

Faculty of Science: Choice Based Credit System (According to NEP-2020)

(w.e.f. 2023-24)

Preamble: The systematic and planned curricula for B.Sc. Electronics shall motivate and encourage the students for pursuing higher studies in Electronics and for becoming an entrepreneur and also to equip the students with basic components in electronics and to understand the principles of operation of fundamental electronic devices and instruments.

Objectives of the course: The objectives of B.Sc. Electronics course are:

- To explore different areas of Electronics.
- To impart the knowledge of basic Electronics
- To train students for in depth study of Electronics.
- To encourage students to explore applications of Electronics in everyday life.
- To inculcate research culture by introducing projects at the final year of the course.
- To train the students in developing the experimental skills in Electronics.

Program Outcomes:

Course in Electronics aims to learning of the applications of basic sciences so that a graduate student must employ his knowledge in various domains consisting of basic principles of Electronics. He must apply his knowledge of principles and theories of Electronics to various to meet the challenges and necessity of the society in day-to-day life. An Electronics graduate must use his knowledge in the advancement of technology. The program in Electronics must enable and encourage him/her to undertake further higher studies in Electronics and related multidisciplinary areas. The successful students will be able to establish research organizations or join research and development organizations. .He/she can join colleges, universities, GOs and NGOs in India & aboard. Also have an opportunity to work in industry, administrative jobs.

Program Specific Outcomes:

- Get the knowledge of basic circuits and can analyze the electronic networks.
- Understand the digital fundamentals
- Get the basic knowledge of the various Semiconductor devices with their characteristics and working.
- Understand and explain the different digital circuits
- Acquire the skills in handling scientific and Electronic instruments, performing laboratory experiments.
- Develop the experimental and data analysis skills through a wide range of experiments through practical at laboratories

Eligibility for Admission: A Candidate passing 10+2 with Physics and/or Electronics as one of the subject and passed from State Board / CBSE / ICSE or equivalent with minimum passing percentage of as per the directives of the higher education is eligible for admission.

Duration: The duration of the B.Sc.-I course is of 1 year (comprising 2 semesters)

Medium of Instruction: English

Pattern of the Course: The autonomous college follows semester pattern.

NEP Structure: B.Sc. I Electronics

SEMESTER-I				
Subject	**Paper Title**	**Credits**	**Hours/week**	**Contact Hours**
Electronics GE –I (For Science)	**Electronic Devices and Circuits**	2	2	30
Electronics GE-I P (For Science)	**Practical- Electronics GE –I**	2	4 (hours/week/batch)	60
Electronics-VEC	**E-waste Management for Sustainability**	2	2	30
SEMESTER-II				
Electronics Minor-I	**Basic Electronics**	2	2	30
Electronics GE-II (For Science)	**Fundamentals of Electronics**	2	2	30
Electronics GE-II P (For Science)	**Practical- Electronics GE-II**	2	4 (hours/week/batch)	60

Outline of Examination:

THEORY:

1) Internal Evaluation (IE): Internal evaluation will consist of **40 % marks** per semester per paper. It may be held as **per the following scheme** per semester **(Annexure: I)**

Credits	Marks for Attendance	Classroom Test	Home Assignment	Total Marks
02	05	10	05	20

2) End Semester Examination (ESE): The detailed question paper pattern (**60 % marks per paper)** is given as in **Annexure- II**

PRACTICAL:

1) Internal Evaluation (IE): Internal evaluation will carry **40 % marks** and may consist of:

Credits	Marks for Attendance	Internal Practical Exam	Journal	Total Marks
02	05	10	05	20

2) **End Semester Examination (ESE):** Practical examination **60 % marks** shall be conducted at the end of each semester. The detailed scheme is given in **Annexure-III**

Semester – I

Electronics GE-I: Electronic Devices and Circuits

Credits: 02 **Total Marks: 50** **Contact Hours: 30**

Unit No.	Title of topic and content	Contact Hours
I	**1. Theory of semiconductors:** Review of semiconductors - energy band theory of crystals Intrinsic semiconductors- Atomic structure of Germanium and Silicon. Current Conduction and drift current in intrinsic semiconductors, Extrinsic semiconductor – P-type and N-type, conduction in both types of semiconductors. **2. Semiconductor diode:** Formation of P-N junction & depletion layer. Symbol Working of P-N junction diode, I-V Characteristics in forward & reverse Bias.	**15**
II	**3. Bipolar Junction Transistor:** Construction, types, CE,CB and CC configurations (mention only), VI characteristics of a transistor in CE mode, Regions of operation (active, cut off and saturation), leakage currents (mention only), Current gains α , β and γ and their inter-relations, dc load line and Q point. Applications of transistor as amplifier and switch - circuit and working. **4.Voltage regulator:** Block diagram of regulated power supply, Line and Load regulation, Zener diode as voltage regulator – circuit diagram, load and line regulation, disadvantages. Fixed and Variable IC Voltage Regulators (78xx, 79xx, LM317), Clippers (shunt type) and clampers (Qualitative analysis only), Voltage Multipliers.	**15**

Practical- Electronics GE –I

Credits: 02 **Total Marks: 50** **Contact Hours: 60**

Title of Practical	Contact Hours
1. Study of use of Multimeter 2. Study of use of CRO 3. Study of clippers 4. Study of Clampers 5. Study of Electronic Components 6. Study of I-V Characteristics of PN-Junction diode 7. Study of Regulated power supply 8. Study of I-V Characteristics of CE configuration 9. Study of I-V Characteristics of CB configuration 10. Study of Zener diode as voltage regulator	60

References:

1. Solid state electronics-by B.L. Theraja
2. Principles of electrons – by V.K. Mehta
3. Fundamentals of electrical &electronic engineering, B L Theraja
4. Electronic devices &circuits, Jacob Millman & Halkias,
5. Electronic device& circuits theory Robert Boylsted & Louis Nashelsky-
6. Basic electronics,B.Grob,8th Edition

About the course:

The course explains the theory of semiconductor and IV-Characteristics of PN Junction. The course also highlights details bipolar junction transistor and voltage regulator.

Course outcomes:

After the completion of this course, students are able to:

1. Describe the basic concepts of semiconductor review.
2. To understand the knowledge of IV-Characteristics of PN Junction.
3. To know about the bipolar junction transistor.
4. To impart the knowledge about voltage regulator.

Electronics-VEC: E-waste Management for Sustainability

Credits: 02 **Total Marks: 50** **Contact Hours: 30**

Unit No.	Title of topic and contents	Contact Hours
I	**1. E-waste**: Identification of e-waste and its types, composition and generation. Global context in e- waste; E-waste pollutants, E waste hazardous properties, Effects of pollutant (E- waste) on human health and surrounding environment, domestic e-waste disposal, Basic principles of E waste management, Technologies for recovery of resources from electronic waste, steps in recycling and recovery of materials-mechanical processing, technologies for recovery of materials, occupational and environmental health perspectives of recycling e-waste in India. Import of hazardous e-waste in India; India's stand on liberalizing import rules, E-waste economy in the organized and unorganized sector. Estimation and recycling of e-waste in metro cities of India.	15
II	**2. E-waste control measures** Need for stringent health safeguards and environmental protection laws in India, Extended Producers Responsibility (EPR), Import of e-waste permissions, Producer-Public-Government cooperation, Administrative Controls & Engineering controls, monitoring of compliance of Rules, Effective regulatory mechanism strengthened by manpower and technical expertise, Reduction of waste at source. E-waste (Management and Handling) Rules, 2011; and E-Waste (Management) Rules, 2016 - Salient Features and its likely implication. Government assistance for TSDFs.	15

References:

1. Johri R., E-waste: implications, regulations, and management in India and current global best practices, TERI Press, New Delhi
2. Hester R.E., and Harrison R.M, Electronic Waste Management. Science, 2009
3. Fowler B, Electronic Waste – 1st Edition (Toxicology and Public Health Issues), 2017Elsevier

About the course:

To provide in-depth knowledge on the effective mechanisms to regulate generation, collection and storage of e-waste and also to develop a holistic view on recycling, treatment and disposal of e-waste and related legislative rules.

Course outcomes:

After successful completion of this course the students are able to

1) To understand holistically analyze the environmental impacts of e-waste
2) Apply concepts of e-waste management hierarchy
3) To provide specific recommendations for improved methods for handling e-waste at different stages such as generation, collection, storage, transport and recycling
4) Analyze the e – waste management measures proposed under national and global legislations.

Semester - II

Electronics Minor-I: Basic Electronics

Credits: 02 **Total Marks: 50** **Contact Hours: 30**

Unit No.	Title of topic and contents	Contact Hours
I	**1. Circuit Elements:** Introduction to Electronics, applications of Electronics, Basic electronics and component identification, Active and passive elements, Resistors, Capacitors, Inductors, Transformers, Relays, Fuses and Batteries (Classification, Specifications and Applications only), R, L & C- features **2. DC and AC Sources:** DC sources, Constant voltage and current sources, AC sources, Sinusoidal and non- sinusoidal sources, RMS current and voltage. **3. AC Circuits:** Phase relationship of current and voltage with pure resistor, capacitor and inductor. Series and Parallel RLC circuits, Phase diagram, Impedance, Admittance, Series and Parallel resonance, Response curve, Band width, Quality factor	15
II	**4. Number Systems:** Binary, Octal, Decimal, Hexadecimal number systems and their inter- conversions, 1's compliment, 2's compliment, Arithmetic operations, signed and unsigned binary numbers, arithmetic; addition, subtraction by 2's compliment **5. Binary Codes:** 8421 code, Excess-3 code, Gray code, ASCII code, Parity bit **6. Logic Gates:** OR, AND, NOT, NAND, NOR, Ex-OR, Ex-NOR gates, Positive and Negative logic, De Morgan's Theorems, Universality of NAND and NOR gates, Study of IC 7400, 7402, 7404, 7408, 7432, 7486	15

References:

1) A Text Book of Applied Electronics by R.S. Shedha (S.Chand & Co.)
2) Electronics Circuits, K. A. Smith and R. E. Alley, 2014, Cambridge University Press
3) Electronic Devices and Circuits, David A. Bell, 5th Edition 2015, Oxford University Press
4) Digital Fundamentals by Floyd, Pearson Education
5) Digital Principles & Applications by A.P. Malvino& D.P. Leach (TMH, New Delhi)
6) Modern Digital Electronics by R.P. Jain
7)Digital Systems: Principles and Applications by Ronald J Tocci, Neat S. Widerman,PEA
8) Digital Electronics, Circuits & Systems by V. K. Puri, TMH, New Delhi

About the course:

The course explains the basic electronics and component identification. The course also highlights circuit fundamentals, deigning of AC Circuits and also course provides information about different number systems and codes. To understand logic gates and truth tables of different logical gates

Course outcomes:

After successful completion of this course the students are able to

1) Understand the concept of circuit elements
2) Impart the knowledge of circuit fundamentals
3) Understand how developmental processes of AC circuits
4) To solve problems based on inter conversion of number systems
5) To understand the concept of different logical gates and also impart the knowledge about arithmetic circuits

Electronics GE-II: Fundamentals of Electronics

Credits: 02 **Total Marks: 50** **Contact Hours: 30**

Unit No.	Title of topic and content	Contact Hours
I	**1. Circuit fundamentals:** Circuit Variables: Circuit concepts Units, Standards and Dimensions. Electric current, Electric charge, potential difference, Electric power and Energy. Circuit elements: Passive elements and active elements. Network Law's: Ohm's Law's, Junction Law's (KCL), Mesh Law's (KVL) Application of Network Law's to simple dc networks theorems- Thevenin's theorem, Norton's theorem Max power transfer theorem **2. Rectifiers:** Introduction of Rectifier, Half wave and full wave rectifier, Bridge Rectifier, expressions for output voltage, ripple factor, efficiency and PIV of half wave and full wave rectifier, Filter circuits.	**15**
II	**3. Boolean Algebra:** Rules and laws of Boolean algebra, Simplification of Boolean expression, K- map, K-maps for 2, 3 and 4 variables, Use of K-map for reduction of Boolean expressions. **4. Arithmetic Circuits:** Exclusive OR gate as a Binary to Gray converter, Parity generator and checker, Controlled inverter, Half adder, Full adder, Parallel binary adder, Half and Full subtractor, Magnitude Comparator	**15**

Practical- Electronics GE-II

Credits: 02 **Total Marks: 50** **Contact Hours: 60**

Title of Practical	Contact Hours
1. Study of KVL 2. Study of KCL 3. Study of Thevenin's Theorem 4. Study of Maximum Transform Theorem 5. Study of Superposition Theorem 6. Study of Full wave rectifier 7. Study of half adder 8. Study of Full adder 9.Verification of De Morgan's theorems 10.NAND / NOR gate as universal gate	60

References:

1) A Textbook of Electronics (Second Edition): S.L Kakani and K.C.Bhandari
2) Electronic Principles: A.P. Malvino ,TMH Edition.
3) D Chattopadhyaya, P.C. Rakshit, B Saha & N N Purkait: Foundations of Electronics, New Age International Edition.
4) Digital Principles & Applications by A.P. Malvino & D.P. Leach (TMH, New Delhi)
5) Modern Digital Electronics by R.P. Jain.

About the course:

This paper helps in understanding the basic electronic concepts. The use of electronics in day to day life is explained. Applications of electronics can be understood by any science student by this paper

Course outcomes:

After the completion of this course, students are able to:

1) To understand concept of circuit fundamentals
2) To impart the knowledge about rectifiers
3) To understand the concept of boolean algebra
4) To familiarize with applications of arithmetic circuits

Annexure I

Question Paper Pattern for Class Room Test (IE)

(02 Credit Theory Course)

Marks 10

Q.No.1 Multiple choice questions - 04 marks.

Q.No.2 Attempt any two - 06 marks.

a)
b)
c)

Annexure II

Scheme of Marking for End Semester Examination (ESE) (Theory)

Walchand College of Arts and Science (Autonomous), Solapur

Theory question paper Pattern for 2 credit course as per NEP 2020
(w. e. f. 2023-24)

Examination: ----------

Class: ---------- **Semester: ----------**
Subject: -------- **Paper: ----------**

Time: 1.5 hrs **Marks: 30**

Instructions: a) All questions are compulsory
b) Figures to the right indicate full marks
c) Draw neat & well labeled diagram wherever necessary
d) Use of logarithm tables and calculator is allowed

Q. No.1 Select the correct alternative of the following **06**

i)
a) b) c) d)
ii)
iii)
iv)
v)
vi)

Q. No.2 Attempt the following (Any three) **06**

i)
ii)
iii)
iv)
v)

Q. No.3 Attempt the following (Any two) **06**

i)
ii)
iii)

Q. No.4 Attempt the following (Any two) **06**

i)
ii)
iii)

Q. No.5 Attempt the following (Any one) **06**

i)
ii)

Annexure-III

Scheme of Marking for End Semester Examination (ESE)
(02 Credit Practical Course)

Time: 3 hours **Total Marks: 30**

Practical examination will be at the end of the semester. Every candidate has to perform one Practical.

a) Practical : 25 Marks

b) Certified Journal : 05 Marks

The breakup of 25 marks should be given in the practical slip.

(Dr.S.G.Holikatti)

Chairman, BOS in Electronics

Shikshan Haach Dharma

S.A.P.D. Jain Pathashala's

(Jain Minority Institute)

Walchand College of Arts and Science, Solapur

(Autonomous)

Affiliated to

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Name of the Faculty: Science and Technology

Name of the Course: B.Sc.

Syllabus: STATISTICS

(CHOICE BASED CREDIT SYSTEM)

(To be effective from the academic year-2023-24)

Walchand College of Arts & Science, Solapur

(Autonomous)

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Outline of NEP:

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(b) Minor Subject (18-20 Credits)

- The Minor subjects may be from the different disciplines of the same faculty of DSC Major (Core) or they can be from different faculty altogether;
- The credits of Minor subjects shall be completed in the first three years of UG Programme

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- GE/OE are to be offered in I and/or II year;
- Faculty-wise baskets of OE shall be prepared by Autonomous College.
- OE/GE is to be chosen compulsorily from faculty other than that of the Major or as per the directions issued by NEP-Steering Committee

(d) Vocational and Skill Enhancement Courses (VSEC)

i) Vocational Skill Courses (VSC): (8-10 credits): Includes Hands on Training corresponding to the Major and/or Minor Subjects:

- To be offered in first three years;
- Wherever applicable vocational courses will include skills based on advanced laboratory practical's of Major

ii) Skill Enhancement Courses (SEC): (06 credits)

- To be offered in I and II year;
- To be selected from the basket of Skill Courses approved by Autonomous College

(e) Ability Enhancement Courses (AEC), Indian Knowledge System (IKS) and Value Education Courses (VEC): (14 Credits)

i) AEC: (08 credits)

- To be offered in I and II year
- English: 04 Credits
- Modern Indian Language: 04 credits
- To be offered from the Basket approved by Autonomous College;

The focus for both languages should be on linguistic and communication skills.

ii) IKS: (2 Credits)

- To be offered in I Year
- Courses on IKS to be selected from the basket of IKS courses approved by Autonomous College

iii) VEC: 04 Credits

- To be offered in I year
- Value Education Courses (VEC) such as Understanding India, Environmental Science/Education, and Digital and Technological Solutions.

(f) Field Projects/ Internship/ Apprenticeship/ Community Engagement and Service corresponding to the Major (Core) Subject, Co-curricular Courses (CC) and Research Project

- Internship/Apprenticeship corresponding to the Major (Core) Subject: (8 Credits)
- Field Projects/Community Engagement and Service (CEP) corresponding to the Major (Core) Subject (minimum 4-6 credits)

-To be offered in II and III years of UG Degree Programmes.

- Co-curricular Courses (CC) such as Health and Wellness, Yoga education, sports and fitness, Cultural Activities, NSS/NCC and Fine/ Applied/Visual/ Performing Arts: (8 credits)

-To be offered in I and/or II year

- Research Projects: (12 credits)

-To be offered in the final year for 4 year Honours with Research UG Degree

- **CREDIT:**

Credit is a numerical value that indicates students work load (Lectures, Lab work, Seminar, Tutorials, Field work etc.) to complete a course unit. The contact hours are

- transformed into credits. Moreover, the grading system of evaluation is introduced for B.Sc. course wherein process of Continuous Internal Evaluation is ensured.
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- **Practical/Tutorial: '**30 contact hours' for practical course constitute 'one credit'.
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6.0	400-499	Bachelor's Degree Honours **OR** Bachelor's Degree-Honours with Research	160	176	8	4
	500-599	First Year PG & or PG Diploma	40	44	2	1
6.5	600-699	PG Degree	80	88	4	2
8.0	700-799	Ph.D.	16+ Ph.D. Work		---	---

Multiple Exit Options

Year	Exit Option	Reentry
First Year	Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/Internship OR Continue with Major and Minor	Students opting for exits at any level 'will have the option to reenter' the programme from where they had left off, in the same or in different higher educational institution 'within three years of exits' and complete the degree program within the stipulated maximum period of 07 years from the date admission of first year of UG.
Second Year	Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF Course/Internship OR Continue with Major and Minor	
Third Year	Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor	
Fourth Year Honours	Four Year UG Honours Degree in Major and Minor with160-176 credits	
Fourth Year Honours with Research	Four Year UG Honours with Research Degree in Major and Minor with160-176 credits	
Post-Graduation Degree		
Post-Graduation: First Year	PG Diploma(44Credits)after Three Year UG Degree	Reentry to complete the PG degree after taking exit option will be permissible up to 5 years from the date admission to PG programme

- **Academic Bank of Credit (ABC):**

It is mandatory for all admitted students to get enrolled on ABC Portal and create ABC ID and share ABC-ID with academic institutions where they are enrolled. Credits earned by the students will be reflected in the students ABC account. This will allow students smooth transition during multiple entry and exit.

Program Outcomes:

The student graduating with the Degree B.Sc. Statistics should be able to

1. Demonstrate the ability to use skills in Statistics and different practicing areas for formulating and tackling Statistics related problems and identifying and applying appropriate principles and methodologies to solve a wide range of problems associated with Statistics.
2. Acquire (i) fundamental/systematic or coherent understanding of the academic field of Statistics and its different learning areas and applications.(ii) procedural knowledge that creates different types of professionals related to subject area of Statistics, including professionals engaged in government/public service and private sectors; (iii) skills in areas related to one's specialization area within the disciplinary/subject area of Statistics and emerging developments in the field of Statistics.
3. Recognize the importance of statistical modeling and computing, and the role of approximation and mathematical approaches to analyze the real problems using various statistical tools.
4. Plan and execute Statistical experiments or investigations, analyze and interpret data/information collected using appropriate methods, including the use of appropriate statistical software including programming languages, and report accurately the findings of the experiment/investigations.
5. Demonstrate relevant generic skills and global competencies such as (i) problem-solving skills that are required to solve different types of Statistics related problems with well-defined solutions, and tackle open-ended problems that belong to the disciplinary-area boundaries; (ii) investigative skills, including skills of independent thinking of Statistics-related issues and problems; (iii) communication skills involving the ability to listen carefully, to read texts and reference material analytically and to present information in a concise manner to different groups/audiences of technical or popular nature; (iv) analytical skills involving paying attention to detail and ability to construct logical arguments using correct technical language related to Statistics and ability to translate them with popular language when needed; (v) ICT skills; (vi) personal skills such as the ability to work both independently and in a group.
6. Demonstrate professional behavior such as (i) being objective, unbiased and truthful in all aspects of work and avoiding unethical, irrational behavior such as fabricating, falsifying or misrepresenting data or committing plagiarism; (ii) the ability to identify the potential ethical issues in work-related situations; (iii) appreciation of intellectual property, environmental and sustainability issues; and (iv) promoting safe learning and working environment.

Program Specific Outcomes:

Students will understand the importance of collecting the data accurately by using appropriate data collection methods suitable to the characteristic under study. Concept of Descriptive Statistics of quantitative data and its techniques. Development of conceptual understanding of scales of measurement, qualitative and quantitative data and categorical analysis .Statistical techniques taught in Semester-I class will help the students- to draft the questionnaire for personal interview or mail questionnaire method of data collection and to decide the appropriate method of data collection for collecting the data accurately. To understand the structure of data and need for qualitative and quantitative classification To draw and understand diagrammatic and graphic representation of data In understanding of concept of probability, & its applications In preparation for Statistics Quiz and other related reputed competitive examinations. Concept of probability, discrete probability distributions.

Walchand College of Arts & Science, Solapur (Autonomous)

Faculty of Science: NEP Choice Based Credit System (CBCS)

(w. e.f. 2023-24)

Preamble:

The syllabus for the B.Sc. Statistics is designed to follow the UGC guidelines. The syllabus of Statistics course is aimed to be more learning centric than teaching centric so that a student progressively develops a deeper understanding of various aspects in statistics. Statistics is learnt more through experimentation than only through classroom sessions. The experiments are designed to develop logical thinking and analytical ability.

Objectives of the course:

The main objective of this course is to acquaint students with some basic concerns statistics. They will be introduced to some elementary statistical methods of analysis and Probability at the end of this course students are expected to be able.

1. To prepare frequency distribution and represent it by graphically with the help of tables.
2. To compute various measures of central tendency, dispersion, moments, Skewness, Kurtosis and to interpret them.
3. To distinguish between random and non-random experiments.
4. To find the probabilities of the events.

Eligibility for Admission: A Candidate passing 10+2 with Statistics as one of the subject and passed from State Board / CBSE / ICSE or equivalent with minimum passing percentage of as per the directives of the higher education is eligible for admission.

Duration: The duration of the B.Sc.-I course is of 1 year (comprising 2 semesters)

Medium of Instruction: English

Pattern of the Course: The autonomous college follows semester pattern.

NEP STRUCTURE: STATISTICS B.Sc.I

		SEMESTER-I			
Subject	**Paper Code**	**Paper Title**	**Credits**	**Hours/week**	**Total Contact Hours**
Statistics: GE-I		Descriptive Statistics-I	2	2	30
Statistics: GE-P		Statistics Practical-I	2	4 (hours/week/batch)	15 weeks
Statistics SEC-I		Statistical Analysis-I	1	1	15
		Statistical Analysis Practical-I	1	2(hours/week/batch)	15 weeks
		SEMESTER-II			
Statistics: GE-II		Descriptive Statistics-II	2	2	30
Statistics: GE		Statistics Practical-II	2	4 (hours/week/batch)	15 weeks
Statistics SEC-II		Statistical Analysis-II	1	1	15
		Statistical Analysis Practical-II	1	2(hours/week/batch)	15 weeks

Outline of Examination:

THEORY:

1) Internal Evaluation (IE): Internal evaluation will consist of **40 % marks** per semester per paper. It may be held as **per the following scheme** per semester **(Annexure: I)**

Credits	**Marks for Attendance**	**Classroom Test**	**Home Assignment**	**Total Marks**
02	05	10	05	20

2) End Semester Examination (ESE): The detailed question paper pattern (**60% marks per paper)** is given as in **Annexure- II and Annexure- III**

PRACTICAL:

1) Internal Evaluation (IE): Internal evaluation will carry **40 % marks** and may consist of:

Credits	**Marks for Attendance**	**Internal Practical Exam**	**Journal**	**Total Marks**
02	05	10	05	20

2) **End Semester Examination (ESE):** Practical examination **60 % marks** shall be conducted at the end of each semester. The detailed scheme is given in **Annexure-IV and Annexure-V**

Walchand College of Arts and Science (Autonomous) , Solapur.

B. Sc. I- STATISTICS

SEMESTER-I

PAPER–I-GE-I: Descriptive Statistics-I

Credits: 02 **Total Marks: 50** **Contact hours: 30**

CONTENTS

Unit: 1 Statistical Methods: (05)

Definition and scope of Statistics, concepts of statistical population and sample . Data: primary and secondary data, quantitative and qualitative data, attributes, variables, discrete and continuous variables, scales of measurement - nominal, ordinal, interval and ratio scale. Presentation: tabular and graphical, including histogram and ogives.

Unit: 2 Measures of Central Tendency: (10)

Concept of central tendency of statistical data, statistical average, requirements of good statistical average. Arithmetic Mean (A. M.): Definition, effect of change of origin and scale, deviation of observations from A. M., Mean of pooled data, Geometric Mean (G.M.): Definition, Harmonic Mean (H.M.):Definition.Relation:A.M.≥G.M.≥H.M. (Proof for n=2, positive observations).Median Definition, Derivation of formula for grouped frequency distribution .Mode: Definition for ungrouped and grouped data derivation of formula. Empirical relation between Mean, Median and Mode. Partition Values: Quartiles, Deciles and Percentiles.

Graphical methods of determination of Median, Mode and Partition values . Comparison between averages in accordance with requirements of good average Examples to illustrate the concept.

Unit: 3 Measures of Dispersion: (07)

Concept of dispersion, Absolute and Relative measures of dispersion, Requirements of a good measure of dispersion. Range: Definition, Coefficient of range. Quartile Deviation(Semi-inter quartile range): Definition, coefficient of Q.D. Mean deviation: Definition, coefficient of M. D., Minimal property of M. D. Mean Square Deviation, Definition, minimal property of M. S. D. Variance and Standard Deviation: Definition, Effect of change of origin and scale, S. D. of pooled data (without

proof).Coefficient of Variation: Definition and use .Comparison of absolute and relative measures of dispersion .Examples.

Unit.4 Moments, Skewness and Kurtosis: (08)

Moments: Raw moments (μ'r) and central moments (μr) for ungrouped and grouped data .Effect of change of origin and scale on moments, relation between central moments and raw moments (upto4thorder). Sheppard's correction, need of Sheppard's correction and its importance. Skewness: Concept of Skewness of a frequency distribution, Types of Skewness and its interpretation. Bowley's coefficient of skewness, Karl Pearson's coefficient of skewness, Measure of skewness based on moments . Kurtosis: Concept of kurtosis of a frequency distribution, Types of kurtosis and its interpretations. Simple examples

*****

PRACTICAL PAPER -I: GE-STATISTICS PRACTICAL -I

Credits: 02 **Total Marks: 50** **Contact hours: 30**

Pre requisites: Knowledge of the topics in the theory papers

Course Outcomes: At the end of this course students are expected to be able

1. To represent statistical data by graphically.
2. To compute various measures of central tendency, dispersion, moments, skewness, and kurtosis.
3. To understand consistency, association and in dependence of attributes

LIST OF PRACTICALS

1. Construction of frequency distribution (One way and two way)
2. Graphical representation of the frequency distribution-I
3. Graphical representation of the frequency distribution-II
4. Measures of Central tendency- I (Ungrouped data).
5. Measures of Central tendency-II (Grouped data).
6. Measures of the Dispersion-I (Ungrouped data).
7. Measures of the Dispersion-II (Grouped data).
8. Moments, Skewness and Kurtosis–I (Ungrouped data).
9. Moments, Skewness and Kurtosis – II (Grouped data).

Note:

Students are allowed to use any type of calculator or computer using software like MS-Excel. Student must complete all the practicals to the satisfaction of the teacher concerned. Students must produce

laboratory journal along with completion certificate signed by concerned teacher and Head of the Department at the time of practical examination.

*****

Skill Enhancement Courses (SEC)

Semester-I

SEC-I: Statistical Analysis – I

Credits: 1.0 **Total Marks: 25** **Contact Hrs: 15**

Learning Objectives:

The primary objectives of the course will be to

1. Familiarise the student with the quantitative skills required for representing and interpreting data for the purpose of decision making.

2. Equip the student with some fundamental concepts, which play a critical role in understanding and visualizing real world data.

3. Enable the student to analyze data and problem situations using relevant IT tools.

Learning Outcomes:

By the end of the course students will be able to

1. Represent and interpret data in tabular and graphical forms

2. Understand and interpret the measures of central tendency and dispersion.

3. Use IT tools such as spreadsheets to visualize and analyze data.

SYLLABUS

Unit I: Introduction to Data Set

This unit provides an introduction to the fundamentals of datasets, sources of data, frequency distributions and graphical representations of data. The aim is to give students a hands-on experience of initiating data analysis through a spreadsheet.

Concept of datasets (Variables, Observations), Different types of variables (Quantitative and Qualitative).Distinction between primary and secondary sources of data. Basic idea of using questionnaire to collect primary data for analysis. How to construct a questionnaire. Concept of frequency distribution: cumulative and relative frequencies.

Unit II: Measures of Central Tendency and Dispersion

The focus of this unit will be to familiarise the student with summary statistics to describe datasets. In particular, two important characteristics of data, viz., central tendency and dispersion, will be used to summarise datasets using a spreadsheet.

Measures of central tendency: mean, median, mode. Examples of situations where it is appropriate to use the mean, median and mode as a measure of central tendency. Measures of dispersion: range, variance, standard deviation. Measure of Skewness and kurtosis.

SEC-Practical-I

Statistical Analysis Practical-I

Credits: 1.0 **Total Marks: 25** **Contact Hrs: 15**

LIST OF PRACTICALS

1. Introduction to spreadsheet
2. Visualize the tabular and graphical presentation of data: data tables using spreadsheets/
3. Visualize the frequency curve, histogram, bar graphs.
4. Visualize pie charts using spreadsheets.
5. Visualize the measures of central tendency (mean, median and mode) using spreadsheets.
6. Visualize the measures of central tendency (H.M and G.M.) using spreadsheets
7. Visualize dispersion measures of dispersion (range and Q.D.) using spreadsheets.
8. Visualize dispersion measures of dispersion (M.D. and S.D.) using spreadsheets.
9. Visualize dispersion measures of skewness using spreadsheets.
10. Visualize dispersion measures of skewness using spreadsheets.

References (Readings and Resources) :

1. Rowntree, D., Statistics without tears - A primer for non-mathematicians, Allyn and Bacon, 2018.
2. Levin, Rubin, Rastogi and Siddiqui, Statistics for Management, 7th Edn, 2014
3. Kumar Bittu, Microsoft Office 2010
4. Frag Curtis, Step by Step Microsoft Excel 2013.
5 .John Walkenbach, 101 Excel 2013 Tips, Tricks and Time severs.
6. Salkind Neil J.Statistics for people who (Think They) Hate Statistics, Using MS- Excel.

Suggested Data Sources

The following data sets are suggested to carry out the activities

1. https://data.worldbank.org/
2. https://www.statista.com/
3. https://data.gov.in/

4. https://censusindia.gov.in/

5. https://www.kaggle.com/

6. http://data.un.org/

SEMESTER-II

PAPER–II-GE-II: Descriptive Statistics-II

Credits: 02 **Total Marks: 50** **Contact hours: 30**

Course Outcomes:

The main objective of this course is to familiarize students with the concepts of correlation and regression. At the end of this course students are expected to be able to

1. compute correlation coefficient, interpret its value,

2. compute regression coefficient, interpret its value and use in regression analysis.

3. compute and interpret various index numbers.

4. compare various index numbers.

CONTENTS

Unit.1Correlation: (07)

Bivariate data, Concept of correlation between two variables, Types of correlation. Scatter diagram, its utility. Covariance: Definition, effect of change of origin and scale. Karl Pearson's coefficient of correlation (r): Definition, Computation for ungrouped and grouped data, Properties: i) $-1 \leq r \leq 1$, ii) Effect of change of origin and scale.(iii) Interpretation when $r = -1, 0, 1$. Spearman's rank correlation coefficient: Definition, Computation (with and without ties), Derivation of the formula for without ties, modification of the formula for with ties, Illustrative examples.

Unit.2 Regression: (08)

Concept of regression, Lines of regression, fitting of lines of regression by the least squares method. Regression coefficients (bxy, byx) and their geometric interpretations,

Properties: i) bxy × byx = r2 , ii) bxy × byx ≤ 1, iii) (bxy + byx) / 2 ≥ r, iv) Effect of change of origin and scale on regression coefficients, v) The point of intersection of two regression lines, Derivation of acute angle between the two lines of regression, Illustrative examples.

Unit.3 Attributes: (07)

Notation, dichotomy, class frequency, order of class, positive and negative class frequency, ultimate class frequency, fundamental set of class frequency, relationship among different class frequencies (up to three attributes). Concept of consistency, conditions of consistency (up to three attributes). Concept of independence and association of two attributes. Yule's coefficient of association (Q): Definition, interpretation. Coefficient of colligation (Y): Definition, interpretation. Relation between Q and Y: Q = 2Y/ (1+Y2), |Q| ≥ |Y|. Illustrative examples

Unit.4 Index Numbers: (08)

Meaning and utility of index numbers, construction of index numbers . Types of index numbers: price, quantity and value index numbers, Unweighted and weighted index numbers using (i) aggregate method, (ii) average of price or quantity relative method (using A.M. & G.M.), Index numbers using Laspeyre's, Paasche's, and Fisher's formula. Unit test, Time reversal test and Factor reversal tests.

*****

PRACTICAL PAPER -II: GE-STATISTICS PRACTICAL -II

Credits: 02 Total Marks: 50 Contact hours: 30

Pre requisites: Knowledge of the topics in the theory papers

Course Outcomes: At the end of this course students are expected to be able

To compute correlation coefficient, regression coefficients.

Understand consistency, association and independence of attributes.

3. To compute price index number, quantity index number and value index numbers.

LIST OF PRACTICALS

1. Correlation Coefficient-I (Ungrouped data)
2. Correlation Coefficient-II (Grouped data)
3. Spearman's Rank Correlation Coefficient
4. Regression –I (Ungrouped data)
5. Regression– II (Grouped data)
6. Attributes-I (Missing frequencies and Consistency)
7. Attributes- II (Association and Independent of Attributes).

8. Index Numbers

Note:

Students are allowed to use any type of calculator or computer using software like MS-Excel. Student must complete all the practicals to the satisfaction of the teacher concerned. Students must produce laboratory journal along with completion certificate signed by concerned teacher and Head of the Department at the time of practical examination.

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Semester-II

SEC-II: Statistical Analysis –II

Credits: 1.0 **Total Marks: 25** **Contact Hrs: 15**

Learning Objectives

The primary objectives of the course will be to

1. Familiarise the student with the quantitative skills required for correlating the data for the purpose of decision making.

2 Equip the student to visualize functions which play a critical role in understanding and visualizing real world data.

3. Enable the student to analyze data and problem situations using relevant IT tools.

Learning Outcomes

By the end of the course students will be able to

1. Establish relationships between variables using correlation and regression analysis.

2. Visualize functions and differentiate between linear and nonlinear functions.

3. Use IT tools such as spreadsheets to visualize and analyze data.

SYLLABUS

Unit I: Functions and their graphical representations:

This unit introduces the graphical visualization of functions to understand the relationship between two variables.efinition and graphical representation of a function , vertical line test. Polynomial functions: linear, quadratic and cubic functions. Reciprocal, exponential and logarithmic functions. Concept of slope of a function through graphical representation.

Unit II: Relationship between Variables

Students will learn about scatter diagrams and correlation analysis as a means to describe the nature and strength of association between two variables. The concept of regression analysis will be introduced as a method for quantifying the relationship between two variables. Scatter diagrams. Correlation analysis: measure and interpretation of correlation coefficient and determination of Coefficient. Bi-variate regression analysis: method of least squares,

SEC Practical-II
Statistical Analysis Practical-II

Credits: 1.0 **Total Marks: 25** **Contact Hrs: 15**

LIST OF PRACTICALS

1. Visualize the linear function using spreadsheets.
2. Visualize the quadratic function using spreadsheets
3. Visualize the cubic function using spreadsheets.
4. Visualize the reciprocal function using spreadsheets and
5. Visualize the exponential using spreadsheets.
6. Visualize the logarithmic using spreadsheets
7. Visualize concept of slope of a function through graphical representations
8. Visualize Scatter Diagram using spreadsheets.

References (Readings and Resources) :

1. Rowntree, D., Statistics without tears - A primer for non-mathematicians, Allyn and Bacon, 2018.
2. Levin, Rubin, Rastogi and Siddiqui, Statistics for Management, 7th Edn, 2014
3. Boundless Algebra : https://courses.lumenlearning.com/boundless-algebra/

Suggested Data Sources :

The following data sets are suggested to carry out the activities

1. https://data.worldbank.org/
2. https://www.statista.com/
3. https://data.gov.in/
4. https://censusindia.gov.in/
5. https://www.kaggle.com/
6. http://data.un.org/

Annexure I

Question Paper Pattern for Class Room Test (IE)

(02 Credit Theory Course)

Marks 10

Q.No.1 Multiple choice questions - 04 marks.

Q.No.2 Attempt any two - 06 marks.

a)
b)
c)

Annexure II

Scheme of Marking for End Semester Examination (ESE) (Theory)

Walchand College of Arts and Science (Autonomous), Solapur

Theory question paper Pattern for <u>2 credit</u> course as per NEP 2020
(w. e. f. 2023-24)

Examination:----------

Class: ---------- **Semester:----------**
Subject:-------- **Paper:----------**

Time: 1.5 hrs **Marks: 30**

Instructions: a) All questions are compulsory
b) Figures to the right indicate full marks
c) Draw neat & well labeled diagram wherever necessary
d) Use of d logarithm tables and calculator is allowed

Q. No.1 Select the correct alternative of the following **06**

i)

a) b) c) d)

ii)
iii)
iv)
v)
vi)

Q. No.2 Attempt the following (Any three) **06**

i)
ii)
iii)
iv)
v)

Q. No.3 Attempt the following (Any two) **06**

i)
ii)
iii)

Q. No.4 Attempt the following (Any two) **06**

i)
ii)
iii)

Q. No.5 Attempt the following (Any one) **06**

i)
ii)

Annexure III

Scheme of Marking for End Semester Examination (ESE) (Theory)

Walchand College of Arts and Science (Autonomous), Solapur

Theory question paper Pattern for **1 credit** course as per NEP 2020

(w. e. f. 2023-24)

Examination:----------

Class: ---------- Semester: ----------

Subject:-------- Paper:----------

Time: 1.5 hrs Marks: 25

Instructions: a) All questions are compulsory
b) Figures to the right indicate full marks
c) Draw neat & well labeled diagram wherever necessary
d) Use of logarithm tables and calculator is allowed

Q. No.1 Select the correct alternative of the following **05**

i)

a) b) c) d)

ii)

iii)

iv)

v)

Q. No.2 Attempt the following (Any five) **05**

i)

ii)

iii)

iv)

v)

vi)

vii)

Q. No.3 A) Attempt the following (Any one) **03**

i)

ii)

B) **Attempt the following (Any one)** **02**

i)

ii)

Q. No.4 A) Attempt the following (Any one) **03**

i)

ii)

B) **Attempt the following (Any one)** **02**

i)

ii)

Q. No.5 Attempt the following (Any one) **05**

i)

ii)

Annexure-IV

Scheme of Marking for End Semester Examination (ESE)
(02 Credit Practical Course)

Time: 3 hours **Total Marks: 30**

Practical examination will be at the end of the semester. Every candidate has to perform one Practical.

a) Practical : 25 Marks

b) Certified Journal : 05 Marks

The breakup of 25 marks should be given in the practical question paper.

Annexure V

Scheme of Marking for End Semester Examination (ESE) (01 Credit Practical Course)

Time: 3 hours **Total Marks: 25**

Practical examination will be at the end of the semester. Every candidate has to perform one Practical.

a) Practical : 20 Marks

b) Journal/Report : 05 Marks

The breakup of 20 marks should be given in the practical question paper.

(Prof. D. M. Zombade)
Chairperson,
Board of Studies in Statistics

Shikshan Haach Dharma

S. A. P. D. Jain Pathashala's

(Jain Minority Institute)

Walchand College of Arts & Science, Solapur

Autonomous College

(Affiliated to P.A.H. Solapur University, Solapur)

।। शिक्षण हाच धर्म ।।

Name of Faculty: Science & Technology

Choice Based Credit System
(According to NEP-2020)

B.Sc. Part-I

Subject: Geology

Syllabus

With Effect from: 2023-24

Walchand College of Arts & Science, Solapur

(Autonomous)

About National Education Policy (NEP) - 2020

With the directions and guidelines issued by **Government of Maharashtra resolution dated 20th April 2023 and 16th May, 2023** regarding the implementation of NEP at UG and PG level, the Walchand College of Arts & Science (Autonomous), Solapur has taken decision to implement NEP 2020 with Choice Based Credit System (CBCS) at Undergraduate level and Post Graduate level. This has been done to achieve the goals and objectives set in NEP-2020 such as- worldwide recognition, acceptability, horizontal as well as vertical mobility for students completing undergraduate and post-graduate degree.

The CBCS provides an opportunity for the students to select from the prescribed courses comprising core, elective/minor or skill based. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations.

Outline of NEP:

The structure of the Three/Four-year bachelor's degree programme allows the opportunity to the students to experience the full range of holistic and multidisciplinary education in addition to a focus on the chosen major and minors as per their choices and the feasibility of exploring learning in different institutions. The structure allows students to learn various components like:

(a) Major (Core) Subject (DSC): This comprises of Mandatory and Elective Courses that require students to achieve:

- Minimum 50% of total credits corresponding to Three/Four - year UG Degree- Mandatory Courses are offered in all four years;
- 2 credit course on Major Specific IKS shall be included under Major;
- Elective courses of Major will be offered in the third and/or final year;
- Vocational Skill Courses, Internship/ Apprenticeship, Field Projects, Research Projects are related to Major

(b) Minor Subject (18-20 Credits)

- The Minor subjects may be from the different disciplines of the same faculty of DSC Major (Core) or they can be from different faculty altogether;
- The credits of Minor subjects shall be completed in the first three years of UG Programme

(c) Generic/ Open Elective Courses (OE) (10-12 credits)

- GE/OE are to be offered in I and/or II year;
- Faculty-wise baskets of OE shall be prepared by Autonomous College.
- OE/GE is to be chosen compulsorily from faculty other than that of the Major or as per the directions issued by NEP-Steering Committee

(d) Vocational and Skill Enhancement Courses (VSEC)

i) Vocational Skill Courses (VSC): (8-10 credits): Includes Hands on Training corresponding to the Major and/or Minor Subjects:

- To be offered in first three years;
- Wherever applicable vocational courses will include skills based on advanced laboratory practicals' of Major

ii) Skill Enhancement Courses (SEC): (06 credits)

- To be offered in I and II year;
- To be selected from the basket of Skill Courses approved by Autonomous College

(e) Ability Enhancement Courses (AEC), Indian Knowledge System (IKS) and Value Education Courses (VEC): (14 Credits)

i) AEC: (08 credits)

- To be offered in I and II year
- English: 04 Credits
- Modern Indian Language: 04 credits
- To be offered from the Basket approved by Autonomous College;

The focus for both languages should be on linguistic and communication skills.

ii) IKS: (2 Credits)

- To be offered in I Year
- Courses on IKS to be selected from the basket of IKS courses approved by Autonomous College

iii) VEC: 04 Credits

- To be offered in I year
- Value Education Courses (VEC) such as Understanding India, Environmental Science/Education, and Digital and Technological Solutions.

(f) Field Projects/ Internship/ Apprenticeship/ Community Engagement and Service corresponding to the Major (Core) Subject, Co-curricular Courses (CC) and Research Project

- Internship/Apprenticeship corresponding to the Major (Core) Subject: (8 Credits)
- Field Projects/Community Engagement and Service (CEP) corresponding to the Major (Core) Subject (minimum 4-6 credits)
  -To be offered in II and III years of UG Degree Programmes.

- Co-curricular Courses (CC) such as Health and Wellness, Yoga education, sports and fitness, Cultural Activities, NSS/NCC and Fine/ Applied/Visual/ Performing Arts: (8 credits)
  -To be offered in I and/or II year
- Research Projects: (12 credits)
  -To be offered in the final year for 4 year Honours with Research UG Degree

➢ **CREDIT:**

- Credit is a numerical value that indicates students work load (Lectures, Lab work, Seminar, Tutorials, Field work etc.) to complete a course unit. The contact hours are transformed into credits. Moreover, the grading system of evaluation is introduced for B.Sc. course wherein process of Continuous Internal Evaluation is ensured.
- **Theory: '**15 contact hours' for theory course constitute 'one credit'
- **Practical/Tutorial: '**30 contact hours' for practical course constitute 'one credit'.
- **Workshop based activities/Skill based activities:** Minimum 30 contact hours per credit in a semester is required
- **Internship/On-Job Training: '**30 contact hours' per credit in a semester is required (1 credit/week)
- **Community Engagement and Service-CEP/Field Project: '**30 contact hours' per credit in a semester is required

➢ **Credit Framework under Three/Four Years UG Programme with Multiple Entry and Multiple Exit Options:**

The minimum and maximum credit structure for different levels under three or four year UG programme with multiple entry and multiple exit options are as given below:

Levels	Code	Qualification Titles	Credit Requirements		Semester	Year
			Minimum	Maximum		
4.5	100-199	UG Certificate	40	44	2	1
5.0	200-299	UG Diploma	80	88	4	2
5.5	300-399	Three Year Bachelor's Degree	120	132	6	3
6.0	400-499	Bachelor's Degree Honours **OR** Bachelor's Degree-Honours with Research	160	176	8	4
	500-599	First Year PG & or PG Diploma	40	44	2	1
6.5	600-699	PG Degree	80	88	4	2
8.0	700-799	Ph.D.	16+ Ph.D. Work		---	---

Multiple Exit Options

Year	Exit Option	Reentry
First Year	Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/Internship OR Continue with Major and Minor	Students opting for exits at any level 'will have the option to reenter' the programme from where they had left off, in the same or in different higher educational institution 'within three years of exits' and complete the degree program within the stipulated maximum period of 07 years from the date admission of first year of UG.
Second Year	Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF Course/Internship OR Continue with Major and Minor	
Third Year	Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor	
Fourth Year Honours	Four Year UG Honours Degree in Major and Minor with160-176 credits	
Fourth Year Honours with Research	Four Year UG Honours with Research Degree in Major and Minor with160-176 credits	
Post-Graduation Degree		
Post-Graduation: First Year	PG Diploma (44 Credits) after Three Year UG Degree	Reentry to complete the PG degree after taking exit option will be permissible up to 5 years from the date admission to PG programme

- **Academic Bank of Credit (ABC):**

It is mandatory for all admitted students to get enrolled on ABC Portal and create ABC ID and share ABC-ID with academic institutions where they are enrolled. Credits earned by the students will be reflected in the students ABC account. This will allow students smooth transition during multiple entry and exit.

- **Programme outcomes:** Earth science is an important scientific discipline which involves dynamics and evolution of earth, interaction with life, oceans, atmosphere etc. It also includes Earth's interior and near space environment. Geological studies act as an important component of the B.Sc. Programme. Students will get exposure to actual rocks during Geological excursions (Fieldwork). Students will learn the data collection, measurements, and interpretations. The knowledge of geology graduate students help to join research organizations and also make career in government and private sectors. The syllabus developed for Geology has the provision of ensuring the integrated personality of the students in terms of providing opportunity for exposure to the students towards Discipline Specific Courses, Generic Elective Courses, Ability Enhancement Courses and Skill Enhancement Courses with specific skills through practical and other innovative transactional modes to develop their employability skills.

- **Programme Specific Outcome Course outcomes:**

After completing the course, the student will be able to

- learn the origin of the Universe, solar system and Earth
- understand the internal structure of Earth
- understand the role of weathering agents learn the fundamentals of geological mapping.
- learn how to read geologic maps and solve simple map problems using strikes and preparations of cross-sections.
- learn the Concept of plate tectonics
- learn earthquakes and Volcanoes
- interpret the geological maps
- measure the geological data from the field
- learn the mineral and their types
- understand the crystal formation, form, and occurrence
- learn the formation of mineral groups and resource
- learn to identify the mineral in hand specimens
- see and feel the natural rocks
- learn the rock formation including minerals genesis
- understand fossils which help to unravel the mystery of the life in the
- past
- understand the evolution of life on earth.
- indicate the fuel, ore mineral deposits like petroleum, coal, gold etc.
- understand Disaster management
- understand watershed management

Walchand College of Arts & Science, Solapur (Autonomous)

Faculty of Science: NEP Choice Based Credit System (CBCS)

(w.e.f. 2023-24)

Preamble:

The purpose of education is to develop an integrated personality of the individual and the educational system provides all knowledge and skills to the learner for this. The present syllabus constitutes of fundamental part of earth dynamics, minerals, various structures formed in the rocks. It helps students to have knowledge of the earth, earthquakes and volcanoes, nature and effects of different types of natural stresses acting on and below the earth. A study of field geological terminology and various structures like folds, faults etc. give applied knowledge to students with respect to engineering geology, economic geology. Minerals are basic substances of the earth. Study of minerals along with crystals help to understand their formation, occurrence and significance.

Objectives of the course: The objectives of B. Sc. Geology course are:

1. To gain basic knowledge of the earth science.
2. To develop foundation and experimental skills related with geological field excursion.
3. To make aware students for the earth and environmental related issues.
4. To encourage students for applying basic geological knowledge in different allied fields of Geology

Eligibility for Admission: A Candidate passing 10+2 with Physics as one of the subject and passed from State Board / CBSE / ICSE or equivalent with minimum passing percentage of as per the directives of the higher education is eligible for admission.

Duration: The duration of the B.Sc.-I course is of 1 year (comprising 2 semesters)

Medium of Instruction: English

Pattern of the Course: The autonomous college follows semester pattern.

NEP Structure: Geology B.Sc.- -I

	SEMESTER-I			
Subject	**Paper Title**	**Credits**	**Hours/week**	**Total Contact Hours**
Geology OE- I (For Arts)	**Fundamentals of Earth**	2	2	30
Geology OE- I P (For Arts)	**Practical - Geology OE- I**	2	4 (hours/week/batch)	60
Geology VSC-I	**Fundamentals of Mineralogy**	1	1	15
Geology VSC-I- P	**Practical- Geology VSC-I**	1	2 (hours/week/batch)	30
Geology SEC-I	**Fundamentals of Structural Geology**	1	1	15
Geology SEC-I- P	**Practical- Geology SEC-I**	1	2 (hours/week/batch)	30
Geology VEC -I	**Environmental Geology**	2	2	30
Geology IKS	**History of Indian Minerals**	2	2	30
	SEMESTER-II			
Geology Minor –I	**General & Physical Geology**	2	2	30
Geology OE-II (For Arts)	**Earth Processes**	2	2	30
Geology OE –II- P(For Arts)	**Practical – Geology OE-II**	2	4 (hours/week/batch)	60
Geology VSC-II	**Optical Mineralogy**	1	1	15
Geology VSC-II- P	**Practical - Geology VSC-II**	1	2 (hours/week/batch)	30
Geology SEC-II	**Watershed Management**	1	1	15
Geology SEC-II- P	**Practical- Geology SEC-II**	1	2 (hours/week/batch)	30
Geology – VEC - II	**Disaster Management**	2	2	30

Outline of Examination:

THEORY:

1) Internal Evaluation (IE): Internal evaluation will consist of **40 % marks** per semester per paper. It may be held as **per the following scheme** per semester **(Annexure: I)**

Credits	Marks for Attendance	Classroom Test	Home Assignment	Total Marks
02	05	10	05	20

2) End Semester Examination (ESE): The detailed question paper pattern (**60 % marks per paper)** is given as in **Annexure- II and Annexure- III**

PRACTICAL:

1) Internal Evaluation (IE): Internal evaluation will carry **40 % marks** and may consist of:

Credits	Marks for Attendance	Internal Practical Exam	Journal	Total Marks
02	05	10	05	20

2) **End Semester Examination (ESE):** Practical examination **60 % marks** shall be conducted at the end of each semester. The detailed scheme is given in **Annexure-IV and Annexure-V**

SEM -I

Geology OE-I: Fundamentals of the Earth

Credits: 02 **Total Marks: 50** **Contact hours: 30**

Unit No.	Title of topic and content	Contact Hours
I	**Earth Dynamics -** Earth as a planet: Holistic understanding of dynamic planet 'Earth' through Geology. Introduction to various branches of Geology with significance. General characteristics and Origin of the Universe, Solar System, and its planets. The terrestrial and Jovian planets. Physical data of earth - size, shape, mass, density, rotational and revolution parameters, and age of earth.	**15**
II	**Earth Processes -** Atmosphere – Evolution, Composition, different layers. Interior of the Earth: Use of seismic waves in understanding the internal structure of the Earth- Core – inner and outer, Mantle – upper and lower, Lithosphere- Sial and Sima (Crust) and major discontinuities. Soils: processes of formation, soil profile and soil types.	**15**

Practical- Geology OE-I

Credits: 02 **Total Marks: 50** **Contact hours: 60**

Title of Practical	Contact Hours
1. Draw and describe interior of the earth (crust, mantle, core) **2.** Draw and describe different layers of Atmosphere **3.** Draw and describe Soil profile **4.** Visit to science center and report 5. Project work related with theory	60

Text Books:

1. **A Text Book of Geology** - P.K. Mukherjee, *World Press, Kolkata*

2. **Physical Geology**- Charles C. Plummer, Diane H. Carlson and Lisa Hammersley, *McGraw Hill*

3. **Principles of Physical Geology** - Arthor Holmes, *Champman and Hall, London*

4. **A text book of Physical geology-** Mahapatra, G.B., 1994. CBS Publishers

Reference Books:

1. **Earth Science: The Earth, The Atmosphere, and Space** - S. Marshak and R. Rauber, *W.W. Norton & Co.*

2. **Encyclopaedia of Geomorphology** - Andrew S. Goudie, *Routledge*

3. **Introduction to Coastal Processes and Geomorphology** - Robin Davidson-Arnott, *Cambridge*

4. **Introduction to Physical Geology**- Thompson and Turk, *Brooks*

About the Course:

The main objective of the course is to introduce the basic understanding of the solar system, its components and origin. It is also intended to give an overall understanding of the earth system including its components, dynamics and history.

Course Learning Outcome

The study of this paper strengthens knowledge of students of any discipline with respect to understanding the essentials of the structural dynamics of the earth. They will also understand the origin of solar system, atmosphere, interior of the earth.

Geology VSC-I: Fundamental of Mineralogy

Credits: 01 **Total Marks: 25** **Contact hours: 15**

Unit No.	Title of topic and contents	Contact Hours
I	**Study of Rock Forming Minerals:** Definition of mineral, chemical bonding in minerals. Physical properties of minerals - Form, Color, Streak, luster, Cleavage, Fracture, Hardness and Specific Gravity. Study of Physical properties, Chemical composition of common rock forming minerals - Quartz, Orthoclase, Plagioclase, Microcline, Olivine, Augite, Hypersthene, Hornblende, Muscovite, Biotite, Garnet, Calcite.	15

Practical -Geology VSC-I

Credits: 01 **Total Marks: 25** **Contact hours: 30**

Title of Practical	Contact Hours
1. Study of Physical properties of different minerals 2. Megascopic identification of following rock forming minerals a. Quartz b. Feldspar - Orthoclase, Plagioclase, Microcline c. Olivine – Olivine d. Pyroxene - Augite, Hypersthene e. Amphibole - Hornblende, Asbestos f. Mica - Muscovite, Biotite g. Other – Gypsum, Garnet, Calcite 3. Determination of Specific gravity of Minerals using Walker's steelyard Balance	**30**

Text Books:

1. **An Introduction to the Rock-Forming Minerals** - W.A. Deer, R.A. Howie and J. Zussman, *The Mineralogical Society London*

2. **Rutley's Element of Mineralogy (Rev. Ed.)** Read, H.H., 1968. Thomas Murby and Co.

Reference Books:

1.Atlas of Rock-Forming Minerals in Thin Section - W. S. MacKenzie and C. Guilford, *Routledge*

2. **Dana's Textbook of Mineralogy** - William E. Ford, *CBS Publishers and Distribut.*

About Course

The course includes the study of minerals with physical properties. Further, it also deals with the study of different minerals and groups.

Course Learning Outcome

The students will learn the basics of mineralogy, types of bonding. The students will be able to identify common rock forming minerals in hand specimens

Geology SEC-I: Fundamental of Structural Geology

Credits: 01 **Total Marks: 25** **Contact hours: 15**

Unit No.	Title of topic and content	Contact Hours
I	**Study of Structures:** Introduction to structural Geology; Elementary ideas of bed, dip and strike, Outcrops. Outliers and inliers. Folds: Definition, nomenclature, Types of Folds: anticline, syncline, symmetrical, asymmetrical, isoclinal, overturned and recumbent. Faults: Definition, nomenclature, and classification of Fault. Types of faults: normal, reverse, horst, graben. Joints: Definition, classification (Geometric and genetic) Unconformity: Definition and types	**15**

Practical -Geology SEC-I

Credits: 01 **Total Marks: 25** **Contact hours: 30**

Title of Practical	Contact Hours
1. Identification and Draw, Describe various structural models of a. strike and dip b. Folds – Anticline, Syncline, Symmetrical, Asymmetrical c. Faults – Normal, Reverse, Horst, Graben d. Joints - Types e. Unconformity – Angular, Disconformity, Non-conformity 2. Preparation of cross-section profile and description from contour maps, Drawing cross sections of geological maps – Horizontal / Inclined beds (with igneous intrusions, unconformity and fault), Exercises on basic structural problems	**30**

Text Books:

1. **Structural Geology** Billings, M.P., 1972. Prentice Hall.

2. Structural Geology of Rocks and Region Davis, G.R., 1984. John Wiley

3. Elements of Structural Geology Hills, E.S., 1963. Farrold and Sons, London.

4. Structural Geology. A Practical Approach Singh, R. P., 1995. Ganga Kaveri Publ., **Varanasi**

Reference Books:

1. **Atlas of Structural Geology** - Soumyajit Mukherjee, *Elsevier*.

2. **Basic Methods of Structural Geology** - S. Marshak and G. Mitra, *Prentice Hall*

3. **Folding and Fracturing of Rocks** - John G. Ramsay, *McGraw Hills Book Company*

About Course

The course deals with study of geological structures formed by the action of forces on rocks. It also helps student to gain knowledge of the geometry of the rock structures

Course Learning Outcome

By this course, the students will learn the skills of identifying different structures and will be acquainted with terminology related with field measurements. It also helps to read geologic maps and solve simple map problems and preparations of cross sections.

Geology-VEC I – Environmental Geology

Credits: 02 **Total Marks: 50** **Contact hours: 30**

Unit No.	Title of topic and contents	Contact Hours
I	**Fundamentals of Environment** Definition of Environment and dimensions of Environment. General idea about components and composition of different Environmental domains such as Atmospheres, Hydrosphere, Biosphere	**15**
II	**Pollution & Natural Hazards** Types of pollution (water, air, soil), past climates in the earth history, concept and origin of monsoon, elements of natural hazards, Soil and types	**15**

Text Books:

1. Text Book of Environmental Studies. Asthana, D. K. 2006. S. ChandPublishing.

2. **Fundamentals of Environmental Studies,** Basu, M., Xavier, S. 2016. Cambridge University Press, India.

3. **Environmental Geology** - James S. Reichard, *McGraw Hill*

4. **Environmental Geology –** Valdiya K S 2nd Edi**.** *McGraw Hill*

Reference Books:

1. **Environmental Geology** - C. Montgomery, *John Wiley and Sons*

About Course

The course includes understanding of basics of environment, various environmental domains, environmental pollution and practices, natural hazards and disasters.

Course Learning Outcome

Upon completion of the course, students will become aware of the importance of environment. They also will know the fundamentals of earth science as applied to the interaction between human activity and the natural environment in terms of pollution, earth processes.

Geology IKS: I History of Indian Minerals

Credits: 02 **Total Marks: 50** **Contact hours: 30**

Unit No.	Title of topic and content	Contact Hours
I	**Unit I: Study of Ores** Definition and Introduction to economic geology; ore and gangue, tenor, processes of formation of ore deposits. Study of metallic (Cu, Fe, Zn, Mn, Au, Al) and Industrial minerals (Gypsum, Limestone, Mica, Quartz, Clay, Asbestos) deposits with respect to geological occurrence and distribution in India Study of occurrence, origin and distribution of coal and petroleum in India	**15**
II	**Unit II: History of Minerals** Importance and use of different Precious and Semi- precious stones, gold etc. in Indian history	**15**

Text books:

1. **Economic Mineral Deposits.** Jensen M.L. and Bateman, A., John Wiley & Sons; Revised Edition.
2. **Industrial minerals and rocks of India**. Deb, S. Allied Publishers.
3. **India's Mineral Resources** - S. Krishnaswamy, *Oxford and IBH*
4. **Ore deposits of India their distribution and processing**, *Gokhale, K.V.G.K.and Rao, T.C.Tata-McGraw Hill, New Delhi.* East West press Ltd.

Reference Books:

1. **Hydrocarbon Exploration and Production** (V-46) - Frank Jahn, *Elsevier*
2. **Mineral Economics: An Indian Perspective** - K. Randive and S. Jawadand, *Nova Scientific Series*
3. **Mineral Resources of India** - D.K. Banerjee, *World Press Pvt. Ltd.*

About Course

This course provides basic knowledge about the economic aspects of geology including genesis, mode of occurrences and uses of economically important metallic and non-metallic minerals as well as fuels

Course Learning Outcome

On completion of the course the students acquaint the knowledge of economic mineral deposits, their processes of formation, mode of occurrence and uses. They will also get information related with importance of gold, precious stones in the historical past.

Semester - II

Geology Minor paper I – General and Physical Geology

Credits: 02 **Total Marks: 50** **Contact hours: 30**

Unit No.	Title of topic and contents	Contact Hours
I	**General Geology:** Introduction to Geology and branches, Earth's origin: Laplace and Kant Nebular Hypothesis; Chamberlain and Moulton Planetesimal Theory, Earth's size, shape, mass, density, and its atmosphere	15
II	**Physical Geology:** Weathering: Definition, Types (physical, chemical, and biological), Agents, controlling factors and its products, Importance of weathering, Erosional, Transportation and Depositional features of different natural agents viz. River, Wind, Ocean	15

Text Books:
1. **A Text Book of Geology** - P.K. Mukherjee, *World Press, Kolkata*
2. **Fundamentals of Physical Geology** - Sreepat Jain, *Springer*
3. **Principles of Physical Geology** - Arthor Holmes, *Champman and Hall, London*

Reference Books:
1. **Earth Science: The Earth, The Atmosphere, and Space** - S. Marshak and R. Rauber, *W.W. Norton & Co.*
2. **Encyclopedia of Geomorphology** - Andrew S. Goudie, *Routledge*

About the course:
The main objective of the course is to introduce the basic understanding of the solar system, its components and origin. It is also intended to give an overall understanding of the earth system including dynamics and physical processes.

Course Learning Outcome

The study strengthens knowledge of students with respect to understanding the essentials of the structural dynamics of the earth, the origin of solar system and various processes operating on the earth.

Geology OE-II: Earth Processes

Credits: 02 **Total Marks: 50** **Contact hours: 30**

Unit No.	Title of topic and content	Contact Hours
I	**Dynamic Geology:** Exogenous and Endogenous processes, Weathering: Definition, Types Earthquake: Definition, Focus, Epicenter, Iso-seismal lines and nature of Seismic waves, Measurement of earthquakes -Seismographs and Seismograms, Intensity and Magnitude (Mercalli Scale and Richter) scales, origin, causes, Effects and prediction of earthquakes, application of seismic study. Volcano: Definition, Super structure of Volcano, Types (Central and fissure), Products and Causes of Volcanism, Mountains and Types	**15**
II	**Physical Geology:** Geological work by natural agents with their erosional, Transportation and Depositional features.	**15**

Practical -Geology OE-II

Credits: 02 **Total Marks: 50** **Contact hours: 60**

Title of Practical	Contact Hours
1. Study of seismic zone map of India **2.** Study of various geomorphic models of physical features River - Valleys, Waterfall, Alluvial plain, Delta, Meanders Wind – Mushroom and Pedestal rock, Types of sand dunes Ocean- Beaches, Sea caves, Wave cut terrace **3.** Draw and describe different types of mountains, typical structure of volcano	**60**

Text Books:

1. **Principles of Physical Geology,** Arthur Holmes, Chapman and Hall, London.
2. **An Introduction to Physical Geology,** Miller, East West Press Ltd.
3. **A text book of Physical geology**. Mahapatra, G.B., CBS Publishers.

Reference Books:

1. **Introduction to Geomorphology** V. S. Kale and A. Gupta, The University Press.
2. **Landscapes and Landforms of India** V. S. Kale, Springer Dordrecht.

About the course:

The intention of the course is to introduce the basic understanding of the surface features and Processes operating on the earth. It is also intended to give an overall understanding of the earth system including its dynamics.

Course Learning Outcome

Students Will learn the structure of Earth, role of weathering agents and action of geological agents. The study of this paper strengthens knowledge with respect to understanding the essentials of the dynamics of the earth and types natural agents with their processes operating in the earth.

Geology VSC-II: Optical Mineralogy

Credits: 01 **Total Marks: 25** **Contact hours: 15**

Unit No.	Title of topic and content	Contact Hours
I	**Petrological Microscope and Minerals:** Nature of Ordinary and polarized Light Polarizing Microscope – Different parts and functioning. Optical properties of minerals in Plane Polarized Light - Color, Pleochroism, Form, Relief and Cleavage and between crossed nicols - Isotropism / anisotropism, twinning, Extinction, Extinction angle, Interference Colors. Optical properties of common rock forming minerals - Quartz, Orthoclase, Plagioclase, Microcline, Olivine, Augite, Hypersthene, Hornblende, Muscovite, Biotite, Garnet, Calcite.	**15**

Practical -Geology VSC-II

Credits: 01 **Total Marks: 25** **Contact hours: 30**

Title of Practical	Contact Hours
1. Study of petrological microscope and its parts 2. Study of Optical properties of common rock forming minerals a. Quartz b. Feldspar - Orthoclase, Plagioclase, Microcline c. Olivine – Olivine d. Pyroxene - Augite, Hypersthene e. Amphibole - Hornblende f. Mica - Muscovite, Biotite g. Other – Garnet, Calcite	**30**

Text Books:

1. **An Introduction to Rock**-Forming Minerals - W.A. Deer, R.A. Howie and J. Zussman,
2. *Mineralogical Society of Great Britain and Ireland*
3. **Rutley's Element of Mineralogy (Rev. Ed.**). Read, H.H. Thomas Murby and Co.
4. **Optical Mineralogy** 5th Ed. err, B.F. Mc Graw Hill, New York.

Reference Books:

1. Optical Mineralogy - P.K. Verma, *Ane Books Pvt. Ltd.*

2. **A textbook of Mineralogy (Reprints).** Dana, E.S. and Ford, W.E.

About the course:

The aim of the introduction of the course is to introduce the students to basic concepts of optics and optical mineralogy including the interaction of light and geological materials.

Course Learning Outcome

Students will learn about the basic principles involved in optics, behaviour of light in crystals and determination of different optical properties of minerals after completion

Geology SEC-II: Watershed management

Credits: 01 **Total Marks: 25** **Contact hours: 15**

Unit No.	Title of topic and content	Contact Hours
I	Watershed development: concept and characteristics of watershed; importance of water resources in watershed; concept of watershed development, salient features of contour bunding, gully plugs, stream bunds, percolation tank, subsurface dams, etc. significance of geology in watershed management; Soil and water conservation structures, assessment of water resources in a watershed: role of NGOs and State Government in watershed development in drought prone region, rain water harvesting.	**15**

Practical -Geology SEC-II

Credits: 01 **Total Marks: 25** **Contact hours: 30**

Title of Practical	Contact Hours
1. 1. Study of drainage pattern (Dendritic, Parallel, Rectangular etc.) 2. Demarcation of Drainage basins from topographic sheets 3. Estimation of Morphometric Parameters of drainage basin. a. Stream length b. Stream length ratio c. Bifurcation ratio d. Drainage area e. Elongation ration f. Drainage Density g. water budgeting in watershed	**30**

Text Books:

Groundwater hydrology, 2ed. Todd, D. K. John Wiley. (p. 535).
Groundwater: Assessment, Development and management, Karanth K.R. Tata McGraw-Hill Pub. Co. Ltd.

Additional Reading:
Introduction to Hydrology. Syed Tajdarul Hassan. 2017. E-PG Pathshala, UGC, MHRD, Govt. of India. Available on: https://epgp.inflibnet.ac.in/ahl.php?csrno=448

Course Objective

The intention of the course is to introduce the fundamental concepts, principles and planning of watershed development and provides inputs for integrated watershed management.

Course Learning Outcome

After completion of this course, the students will acquire knowledge about watershed development and integrated watershed management thereby enhancing their employability with NGOs, government agencies, etc. working in the fields of rain water harvesting, watershed and rural development.

Geology-VEC II – Disaster Management

Credits: 02 **Total Marks: 50** **Contact hours: 30**

Unit No.	Title of topic and contents	Contact Hours
I	**Natural Disaster**: Definitions of Hazard, Disaster and Natural disasters: study of different natural hazards viz. Floods, cloud burst, drought, Earthquakes, Volcano and Landslides. Hazards and impacts, Mitigation measures of natural hazards.	15
II	**Management of Disaster:** Man-made disasters: Chemical disasters, biological disasters, radiological disasters, nuclear disasters. Meaning, nature, importance and scope of disaster management. Disaster Management Cycle, Stages of disaster management. Disaster risk reduction, prevention, mitigation and preparedness	15

Text Books:

1. **Geological Hazards,** Bell, F.G. Routledge, London.
2. **Environmental Hazards**. Smith, K. Routledge, London.
3. **Textbook in Environmental Science** Subramaniam, V. Narosa International
4. **Disaster Management,** Mukesh Dhunna, Vayu Education of India.
5. **Disaster Education and Management,** Rajendra K. Bhandari, 2014., Springer India

About the course:

To create awareness and knowledge base of different types of natural disasters.

To understand the management of natural disasters. To impart knowledge regarding the risks, vulnerability and disaster risk reduction.

Course Learning Outcomes

Students understand disaster, types of natural disasters. They also understand role of geology for natural disasters, landslide causes & mapping techniques, Disaster management techniques in day today life.

Annexure – I

Walchand College of Arts and Science, Solapur
(Autonomous)

Question Paper for Class Room Test (IE)

(02 Credit Theory Course)

Marks: 10

Q.No.1 Multiple choice questions - 04 marks.

Q.No.2 Attempt any two - 06 marks.

a)
b)
c)

Annexure – II

Scheme of Marking for End Semester Examination (ESE) (Theory)

Walchand College of Arts and Science (Autonomous), Solapur

(ESE)

w. e. f 2023-24

Theory question paper Pattern for **2 credit all courses** as per NEP 2020(ESE)

Examination:
Class: **Semester:**
Subject: **Paper:**
Time: 1.5 hrs **Marks: 30**

Instructions: a) All questions are compulsory
b) Figures to the right indicate full marks
c) Draw neat & well labelled diagram wherever necessary

Q. No.1 Select the correct alternative of the following **06**

i)

a) b) c) d)

ii)
iii)
iv)
v)
vi)

Q. No.2 Attempt the following (Any three) **06**

i)
ii)
iii)
iv)
v)

Q. No.3 Attempt the following (Any two) **06**

i)
ii)
iii)

Q. No.4 Attempt the following (Any two) **06**

i)
ii)
iii)

Q. No.5 Attempt the following (Any one) **06**

i)
ii)

Annexure - III

Scheme of Marking for End Semester Examination (Theory)

Walchand College of Arts and Science (Autonomous), Solapur

Theory question paper Pattern for **1 credit all courses** as per NEP 2020(ESE)

w. e. f 2023-24

Examination:

Class: **Semester:**

Subject: **Paper:**

Time: 1.5 hrs Marks: 25

Instructions: a) All questions are compulsory
b) Figures to the right indicate full marks
c) Draw neat & well labelled diagram wherever necessary

Q. No.1 Select the correct alternative of the following **05**

i)

a) b) c) d)

ii)

iii)

iv)

v)

Q. No.2 Attempt the following (Any five) **05**

i)

ii)

iii)

iv)

v)

vi)

vii)

Q. No.3 A) Attempt the following (Any one) **03**

i)

ii)

B) **Attempt the following (Any one)** **02**

i)

ii)

Q. No.4 A) Attempt the following (Any one) **03**

i)

ii)

B) **Attempt the following (Any one)** **02**

i)

ii)

Q. No.5 Attempt the following (Any one) **05**

i)

ii)

Annexure-IV

Scheme of Marking for End Semester Examination (ESE)

(02 Credit Practical Course)

Time: 3 hours **Total Marks: 30**

Practical examination will be at the end of the semester. Every candidate has to perform Practical.

a) Practical : 25 Marks
b) Certified Journal : 05 Marks

The breakup of 25 marks should be given in question paper.

Annexure V

Scheme of Marking for End Semester Examination (ESE)

(01 Credit Practical Course)

Time: 3 hours **Total Marks: 25**

Practical examination will be at the end of the semester. Every candidate has to perform Practical.

a) Practical : 20 Marks
b) Journal/Report : 05 Marks

The breakup of 20 marks should be given in the question paper.