

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

SYLLABUS: CHEMISTRY

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

(Syllabus to be implemented w.e.f. June 2022-23)

Walchand College of Arts & Science, Solapur

(Autonomous)

Choice Based Credit System:

With the view to ensure worldwide recognition, acceptability, horizontal as well as vertical mobility for students completing undergraduate degree, Walchand College of Arts & Science, Solapur has implemented Choice Based Credit System (CBCS) at Undergraduate level.

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. 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 Choice Based Credit System:

1. **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
2. **Elective Course:** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

Discipline Specific Elective (DSE) Course:

Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective.

3. Ability Enhancement Courses (AEC):

The Ability Enhancement (AE) Courses may be of two kinds: **Ability Enhancement Compulsory Courses (AECC)** and **Skill Enhancement Courses (SEC)**. “AECC” courses are the courses based upon the content that leads to Knowledge enhancement; (i) Environmental Science and (ii) English/MIL Communication. These are mandatory for all disciplines. SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

Credit:

Credit is a numerical value that indicates students work load (Lectures, Lab work, Seminar, Tutorials, Field work etc.) to complete a course unit. In most of the universities **15 contact hours** constitute **one credit**. 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.

Walchand College of Arts & Science, (Autonomous) Solapur: Faculty of Science

B.Sc.-Part-II

Choice Based Credit System (CBCS), (w.e.f. 2022-23)

Course Structure

Sr. No.	Title/Subject	Type of Paper	Semester III	Semester IV	Total Marks
Any Three of the Four Optional Subject Groups Opted at B.Sc. Part-I (Excluding Statistics):					
1	Chemistry	Elective	40+10=50 (Paper-V) + 40+10=50 (Paper-VI)	40+10=50 (Paper-VII) + 40+10=50 (Paper-VIII)	200
2	Zoology	Elective	40+10=50 (Paper-V) + 40+10=50 (Paper-VI)	40+10=50 (Paper-VII) + 40+10=50 (Paper-VIII)	200
3	Mathematics	Elective	40+10=50 (Paper-V) + 40+10=50 (Paper-VI)	40+10=50 (Paper-VII) + 40+10=50 (Paper-VIII)	200
4	Physics	Elective	40+10=50 (Paper-V) + 40+10=50 (Paper-VI)	40+10=50 (Paper-VII) + 40+10=50 (Paper-VIII)	200
5	Geology	Elective	40+10=50 (Paper-V) + 40+10=50 (Paper-VI)	40+10=50 (Paper-VII) + 40+10=50 (Paper-VIII)	200
6	Microbiology	Elective	40+10=50 (Paper-V) + 40+10=50 (Paper-VI)	40+10=50 (Paper-VII) + 40+10=50 (Paper-VIII)	200
7	Electronics	Elective	40+10=50 (Paper-V) + 40+10=50 (Paper-VI)	40+10=50 (Paper-VII) + 40+10=50 (Paper-VIII)	200
8	Botany	Elective	40+10=50 (Paper-V) + 40+10=50	40+10=50 (Paper-VII) + 40+10=50	200

			(Paper-VI)	(Paper-VIII)	
9	Practical (Compulsory Year End (YE) Examination)	Practical-II (for each subject)	40+10=50		50+50=100
		Practical-III (for each subject)	40+10=50		
Grand Total for B.Sc.-II Programme			Semester-III:-100 x 3 = 300 Semester-IV:- 100 x 3 =300 Practical: 100 x 3 = 300 Environmental Science= 50 Grand Total=950		

Along with the above course, for B.Sc. Part-II students will study the Ability Enhancement Compulsory Course viz. **Environmental Studies** course (without Credit) of 50 marks (40+10).

Walchand College of Arts & Science, Solapur: Faculty of Science

(Autonomous)

B.Sc.-Part-II

Choice Based Credit System (CBCS), (w.e.f. 2022-23)

Preamble:

The students of undergraduate programme in Chemistry should be exposed to the fundamental and advanced knowledge used in science. The objective of this academic plan is to make the concepts and methods of chemistry clear and interesting to students. In Physical chemistry section the student will be able to understand the basic concepts of Chemical Kinetics, Thermodynamics and Gas Laws. For Inorganic Chemistry view point molecules are formed from the combination of atoms. The student learns the different approximation for generation molecules, namely the valence bond method and the molecular orbital method. Thus he gets an idea of the quantum mechanical treatment of chemical bonding in diatomic molecules. The concept of hybridization (linear combination of orbitals of the same atom) explains the formation of bands from the atomic orbitals in metals. The course aims to inculcate an atomic/molecular level thinking in the minds of the students. Thousands of organic compounds especially biologically active are added in the literature even on daily basis. For a thorough understanding in Organic Chemistry an undergraduate student is to be exposed to few fundamental aspects: Introduction to UV Spectroscopy, introduction to Stereochemistry, primary information on molecules with functional groups like alcohols, phenols, aldehydes, ketones, acids, diazonium compounds, ethers and epoxides. Practical part of syllabus is framed in such a way that students will be able to apply the knowledge of fundamental principles of chemistry through experimental work.

Objectives of the program:

The broad aims of bachelors degree programme in Chemistry are: The aim of bachelor's degree programme in chemistry is intended to provide: (i). Broad and balance knowledge in chemistry in addition to understanding of key chemical concepts, principles and theories. (ii). To develop students' ability and skill to acquire expertise over solving both

theoretical and applied chemistry problems. (iii). To provide knowledge and skill to the students' thus enabling them to undertake further studies in chemistry in related areas or multidisciplinary areas that can be helpful for self-employment/entrepreneurship. (iv).To provide an environment that ensures cognitive development of students in a holistic manner. A complete dialogue about chemistry, chemical equations and its significance is fostered in this framework, rather than mere theoretical aspects (v).To provide the latest subject matter, both theoretical as well as practical, such a way to foster their core competency and discovery learning. A Chemistry graduate as envisioned in this framework would be sufficiently competent in the field to undertake further discipline-specific studies, as well as to begin domain-related employment. (vi).To mould a responsible citizen who is aware of most basic domain-independent knowledge, including critical thinking and communication. (vii). Enable students to develop scientific inquiry skills to design and carry out scientific investigations by applying the principles of organic, inorganic, physical chemistry, instrumental methods of analysis and analytical chemistry. (viii).(ix) Describe and discuss ways in which science is applied and used to solve local and global problems and to discuss how science and its applications interact with social, economic, political, environmental, cultural and ethical factors.

Eligibility and Admission:

B. Sc. I Pass / ATKT.

Duration:

The duration of the B.Sc.-II course is of 1 year (comprising 2 semesters) and the B.Sc. entire program is of 3 years (06 Semesters)

Medium of Instruction: English

Walchand College of Arts & Science, Solapur (Autonomous)

Faculty of Science: Choice Based Credit System (CBCS)

(w.e.f. 2022-23)

Programme outcomes:

Student should learn

1. Basics of the chemistry along with the practical applications/skills, industrial usage
2. The principles underlying the different experiments
3. Functional group conversions
4. Preparation of standard solutions and analytical skills
5. Handling of instruments to develop instrumental skills with respect to industries
6. Nomenclature of inorganic and organic compounds and their characterization

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.

B.Sc. Part-II Chemistry
Choice Based Credit System (CBCS)
In force from June-2022

General Structure of the Chemistry Subject:

There will be two theory papers of 50 marks (ESE 40 + IE 10 marks) for each semester. There titles & marks distribution are as under.

N. B.

- i. Figures shown in bracket indicates the total number of contact hours required for the respective topics
- ii. The question paper should cover the entire syllabus. Marks should be in proportion number of contact hours allotted to respective topics.
- iii. All topics should be dealt with S.I units.
- iv. Use of scientific calculator is allowed.
- v. Industrial tour is prescribed.

Semester-III

Paper-V: Organic Chemistry 50 marks (40 + 10 marks)

Paper-VI: Inorganic Chemistry 50 marks (40 + 10 marks)

Semester-IV

Paper-VII: Physical Chemistry 50 marks (40 + 10 marks)

Paper-VIII: Analytical & Industrial Inorganic Chemistry 50 marks (40 + 10 marks)

Practical Chemistry - (80 + 20 marks)

Walchand College of Arts and Science, Solapur

SYLLABUS FOR B. Sc – II (CHEMISTRY)

NEW CHOICE BASED CREDIT SYSTEM (CBCS) SYLLABUS

Structure of the Course:

- Structure of B.Sc. course in faculty of science has total of 06 semesters for 3 years.
- B.Sc.-II comprises of total two semesters. Each semester will have **two** theory papers of 40 marks for external examination and 10 marks for internal examination for each paper.
- At the end of academic year i.e. semester IV the practical examination will be conducted.

The weightage of practical is of 80 marks for external practical examination and 20 marks for internal practical examination.

- The titles and marks distribution for each paper are as under.

Semester	Title of the Core Course	Paper No.	Lectures	Examination			Total Credit
				End Semester Exam. (ESE)	Internal Exam. (IE)	Total Marks	
Semester III	Organic Chemistry	Paper -V	30	40	10	50	02
	Inorganic Chemistry	Paper -VI	30	40	10	50	02
Semester IV	Physical Chemistry	Paper -VII	30	40	10	50	02
	Analytical & Industrial Inorganic Chemistry	Paper -VIII	30	40	10	50	02
Practical	Chemistry	Practical-II		80	20	100	04
				240	60	300	12

Semester-III

Paper-V: Organic Chemistry

Total Credits: 2

(30 Contact hrs.)

UNIT-I

1. Spectroscopic Methods

(6)

Ultra-Violet (UV) absorption:

1.1 Introduction to Spectroscopy, Beer – Lambert law (mathematical derivation not expected), Types of electronic transitions, Terms used in UV spectroscopy: Chromophore, Auxochrome, Bathochromic Hypsochromic, Hypochromic and Hyperchromic shifts, Effect of conjugation on position of UV and visible bands.

1.2 Calculation of λ_{max} by Woodward-Fieser rules for conjugated dienes and enones. Applications of UV spectroscopy – Determination of structure and stereochemistry (cis and trans) spectral problems based on UV. (Spectroscopic charts will not be supplied)

2. Stereochemistry

(6)

2.1. Geometrical isomerism: Introduction, Geometrical isomerism in aldoximes and ketoximes, configuration of ketoximes-Beckmann transformation (Mechanism & Proof are not expected) configuration of aldoximes.

2.2. Conformational Isomerism: Introduction, conformation of ethane and n-butane and their representation by using Saw-Horse, Fischer (dotted Wedge line) and Newmann's projection formulae.

2.3. Conformational analysis of ethane and n-butane with the help of energy profile diagrams.

2.4. Nomenclature – D & L, R & S, E & Z systems

3. Alcohols and Phenols

(6)

3.1. Alcohols : Introduction

i. Dihydric alcohols : Nomenclature, Methods of formation of ethylene glycol from ethylene, ethylene dibromide and ethylene oxide, physical properties & chemical reactions of ethylene glycol – acidic nature, reaction with hydrogen halide, oxidation – lead acetate, HIO_4 and nitric acid, Uses of ethylene glycol. Pinacol formation, Pinacol-Pinacolone rearrangement and its mechanism.

ii. Trihydric alcohols: Nomenclature, Methods of formation of glycerol – from fats and oils physical properties. Chemical reactions of glycerol – reaction with electropositive metals,

reaction with hydrogen halide HCl and HI Reaction with conc. nitric acid in presence of conc. sulphuric acid. Reactions with potassium hydrogen sulphate, esterification, oxidation. Uses of glycerol.

3.2. Phenols : Introduction, Reactions of phenol (carbolic acid) :

- i. Acylation and Fries rearrangement
- ii. Ether formation and claisen rearrangement
- iii. Gattermann Synthesis
- iv. Carboxylation – Kolbe's reaction
- v. Reimer – Tiemann reaction and its mechanism.

UNIT- II

4. Aldehydes and Ketones

(3)

Introduction, Nomenclature, structure and reactivity of the carboxyl group. Mechanism of nucleophilic additions to carbonyl group. Study of following reactions with mechanism and applications 1) Aldol condensation (base catalysed), 2) Perkin reaction, 3) Cannizzaro's reaction, 4) Knoevenagel reaction 5) benzoin condensation.

5. Ethers and Epoxides

(3)

5.1. Ethers : Introduction, Nomenclature, Methods of formation of anisole by Williamson's synthesis and from diazomethane, chemical reactions of anisole with HI, Gravimetric estimation of $-\text{OCH}_3$ group by Ziesel's method (Related problems are expected based on % of $-\text{OCH}_3$ and number of $-\text{OCH}_3$ groups).

5.2. Epoxides : Introduction, Nomenclature, commercial method of preparation of ethylene oxide. Acid and base catalysed ring opening of ethylene oxide, reactions of Grignard and organolithium reagents with ethylene oxide.

6. Carboxylic acids

(4)

6.1. Monocarboxylic acids : Introduction. Methods of formation of Halo acids, di- and trichloroacetic acid by HVZ reaction, substitution reactions of monochloroacetic acid by nucleophiles CN^- , OH^- , I^- , and NH_3 .

6.2. Hydroxy acids : A. Malic acid and B. Citric acid, Methods of formation of malic acid from maleic acid and from α -bromo succinic acid. Reactions of malic acid – action of heat, oxidation reaction and reaction with HI, uses of malic acid. Methods of formation of citric acid from glycerol. Reactions of citric acid: Acetylation with acetic anhydride reduction by HI, Action of heat at 4220K. Uses of citric acid.

6.3. Unsaturated acids : Methods of formation A. Acrylic acid from acrolein and by dehydration of β -hydroxy propionic acid. Reactions of acrylic acid – Addition of H_2O , reduction by Na / C_2H_5OH . Uses of acrylic acid. Methods of formation B. Cinnamic acid from benzaldehyde using diethyl malonate and by using acetic anhydride and sodium acetate. Reactions of cinnamic acid – bromination, oxidation. Uses of cinnamic acid.

6.4. Dicarboxylic acids : Succinic and phthalic acids. Methods of formation of succinic acid from ethylene bromide, maleic acid. Reactions of succinic acid – action of heat, action of $NaHCO_3$, C_2H_5OH in presence of acid. Uses of succinic acid. Methods of formation of phthalic acid from o-xylene and naphthalene Reactions of phthalic acid – action of heat, reaction with sodalime, NH_3 . Uses of phthalic acid.

7. Diazonium Salts

(2)

7.1 Diazonium salts : Introduction, benzene diazonium chloride – preparation, chemical properties.

- i. Formation of iodo benzene
- ii. Sandmeyer's reaction
- iii. Formation of benzene
- iv. Formation of phenylhydrazine
- v. Azo coupling – synthesis of methyl orange and congo red.

Reference Books :

Latest editions of following reference books.

1. Organic Chemistry. Volume 1 – The fundamental principles by I.L. Finar.
2. Organic Chemistry. Volume 2 – Stereochemistry and the chemistry of natural. Products by I.L. Finar, Low-priced Edn. ELBS – Longman
3. Organic Chemistry. Volume I, II, III by S.M. Mukharjee, S.P. Singh and R.P. Kapoor. Wiley Eastern Limited.
4. Advanced Organic Chemistry by, B.S. Bahl, Arun Bahl. S.Chand & Company, Ltd.

5. Organic Chemistry by Morrison – Boyd.
6. A Text Book of Organic Chemistry by K.S. Tiwari. S.N. Meharotra. N.K. Vishnoi. Vikas Publication, Meerut.
7. Spectroscopic methods in Organic Chemistry by Williams and Fleming. Mc-Graw Hill.
8. Stereochemistry of Organic Compounds by E.L. Eliel. Orient Longman.
9. Stereochemistry of Organic Compounds by P.S. Kalsi. New Age International Ltd.
10. A Guide Book to Mechanism in Organic Chemistry by Peter Sykes.
11. Advanced Organic Chemistry, structure, reactions and mechanism by Jerry March. Mc Graw Hill Kogakusha, Ltd.
12. Spectroscopy of Organic Compounds by P.S. Kalsi.
13. Absorption spectroscopy of Organic molecules by V.M. Parikh.
14. College Organic Chemistry Part I & II by G.R. Chatwal.
15. Stereochemistry by Nasi Puri

Course Outcomes

1. Students should learn basic concepts in UV spectroscopy and should be able to calculate λ_{max} values for organic molecules.
2. Students should learn basics of stereochemistry.
3. Students should learn basics of reactions of molecules with functional group such as alcohols, phenols, aldehydes, ketones, epoxides, ethers, acids and diazonium salts.

Semester-III
Paper-VI- Inorganic Chemistry

Total Credits: 2

(30 Contact hrs.)

UNIT-I

1. Co-ordination Chemistry: (10)

1.1 Definition and formation of co-ordinate covalent bond in $\text{BF}_3 \cdot \text{NH}_3$ and in $[\text{NH}_4]^+$.

1.2 Distinction between double salt and complex salt,

1.3 Werner's theory: A. Postulates of theory,

B. Applications of theory:

Theory applied to cobalt amine viz;

a]. $\text{CoCl}_3 \cdot 6\text{NH}_3$ b] $\text{CoCl}_3 \cdot 5\text{NH}_3$, c] $\text{CoCl}_3 \cdot 4\text{NH}_3$, d] $\text{CoCl}_3 \cdot 3\text{NH}_3$

C. Limitations

1.4 Description of terms –a] ligand, b] Co-ordination number, c] co-ordination sphere,

d] effective atomic number, e] Geometrical isomerism and

Optical isomerism in co-ordination compounds for $\text{CN} = 4$ and $\text{CN} = 6$.

1.5 IUPAC nomenclature of co-ordination compounds,

1.6 Valence bond theory of transition metal complexes.

A. Introduction

B. Postulates of VBT/ basic concepts of VBT

C. Role of transition metal in the formation of complex

D. Stepwise process of formation of complex: Salient features

E. Applications: High spin and low spin complexes w.r.t. $\text{CN} = 4$ and $\text{CN} = 6$.

F. Limitations of Valence bond theory.

2. Chelation

(05)

- 2.1 A brief introduction w.r.t. ligand, chelating agent, Chelation and metal chelate.
- 2.2 Structural requirements of chelate formation.
- 2.3 Difference between metal chelate and metal complex.
- 2.4 Classification of chelating agents (with specific illustrations of bidentate chelating agent).
- 2.5 Applications of Chelation w.r.t. 1. Chelating agents: EDTA and DMG. 2. Industrial and Agriculture applications w.r.t. Catalysis, Water softening and fertilizers.

UNIT-II

3. Acids and Bases

(05)

- 3.1 Lewis Concept: A. Definition, B. classification, C. merits and D. demerits.
- 3.2 Hard and soft acids and bases (HSAB):
 - A. Classification of acids and bases as hard and soft,
 - B. Pearson's HSAB concept,
 - C. Acid-Base strength and hardness-softness,
 - D. Applications and limitations of HSAB principle.

4. Study of d-block elements

(10)

- 4.1 Introduction,
- 4.2 Position of d-block elements in periodic table,
- 4.3 Names & electronic configuration of 1st, 2nd & 3rd three transition series.
- 4.4 General Characteristics of 3 d-block elements w.r.t. –
 - a) Oxidation state b) colour c) Magnetic behavior (spin only formula)
 - d) Catalytic properties and e) tendency to form complexes.
- 4.5 Comparison of 1st transition series with 2nd & 3rd transition series w.r.t. –

- a) Electronic configuration b) reactivity c) stability of oxidation state
- d) Magnetic behavior and e) stability of complexes (Brief account only)

Reference Books:

1. Concise Inorganic Chemistry by J.D. Lee ELBS 4th & 5th Edn.
2. Basic Inorganic Chemistry by F.A. Cotton, G. Wilkinson and P.L. Gaus Wiley.
3. Concepts and Models of Inorganic Chemistry by B. Douglas. D.Mc. Daniel and J. Alexander, John Wiley.
4. Advanced Inorganic Chemistry by Satyaprakash, Tuli, Basu (S. Chand and Co.)
5. Inorganic Chemistry by Puri and Sharma (S. Chand & Co.)
6. Inorganic Chemistry by Agrawal.
7. Inorganic Chemistry by D.E. Shriver, P.W. Atkins and C.H. Longford, Oxford.
8. Selected topics in Inorganic Chemistry: Madan, Malik Tuli, S. Chand & Company.
9. Vogel's Text Book of Quantitative Inorganic Analysis–Bassett, Denny, Jeffery Mendham.
10. Basic concepts of Analytical Chemistry by S.M. Khopkar

Course Outcomes:

- 1) To know the Distinction between double salt and complex salt.
- 2) To understand the Valence bond theory of transition metal complexes.
- 3) To understand the Pearson's HSAB concept.
- 4) To study the Structural requirements of chelate formation.
- 5) To study the Position of d-block elements in periodic table.

B.Sc.-II (Semester-IV)

Total Credits: 2

(30 Contact hrs.)

Paper-VII- Physical Chemistry

1. Electrochemistry: (12)

1.1. Introduction, conduction of electricity, Types of conductors: electronic and electrolytic.

1.2. Explanation of terms: Ohm's law, Resistance, Conductance, Specific resistance, Specific conductance, Equivalent conductance, Molecular conductance.

1.3. Variation of specific, equivalent and molecular conductance with concentration, Equivalent conductance at infinite dilution.

(Mention Onsager equation, $\lambda_v = \lambda_\infty - b\sqrt{c}$ from graph)

1.4. Migration of ions, Hittorf's rule, Transport number, Determination of transport number by moving boundary method, factors influencing transport number: Nature of electrolyte, concentration, temperature, complex formation and Degree of hydration.

1.5. Kohlrausch law, Applications of Kohlrausch law:

- i. Determination of relationship between ionic conductance, ionic mobility and transport number.
- ii. Determination of ionic conductance
- iii. Determination of absolute ionic mobility
- iv. Determination of equivalent conductance at infinite dilution of weak electrolytes.
- v. Determination of degree of dissociation of weak electrolyte.
- vi. Determination of ionic product of water.
- vii. Determination of solubility of sparingly soluble salts.

1.6. Numerical problems.

2. Thermodynamics (05)

2.1. Introduction, concept of entropy, Entropy as a state function: Definition, mathematical expression, unit, physical significance of entropy.

2.2. Entropy changes for reversible and irreversible processes in isolated systems.

2.3. Entropy changes for an ideal gas as a function of V and T and as a function of P and T.

2.4. Entropy change in mixing of gases.

2.5. Entropy change in physical transformation: Fusion of a solid, Vaporization of a liquid and Transition from one crystalline form to another.

2.6. Third law of thermodynamics, Absolute entropy and Evaluation of absolute entropy, use of absolute entropies, Determination of entropy changes in chemical reactions.

2.7. Numerical problems.

3. The Solid State (06)

3.1. Introduction, space lattice, lattice sites, lattice planes, Unit Cell.

3.2. Laws of crystallography:

- i. Law of constancy of interfacial angles.
- ii. Law of rational indices
- iii. Law of crystal symmetry.

3.3. Weiss indices and Miller indices.

3.4. Cubic lattice and types of cubic lattice, planes or faces of a simple cubic system, spacings of lattice planes.

3.5. Diffraction of X-rays, Derivation of Bragg's equation.

3.6. Determination of crystal structure of NaCl and KCl on the basis of Bragg's equation.

3.7. Numerical problems.

4. Distribution Law (07)

4.1. Introduction

4.2. Nernst distribution law, its limitations and modification with respect to association and dissociation of solute in one of the solvents

4.3. Applications of distribution law in

- i. Process of extraction (derivation expected)
- ii. Determination of solubility
- iii. Distribution indicators
- iv. Determination of molecular weight

4.4. Numerical problems expected

Reference Books:

1. Elements of Physical Chemistry: S. Glasstone and D. Lewis (D. VanNostrand Co. Inc)
2. Physical Chemistry: W.J. Moore (Orient Longman)
3. Principles of Physical Chemistry: Maron & Prutton (Oxford IVth Edn.)
4. Chemistry Principle & Applications: P.W. Atkins, M.J. Clugsto, M.J. Fiazzer, R.A.Y. Jone (Longman)
5. Physical Chemistry: G.M. Barrow (Tata Mc-Graw Hill)
6. Essentials of Physical Chemistry: B.S. Bahl & G.D. Tuli (S. Chand)
7. Physical Chemistry: Daniels – Alberty.
8. Principles of Physical Chemistry: Puri – Sharma (S. Nagin)
9. Basic Chemical Thermodynamics: V.V. Rao.
10. Physical Chemistry: S. Glasstone.
11. The Elements of Physical Chemistry by P. W. Atkins, Oxford.
12. Principles of Physical Chemistry: B. R. Puri, L. R. Sharma and M. S. Pathania
13. Electrochemistry: S. Glasstone

Course Outcome (COs) of Physical Chemistry (Theory and Practical):

Upon successful completion students should be able to:

1. State and apply Kohlrausch law for various weak electrolytes for different applications and in the calculation of ionic conductance, degree of dissociation, equivalent conductance at infinite dilution.
2. The third law of thermodynamics, concept of entropy, entropy change in different processes and perform calculations.
3. To apply the concepts of solid state to determination crystal structure based on x-ray diffraction pattern.

4. To learn depth knowledge about distribution coefficient in extraction process and calculation of distribution coefficient with association and dissociation of solute in solvent.
5. To apply knowledge of determination of order of reaction in measurement of rate constant, relative strength and effect of concentration on rate of reaction.
6. To measure conductance using conductometer to verify Ostwald dilution law, Onsager equation and to find end points of acid-base titrations.
7. To apply the concept of refraction of light to the measurement of refraction of $-\text{CH}_2$ group with the help of Abbe's Refractometer.
8. To apply the knowledge of polarization to measure the specific rotation of optically active solution

Semester-IV

Paper- VIII- Analytical & Industrial Inorganic Chemistry

Total Credits: 2

(30 Contact hrs.)

1. Volumetric Analysis: (10)

1.1 Introduction, Terminology:- Titrant; Titrand, Standard solution; Titration Indicator; Equivalence point; End point, Primary standard substance, Secondary standard substance, Strength of solution.

1.2 Volumetric analysis & their types.

1.3 Acid Base Titration:

i) Introduction

ii) Colour change Interval

iii) Theory of Acid-Base indicator:

a) Ostwald's ionization theory

b) Quinoid theory

iv) Neutralization curve and choice of indicator for following titrations:

a) Strong acid and Strong Base

b) Strong Acid and Weak Base

c) Weak Acid and Strong Base

1.4 Complexometric titration:

a) General account,

b) Types of EDTA Titrations,

c) Metallochromic Indicator w.r.t. Eriochrome Black-T

2. Gravimetric Analysis: (10)

2.1. Introduction, Terminology :-Gravimetric analysis, Saturation, Super-saturation, Sol, Gel, Coagulation or Flocculation, Coagulation or Flocculation value, Peptisation, Precipitation, Precipitate, Precipitant, Solubility, Aging or digestion, Ignition

2.2. General steps involved in gravimetry

2.3. Precipitation – A) Physical nature of Precipitate: Gelatinous, Curdy and Crystalline.

B) Conditions of Precipitation

2.4. Process of precipitation – A) Nucleation B) Crystal growth C) Digestion

2.5. Co-precipitation and Post precipitation and their difference.

2.6. Role of Organic precipitants in gravimetric analysis,

2.7. Study of organic precipitants viz. A) DMG B) Aluminon C) 8- Hydroxy quinoline.

2.8. Advantages and disadvantages of organic precipitants.

3. Industrial Heavy Chemicals (03)

3.1 Introduction

3.2 Physicochemical Principles & manufacture of following heavy chemicals:

i) Ammonia by Haber process

ii) Sulphuric acid by contact process.

4. Metallurgy (03)

4.1 Introduction: Terminology:- Metallurgy, Mineral, Ore, Gangue, Flux, Slag

4.2 Occurrence of metals: Types of ores

4.3 Steps involved in metallurgical processes:

A) Concentration of ores-

a) Physical methods: i) Gravity separation method, ii) Magnetic separation method,

iii) Froth flotation process.

b) Chemical Methods: i) Calcination ii) Roasting

B) Reduction- i) Chemical methods of reduction

ii) Electrolytic reduction/refining method for e.g. Aluminium and Copper

5. Iron and Steel (04)

5.1 Occurrence of Iron

5.2 Extraction of Iron: Blast furnace

5.3 Types of Iron

5.4 Steel-

A) Definition

B) Composition and properties of different types of steels

C) Manufacture of Steel: i) Bessemer process ii) L. D. process

D) Heat treatment on Steel

Course Outcome (COs) of Inorganic Chemistry (Theory and Practical):

Upon successful completion students should be able to:

1. Understand fundamentals of Volumetric analysis
2. Students will be able to carry out Volumetric analysis of simple samples.
3. Understand fundamentals of Gravimetric analysis
4. Students will be able to carry out Gravimetric analysis of simple samples.
5. Student will have basic idea about Industrial Heavy Chemicals, Metallurgy and Iron and Steel

List of Reference Books :

1. Concise Inorganic Chemistry by J.D. Lee ELBS 4th & 5th Edn.
2. Basic Inorganic Chemistry by F.A. Cotton, G.Wilkinson and P.L. Gaus Wiley.
3. Advanced Inorganic Chemistry by Satyaprakash, Tuli, Basu (S. Chand and Co.)
4. Inorganic Chemistry by Puri and Sharma (S. Chand & Co.)
5. Inorganic Chemistry by G.S. Manku Tata Mc. Graw Hill.
6. Inorganic Chemistry by Agrawal.
7. Industrial Chemistry by B.K. Sharma.
8. Inorganic Chemistry by D.E. Shriver, P.W. Atkins and C.H. Longford, Oxford.
9. Text book of Quantitative Inorganic Analysis by A.I. Vogel.
10. Vogel's Text Book of Quantative Inorganic Analysis – Bassett, Denny, Jeffery Mendham.
11. Basic concepts of Analytical Chemistry by S.M. Khopkar.

Laboratory Course Physical Chemistry

A) Instrumental Experiments

1. Viscosity: To determine the percentage composition of a given liquid mixture by viscosity method. (Density data be given)
2. Refractometry: To determine the specific and molar refractions of benzene, toluene and xylene by Abbe's refractometer and hence determine the refraction of $-\text{CH}_2$ group. (Densities should be determined by the students.)
3. Polarimetry: To determine the specific rotation and find unknown concentration of sugar solution.
4. Conductometry : (any two)
 - i. To determine degree of dissociation and dissociation constant of acetic acid at various dilutions and to verify Ostwald's dilution law conductometrically.
 - ii. To determine the normality of the given strong acid by titrating it against strong alkali conductometrically.
 - iii. To determine the equivalent conductance at infinite dilution of strong electrolyte at five different dilutions conductometrically. (e.g. any one from KCl, NaCl, KNO_3 and HCl) and verify Onsager equation.

B) Non-Instrumental Experiments

1. Chemical Kinetics (ANY THREE)
 - i. To study the hydrolysis of methyl acetate in presence of HCl and H_2SO_4 and to determine the relative strong of acids.
 - ii. To study the effect of acid strength (0.5M and 0.25M HCl) on hydrolysis of an ester.
 - iii. To study the reaction between $\text{K}_2\text{S}_2\text{O}_8$ and KI (unequal concentrations)
 - iv. To study the reaction between KBrO_3 and KI (equal concentrations)

Reference Books:

1. Experimental Physical Chemistry by A. Findlay, Longman.
2. Experiments in Physical Chemistry by R.C. Das & B. Behra, Tata McGraw Hill.
3. Advanced Experimental Chemistry Vol. I Physical by J.N. Gurtu and R. Kapoor, S. Chand & Co.
4. Experiments in Physical Chemistry by J.C. Ghosh, Bharati Bhavan.
5. Practical book of Physical Chemistry – by Nadkarni Kothari Lawande, Bombay Popular Prakashan.
6. Systematic Experimental Physical Chemistry – by S.W. Rajbhoj, Chondhekar, Anjali Publication.

Practical Course Inorganic Chemistry

1. Gravimetric Analysis:

- i. Gravimetric estimation of Fe as Fe_2O_3 from a given solution containing ferrous ammonium sulphate and free sulphuric acid.
- ii. Gravimetric estimation of Ba as BaSO_4 from a given solution containing barium chloride and free hydrochloric acid.

2. Titrimetric Analysis: Calibration of burette, pipette and volumetric flask.

- i. Analysis of commercial vinegar – To prepare standard solution of oxalic acid to standardize given NaOH solution and determine the percentage of acetic acid in a given commercial sample of vinegar.
- ii. To prepare standard solution of calcium chloride from calcium carbonate and determine the total hardness of given water sample.

3. Inorganic Preparations (Any Two):

- i. Ferrous Ammonium Sulphate (Mohr's salt)
- ii. Preparation of tetramminecopper(II) sulphate
- iii. Preparation of Iron(III) acetylacetonate
- iv. Preparation of Manganese(III) acetylacetonate

4. Semi-micro Qualitative Analysis:

Cations : Cu^{++} , Al^{+++} , Fe^{+++} , Mn^{++} , Zn^{++} , Ni^{++} , Ba^{++} , Ca^{++} , Mg^{++} , NH_4^+ , K^+

Anions : Cl^- , Br^- , I^- , SO_4^{--} , NO_3^- , CO_3^{--}

Note : At least SIX mixtures to be completed.

Reference Books:

1. Quantitative Inorganic Chemistry – A.I. Vogel.
2. Practical Chemistry – Physical – Inorganic – Organic and Vice-voce by Balwant Rai Satija. Allied Publishers Pvt. Ltd.
3. Inorganic Qualitative Analysis – A.I. Vogel.
4. Basic Concepts in Analytical Chemistry – S.M. Khopkar.
5. Vogel's Text Book of Quantitative Inorganic Analysis – Bassett, Denny, Jeffery Mendham.

N. B. – 1. A calculation of % yield is expected.

2. After preparation, physico-chemical characterization is expected with 5(Five) marks weightage in terms of:

- a) Name of central metal ion
- b) Oxidation number of metal ion
- c) Nature of ligand
- d) Nature of bonding
- e) Type of hybridization
- f) Inner orbital or outer orbital complex
- g) Geometry of the complex with structure
- h) Magnetic property of the compound
- i) Color of the compound
- j) Nature: Crystalline /Amorphous

Laboratory Course Organic Chemistry

A) Organic Qualitative Analysis :

Identification of at least **Eight organic compounds** with reactions including two from acids, two from phenols, two from bases and two from neutrals.

- **Acids** : succinic acid, phthalic acid, salicylic acid, aspirin
- **Phenols** : α - naphthol, o-nitrophenol, p-nitrophenol
- **Bases** : o-, m-, and p-nitroanilines N, N-dimethylaniline
- **Neutral**: urea, acetanilide, carbontetrachloride, bromobenzene, methylacetate, nitrobenzene, naphthalene, anthracene, acetophenone, ethylmethyl ketone.

Note : A systematic study of an organic compound involves the following operations which should be taught in details with reactions in the determination of elements and functional group.

- 1) Preliminary tests and physical examination
- 2) Determination of type
- 3) Determination of physical constant
- 4) Detection of elements
- 5) Determination of functional group
- 6) A search into the literature
- 7) Special test if any
- 8) Summary
- 9) Result.

B) Organic Quantitative Analysis :

i. Estimations (Any Two)

1. Estimation of ester
2. Estimation of acetone
3. Estimation of ibuprofen from ibuprofen tablet

ii. Organic Preparations (Any Three)

1. Preparation of phthalimide from phthalic anhydride.
2. Preparation of p-bromoacetanilide from acetanilide.
3. Preparation of m-dinitrobenzene from nitrobenzene using NaNO_2 and conc. H_2SO_4 .
4. Preparation of acetanilide from aniline using acetic acid and anhydrous zinc chloride.
5. Preparation of p-nitroethylbenzoate from p-nitrobenzoic acid
6. Preparation of aryloxyacetic acid from given phenol.

Reference Books :

1. Practical Organic Chemistry by A.I. Vogel.
2. Hand book of Organic qualitative analysis by H.T. Clarke.
3. A laboratory Hand Book of Organic qualitative analysis and separation by V.S. Kulkarni. Dastane Ramchandra & Co.
4. Practical Organic Chemistry by F.G. Mann and B.C. Saunders. Low – priced Text Book. ELBS. Longman.
5. Experiments in General Chemistry by C.N.R. Rao. Affiliated East-West Press Pvt. Ltd. Delhi.
6. Advanced Practical Organic Chemistry by N.K. Vishnoi. Vikas Publishing House Private Limited.
7. Comprehensive Practical Organic Chemistry Qualitative Analysis by V.K. Ahluwalia, Sunita Dhingra. University Press. Distributor-Orient Longman Ltd.
8. Practical Chemistry – Physical – Inorganic – Organic and Viva – voce by Balwant Rai Satija. Allied Publishers Private Limited.
9. Experimental organic chemistry by J. R. Norris, published by Sarup and sons, Delhi
10. Advanced practical chemistry by J. Singh, L. D. S. Yadav, R. K. P. singh, I. R. Siddiqui et.al, Pragati prakashan.

Course Outcomes

1. Students should learn to identify physical constant, determine elements, functional group present in given organic compounds
2. Students should be able to carry out estimations of ester, acetone and ibuprofen from given samples.
3. Students should learn to carry out preparations of phthalimide, p-bromoacetanilide, m-dinitrobenzene, acetanilide and p-nitroethylbenzoate.
4. Students should be able to calculate theoretical, practical and practical percentage yields of preparations.

Outline of Examination:

- **Internal Examination (Theory):** Internal examination will consist of **10 marks** per semester per paper. It may be held as **any two components** per semester from (a) to (e).
 - a) Presentation:
 - b) MCQ Test:
 - c) Field studies / Study visits:
 - d) Home Assignments:
 - e) Written Class Test:
- **Internal Evaluation (IE) (Practical):** Internal examination will consist of 20 marks and may consists of:
 - a) Marks for practical examination: 15 marks
 - b) Oral examination : 03 marks
 - c) Marks for Journal : 02 marks
- **End Semester Examination (Theory)** The detailed question paper pattern is given as **Annexure-I.**
- **End-semester Practical Examination:** The detailed question paper pattern is given as **Annexure-I.**
- 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-I.

Walchand College of Arts & Science (Autonomous), Solapur

Scheme of Marking for End Semester Theory Examination

Time: 2 Hrs

Maximum Marks: 40

Instructions: a) All questions are compulsory

b) Figures to the right indicates full marks

c) Draw neat & well labeled diagram wherever necessary

Q.1: Fill in the blanks by choosing correct alternatives (eight): 08

1)

2)

3)

4)

5)

6)

7)

8)

Q.2: Answer the following questions briefly (any four): 08

1)

2)

3)

4)

5)

6)

Q.3: Write notes on any two of the following

08

1)

2)

3)

Q.4: Attempt any two the following

08

1)

2)

3)

Q.5: Answer any one of the following

08

1)

2)

Practical Course:

Practical Examination will be held at the end of the year- 100 marks = (ESE 80 + IE 20)

A) Distribution of marks for practicals (ESE 80 Marks):

- a) Physical: 20 marks (15 marks physical experiment + 5 marks oral + Journal- 3 marks)
- b) Inorganic: 30 marks (gravimetric analysis-15 marks + Preparation- 10 marks / Volumetric estimation – 15 marks + Preparation- 10 marks/ semi-micro analysis 15 marks + Preparation- 10 marks +5 marks oral + Journal- 4 marks)
- c) Organic: 20 marks (organic qualitative Analysis- 15 marks/ estimation- 15 marks/ preparation- 15 marks oral- 5 marks + Journal- 3 marks)

Duration of Examination – Two days, 6 hrs. per day

B) Distribution of marks for practicals (IE 20 Marks):

One Experiment from Physical/Inorganic/Organic Chemistry section 15 Marks +3 Oral +3 Marks for Journal.

Duration of Examination – One day, 3 hrs.

**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)



Name of Faculty: Science & Technology

New Choice Based Credit System

B.Sc. Part-II

Subject: Zoology

With Effect from: 2022 -23

Walchand College of Arts and Science (Autonomous), Solapur
Choice Based Credit System (CBCS)
B.Sc.-II Zoology
(w.e.f. June 2022)

Background of Curriculum:

In accordance with the UGCs reference to standardize curricula at the national level and bring a match across all the Indian Universities, an attempt has been made to follow the pattern given in the UGCs Undergraduate Template.

Zoology deals with the study of animal kingdom specially the structural diversity, biology, embryology, evolution, habits and distribution of animals, both living and extinct. As it covers a fascinating range of topics, the modern zoologists need to have insight into many disciplines. The learning outcomes-based curriculum framework for a B.Sc. degree in Zoology is designed to cater to the needs of students in view of the evolving nature of animal science as a subject. The framework is expected to assist in the maintenance of the standard of Zoology degrees/programmes across the country by reviewing and revising a broad framework of agreed expected graduate attributes, qualification descriptors, programme learning outcomes and course-level learning outcomes. The framework, however, does not seek to bring about uniformity in syllabi for a programme of study in Zoology, or in teaching learning process and learning assessment procedures. Instead, the framework is intended to allow for flexibility and innovation in programme design and syllabi development, teaching learning process, assessment of student learning levels. A comprehensive knowledge of structure-function relationship at the level of gene, genome, cell, tissue, organ, and systems, through development would further add to the knowledge base and the learning outcome in terms of editing of genes and genomes for industrial application and research purposes.

Learning Outcomes based approach to Curriculum Planning:

The courses should be delivered in terms of concepts, mechanisms, biological designs & functions and evolutionary significance cutting across organisms at B.Sc. level. These courses should be studied by students of all branches of biology. Both chalk and board, and PowerPoint presentations can be used for teaching the course. The students should do the dissertation/ project work under practical of different courses, wherever possible.

The students are expected to learn the courses with excitements of biology along with the universal molecular mechanisms of biological designs and their functions. They should be able to appreciate shifting their orientation of learning from a descriptive explanation of biology to a unique style of learning through graphic designs and quantitative parameters to realize how contributions from research and innovation have made the subjects modern, interdisciplinary and applied and laid the foundations of Zoology, Animal Sciences, Life Sciences, Molecular Biology and Biotechnology. These courses and their practical exercises will help the students to apply their knowledge in future course of their career development in higher education and research. In addition, they may get interested to look for engagements in industry and commercial activities employing Life Sciences, Molecular Biology and Biotechnology. They may also be interested in entrepreneurship and start some small business based on their interest and experience.

Graduate Attributes in Zoology:

- **Disciplinary knowledge and skills:** Capable of demonstrating (i) comprehensive knowledge and understanding of major concepts, theoretical principles and experimental findings in Zoology and its different subfields (ii) ability to use modern instrumentation for advanced genomic and proteomic technology.
- **Skilled communicator:** Ability to impart complex technical knowledge relating to Zoology in a clear and concise manner in writing and oral skills.
- **Critical thinker and problem solver:** Ability to have critical thinking and efficient problem solving skills in the basic areas of Zoology
- **Sense of inquiry:** Capability for asking relevant/appropriate questions relating to issues and problems in the field of Zoology, and planning, executing and reporting the results of an experiment or investigation.
- **Team player/worker:** Capable of working effectively in diverse teams in both classroom, laboratory and in industry and field-based situations.
- **Skilled project manager:** Capable of identifying/mobilizing appropriate resources required for a project, and manage a project to completion, while observing responsible and ethical scientific conduct; and safety and chemical hygiene regulations and practices.
- **Digitally literate:** Capable of using computers for Bioinformatics and computation and appropriate software for analysis of genomics and proteomics data, and employing modern bioinformatics search tools to locate, retrieve, and evaluate location and biological annotation genes of different species.
- **Ethical awareness/reasoning:** Capable of conducting their work with honesty and precision thus avoiding unethical behavior such as fabrication, falsification or misrepresentation of data or committing plagiarism, and appreciating environmental and sustainability issues. Research ethics committee expects them to declare any type of conflict of interest that may affect the research. Any plan to withhold information from researchers should be properly explained with justification in the application for ethical approval.
- **Lifelong learners:** Capable of self-paced and self-directed learning aimed at personal development and for improving knowledge/skill development and reskilling

Choice Based Credit System: With the view to ensure worldwide recognition, acceptability, horizontal as well as vertical mobility for students completing undergraduate degree, Solapur University has implemented Choice Based Credit System (CBCS) at Undergraduate level. The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. 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 Choice Based Credit System:

1. *Core Course*: A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

2. *Elective Course*: Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

Discipline Specific Elective (DSE) Course: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective.

3. *Ability Enhancement Courses (AEC)*: The Ability Enhancement (AE) Courses may be of two kinds: Ability Enhancement Compulsory Courses (AECC) and Skill Enhancement Courses (SEC). "AECC" courses are the courses based upon the content that leads to Knowledge enhancement; (i) Environmental Science and (ii) English/MIL Communication. These are mandatory for all disciplines. SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

- **Credit**: Credit is a numerical value that indicates students work load (Lectures, Lab work, Seminar, Tutorials, Field work etc.) to complete a course unit. In most of the universities 15 contact hours constitute one credit. 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. The candidate has to appear for Internal Evaluation of 20 marks and University Evaluation for 80 marks.

Walchand College of Arts and Science (Autonomous), Solapur
Choice Based Credit System (CBCS): (w.e.f.2022-23)

Subject/ Core Course	Name and Type of the Paper		No. of papers/ Practical	Hrs/week			Total Marks Per Paper	ESE	IE	Credits	
	Type	Name		L	T	P					
Class :	B.Sc.- II : semester-III										
Core (*Students can opt any Three subjects among the Four Subjects offered at B.Sc.I. Out of Three Subjects offered One Subject will be the Core Subject OR		C-5	Paper-V	3.0	--	--	50	40	10	4.0	
			Paper-VI	3.0	--	--	50	40	10		
		C-6	Paper-V	3.0	--	--	50	40	10	4.0	
			Paper-VI	3.0	--	--	50	40	10		
		C-7 (Zoology)	Paper-V: Cell Biology	3.0	--	--	50	40	10	4.0	
			Paper-VI: Principles of Ecology	3.0	--	--	50	40	10		
		SEC-1									
		Grand Total				18	--	--	300	240	60
Class :	B.Sc.- II Semester – IV										
Core (*Students can opt any Three subjects among the Four Subjects offered at B.Sc.I. Out of Three Subjects offered One Subject will be the Core Subject OR Students can opt any Two subjects among the Four Subjects offered at B.Sc.I. Out of Two Subjects One Subject will be the Core Subject and any One Subject among the other will be Elective		C-8	Paper-VII	3.0	--	--	50	40	10	4.0	
			Paper-VIII	3.0	--	--	50	40	10		
		C-9	Paper-VII	3.0	--	--	50	40	10	4.0	
			Paper-VIII	3.0	--	--	50	40	10		
		C-10 (Zoology)	Paper-VII Fundamentals of Biochemistry	3.0	--	--	50	40	10	4.0	
			Paper-VIII Physiology- Control & Coordination	3.0	--	--	50	40	10		

Subject									
	SEC-2								
AECC	Environmental Studies		3.0	--	--	50	40	10	NC
Total (Theory)			21	--	--	350	280	70	12
Practical	C-5 & C-8	Pr. III&IV	--	--	8	100	80	20	4.0
	C-6 & C-9	Pr. III&IV	--	--	8	100	80	20	4.0
	C-7 & C-10 (Zoology)	Pr. I: (Cell Biology & Principles of Ecology) & Pr. II: (Fundamentals of Biochemistry & Physiology-Control & Coordination)	--	--	8	100	80	20	4.0
Total (Practical)					24	300	240	60	12
Grand Total			39		24	950	760	190	36

*Core Subjects

Chemistry/Physics/Electronics/Mathematics/Botany/Zoology/Microbiology/Geology/

Summary of the Structure of B.Sc. Programme as per CBCS pattern

Class	Semester	Marks-Theory	Credits-Theory	Marks-Practical	Credits-Practicals	Total – credits
B.Sc.-II	III	300	12	--	--	12
	IV	350	12	300	12	24
Total		650	24	300	12	36

B.Sc.-II Zoology Programme:

Total Marks : Theory + Practical's = 650 + 300 = 950

Credits : Theory + Practical's = 12 + 24 = 36

Numbers of Papers Theory: Ability Enhancement Course (AECC) 00

Theory: Discipline Specific Elective Paper (DSE) 00

Theory: CC 06

Skill Enhancement Courses 00

Abbreviations:

L	Lecture	ESE	End Semester Examination
T	Tutorials	CC	Core Course
P	Practicals	SEC	Skill Enhancement Course
IE	Internal Evaluation		

Walchand College of Arts and Science (Autonomous), Solapur
Choice Based Credit System (CBCS)
(W.e.f. 2022-23)

- Title of the Course: B.Sc. Part-II
- Subject: Zoology

• **Introduction:** 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. Zoology course are:**

To provide an intensive and in depth learning to the students in field of Zoology. Beyond simulating, 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.

- **Course outcome and Advantages:** Zoology has tremendous job potential. The successful students will be able to establish research organizations with the help of agriculture, environment protection and also their own industry for transgenic animals, clinical pathology, genetic counseling, human karyotyping etc. Scientific Research Organizations. Universities in India & abroad.

- Medium of Instruction: English
- Syllabus Structure: CBCS
- B.Sc. Part-II Zoology shall consist of two semesters: Semester III and Semester IV

In semester III: there will be two CC papers having paper V and paper VI of 100 marks. There will a **Compulsory paper on “Ability Enhancement Compulsory Course (AECC)” on Environmental Studies**

In Semester IV: there will be two CC papers having paper VII and paper VIII of 100 marks.

The scheme of evaluation of performance of candidates shall be based on Internal Evaluation (**IE**) as well as **End Semester Examination (ESE)** as given below.

For B.Sc.Part-II Zoology Sem III & IV the “Internal Evaluation” will be based on:

- a) Internal tests
- b) Home assignment
- c) Tutorials
- d) Open Book Examination
- e) Seminars
- f) Group discussion,
- g) Brain stormingsessions

- **Practical course examination** is of 100 marks that shall be conducted at the end of semester II. The practical examination of 100 marks shall also consist of:

a) **End Semester Examination:** 80 marks and

b) **Internal Evaluation:** 20 marks

Semester – III: Theory: (100 marks): Comprising CC

a) End Semester Examination (80 marks): No. of theory papers: 2
(paper V and paper VI of 40 marks each)

b) Internal Evaluation ((20 marks): No. of theory papers: 2
(paper V and paper VI of 10 marks each)

c) **Compulsory paper on “Ability Enhancement Compulsory Course (AECC)” on**
Environmental Studies: 40 (ESE)+ 10 (IE)

Semester – IV: Theory: (100 marks): Comprising DSC-

a) End Semester Examination (80 marks): No. of theory papers: 2
(paper VII and paper VIII of 40 marks each)

b) Internal Evaluation ((20 marks) : No. of theory papers: 2
(paper VII and paper VIII of 10 marks each)

Practical Examination: (100 marks)

End Semester Examination (80 marks): No. of practicals: 02

Practical-I: Based on papers V & VI : (40 ESE + 10 IE)

Practical-II: Based on papers VII & VIII : (40 ESE + 10 IE)

Internal Continuous Assessment: (20 marks):
Practical-I (10) + Practical-II (10)

(a) Internal practical test, viva/group discussion/model or chart/attitude/attendance/overall behavior

(b) End Semester Examination of 80 marks (Practical I & II for **two separate days**) will be conducted at the end of semester IV

Passing Standard:

The student has to secure a minimum of 4.0 grade points (Grade C) in each paper. A student who secure less than 4.0 grade point (39% or less marks, Grade FC/FR) will be declared fail in that paper and shall be required to reappear for respective paper. A student who failed in End Semester Examination (theory) and passed in internal evaluation of a same paper shall be given FC Grade.

Such student will have to reappear for End Semester Examination only. A student who fails in internal evaluation and passed in End Semester Examination (theory) shall be given FR Grade. Such student will have to reappear for both End Semester Examination as well as internal evaluation.

• ATKT:

Candidate passed in all papers, except 5 (five) papers combined together of semester I and II of B.Sc. Part-I Zoology examination shall be permitted to enter upon the course of Semester III of B.Sc. Part-II Zoology.

Walchand College of Arts and Science (Autonomous), Solapur

B.Sc .II Semester-III & IV, ZOOLOGY

Choice Based Credit System (CBCS) Structure (2022-23)

Semester- III (Theory)

Paper	Title	Marks
V	Cell Biology	50 (40- ESE and 10-IE)
VI	Principles of Ecology	50 (40- ESE and 10- IE)

Semester- IV (Theory)

Paper	Title	Marks
VII	Fundamentals of Biochemistry	50 (40- ESE and 10- IE)
VIII	Physiology-Control & Coordination	50 (40- ESE and 10- IE)

PRACTICALS

PRACTICAL	Title	Marks
I	Cell Biology & Principles of Ecology	50 (40- ESE and 10- IE)
II	Fundamentals of Biochemistry & Physiology Control & Coordination	50 (40- ESE and 10- IE)
Total Marks		100 (80- ESE + 20- IE)

Semester-III

Walchand College of Arts and Science (Autonomous), Solapur
Choice Based Credit System (CBCS)

B.Sc.-II Zoology

Paper-V

CELL BIOLOGY: THEORY (Credits-02 & contact hours-30)

Unit 1:	Overview of Cells Prokaryotic and Eukaryotic cells, types of viruses	02
Unit 2:	Plasma Membrane Singer & Nicholson's model of plasma membrane. Transport across membranes: active and passive transport with examples	03
Unit 3:	Endomembrane System Structure and Functions of Endoplasmic Reticulum, Golgi apparatus, Lysosomes	06
Unit 4:	Mitochondria Mitochondria: Ultrastructure, Semi-autonomous nature, Endosymbiotic hypothesis Mitochondrial Respiratory Chain, functions.	04
Unit 5:	Ribosomes: Ultrastructure and function of prokaryotic and eukaryotic ribosomes	02
Unit 6:	Cytoskeleton Structure and Functions: Microtubules, Microfilaments	04
Unit 7:	Nucleus and Cell Division Structure and functions of Nucleus, Nuclear envelope, Nuclear pore complex, Nucleolus; Chromatin: Euchromatin, Heterochromatin and nucleosome; Cell cycle, Mitosis and Meiosis	07
Unit 8:	Cell Signaling Types of cell signaling, Brief idea of G-Protein Coupled Receptor (GPCR) and Role of secondary messengers (cAMP)	02

SUGGESTED READINGS

- 1) Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley and Sons. Inc.
- 2) De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
- 3) Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. V Edition. ASM Press and Sunderland, Washington, D.C.; Sinauer Associates, MA.
- 4) Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
- 5) Bruce Albert, Bray Dennis, Lewis Julian, Raff Martin, Roberts Keith and Watson James (2008).

Learning outcomes : Students will come to know about:

- Cellular architecture & their functions at organismic level
- This knowledge will help students in future to explore areas like: oncology, medical diagnostics and treatment
- Understand the functioning of nucleus and extra nuclear organelles and understand the intricate cellular mechanisms involved.
- Acquire the detailed knowledge of different pathways related to cell signaling and apoptosis thus enabling them to understand the anomalies in cancer.
- Develop an understanding how cells work in healthy and diseased states and to give a 'health forecast' by analyzing the genetic database and cell information.
- Get new avenues of joining research in areas such as genetic engineering of cells, cloning, vaccines development, human fertility programme, organ transplant, etc.

Paper-VI

PRINCIPLES OF ECOLOGY: THEORY (Credits-02 & contact hours-30)

Unit 1:	Introduction to Ecology	02
	History of ecology, Autecology and synecology	
Unit 2:	Population Ecology	05
	Brief idea about attributes of population: Density, natality, mortality, life tables, fecundity tables, survivorship curves.	
Unit 3:	Animal Associations- Brief idea and definitions	05
	<ul style="list-style-type: none">• Intraspecific associations: Parental care in fishes, groupism and social behavior (e.g.- honey bee, termites and ants)• Interspecific associations: commensalism, mutualism, predation and parasitism	
Unit 4:	Abiotic Factors	03
	Introduction & Effects on animals: Temperature, light, water, water hardness, humidity, soil, oxygen and carbon dioxide.	
Unit 5:	Community Ecology	04
	Ecological succession: Definition, primary, secondary succession and its significance	
Unit 6:	Ecosystem	05
	General characteristics & faunal adaptations in: <ul style="list-style-type: none">• Aquatic (freshwater ecosystem: lotic and lentic) &• Terrestrial (grassland and desert ecosystem).	
Unit 7:	Food chain and food web:	04
	Pond ecosystem: with reference to food chain and <u>food web</u> , ecological pyramid, energy flow and ecological succession,	
Unit 8	Applied Ecology	02
	Brief idea of- Biodiversity hot-spots and sacred groves in India with examples	

SUGGESTED READINGS:

- 1) Colinviaux, P. A. (1993). Ecology. II Edition. Wiley, John and Sons, Inc.
- 2) Krebs, C. J. (2001). Ecology. VI Edition. Benjamin Cummings.
- 3) Odum, E.P., (2008). Fundamentals of Ecology. Indian Edition. Brooks/Cole
- 4) Robert Leo Smith Ecology and field biology Harper and Row publisher
- 5) Ricklefs, R.E., (2000). Ecology. V Edition. Chiron Pres

Learning Outcomes (LO): Students will come to know about

- Ecological principles & applications that govern the planet Earth
- This knowledge will help students in future to explore areas like: biodiversity, conservation biology, forestry & natural resource management
- Know the evolutionary and functional basis of animal ecology.
- Understand what makes the scientific study of animal ecology a crucial and exciting endeavor.
- Engage in field-based research activities to understand well the theoretical aspects taught besides learning techniques for gathering data in the field.
- Analyze a biological problem, derive testable hypotheses and then design experiments and put the tests into practice.
- Solve the environmental problems involving interaction of humans and natural systems at local or global level.

Semester-IV

B.Sc.-II Zoology (CBCS): Semester-IV

PAPER-VII: FUNDAMENTALS OF BIOCHEMISTRY

THEORY (CREDITS 2; Contact Hours-30)

- Unit 1: Carbohydrates (04)**
Structure and biological Significance of: Monosaccharides, Disaccharides, Polysaccharides and Glycoconjugates
- Unit 2: Lipids (04)**
Structure and biological Significance of: Physiologically important of saturated and unsaturated fatty acids, Tri-acylglycerols, Phospholipids, Glycolipids, Steroids
- Unit 3: Amino Acids (03)**
Amino acids: Structure, Classification and General Properties of α -amino acids;
- Unit 4: Proteins: (02)**
Levels of organization in proteins (primary, secondary, tertiary & quaternary); Simple and conjugate proteins with examples
- Unit- 5: Immunoglobulins: (02)**
Basic Structure, Classes and biological significance
- Unit 6: Nucleic Acids (04)**
Structure: Purines and pyrimidines, Nucleosides, Nucleotides, Nucleic acids: Base pairing, Denaturation and Renaturation of DNA; Types of DNA and RNA.
- Unit 7: Vitamins (04)**
Water soluble and fat soluble vitamins (Source, functions and deficiency)
- Unit 8: Enzymes (07)**
Nomenclature and classification; Co-factors; Properties of enzymes; Mechanism of enzyme action; Factors affecting enzyme actions; Enzyme inhibition, Isozymes

Learning Outcome:

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

- Understand the structure and biological significance of carbohydrates, amino acids, proteins, lipids and nucleic acids.
- Understand the structure and function of immunoglobulins.
- Understand the concept of enzyme, its mechanism of action and regulation.
- Understand the process of DNA replication, transcription and translation.
- Learn the preparation of models of peptides and nucleotides.
- Learn biochemical tests for amino acids, carbohydrates, proteins and nucleic acids.
- Learn measurement of enzyme activity and its kinetics.

PAPER-VIII

ANIMAL PHYSIOLOGY: CONTROLLING AND COORDINATING SYSTEMS

Unit 1: Tissues **(04)**

Structure, location, classification and functions of: epithelial tissue, connective tissue, muscular tissue and nervous tissue:
Blood –Types of blood cells (RBC,WBC, Platelets, Plasma) , functions of blood

Unit 2: Histology of following mammalian organs: (04)

i) Tooth ii) Salivary gland iii) Stomach iv) Ileum
v) Liver vi) Pancreas vii) Kidney viii) Testis ix) Ovary

Unit 3: Nervous System (04)

Ultrastructure of neuron, resting membrane potential, origin of action potential and its propagation across the nerve fibers; Structure of Synapse and Synaptic transmission.

Unit 4: Muscle (03)

Types of muscles (smooth, Striated, cardiac) and Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction.

Unit 5: Reproductive Physiology (03)

Pituitary gland & its hormones, Sex hormones (male & female)

Unit 6: Reproductive Cycle (04)

Oestrous and Menstrual cycle, Hormonal control of pregnancy, parturition and lactation; Contraception methods: Physical, oral contraceptives pills, IUD, surgical methods

Unit 7: In-vitro Fertilization (02)

Assisted Reproductive Techniques (ART): Gamete Intrafallopian Transfer (GIFT), Zygote Intrafallopian Transfer (ZIFT), Frozen Embryo Transfer (FET)

Unit 8: Endocrine System (06)

Histology, hormonal secretions & their functions and disorders of following endocrine glands- Pituitary, Thyroid, Parathyroid, Pancreas, Adrenal.

*Note: With reference to mammals.

Learning outcomes:

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

- Acquire knowledge of the coordinated physiological functioning
- Realize that very physiological mechanisms are used in very diverse organisms.
- Understand how cells, tissues, and organisms function at different levels.
- Develop an understanding of the related disciplines, such as cell biology, neurophysiology, pharmacology, biochemistry etc
- 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.

REFERENCES:

CELL BIOLOGY:

- Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. JohnWiley and Sons. Inc.
- De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
- Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. V Edition. ASM Press and Sunderland, Washington, D.C.; Sinauer Associates, MA.
- Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
- Bruce Albert, Bray Dennis, Levis Julian, Raff Martin, Roberts Keith and Watson James (2008). Molecular Biology of the Cell, V Edition, Garland publishing Inc., New York and London.

ECOLOGY:

- Colinvax, P. A. (1993). Ecology. II Edition. Wiley, John and Sons, Inc.
- Krebs, C. J. (2001). Ecology. VI Edition. Benjamin Cummings.
- Odum, E.P., (2008). Fundamentals of Ecology. Indian Edition. Brooks/Cole
- Robert Leo Smith Ecology and field biology Harper and Row publisher
- Ricklefs, R.E., (2000). Ecology. V Edition. Chiron Pres

FUNDAMENTALS OF BIOCHEMISTRY:

- Cox, M.M and Nelson, D.L. (2008). Lehninger's Principles of Biochemistry, V Edition, W.H. Freeman and Co., New York.
- Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). Biochemistry, VI Edition, W.H. Freeman and Co., New York.
- Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). Harper's Illustrated Biochemistry, XXVIII Edition, International Edition, The McGraw-Hill Companies Inc.
- Hames, B.D. and Hooper, N.M. (2000). Instant Notes in Biochemistry, II Edition, BIOS Scientific Publishers Ltd., U.K.
- Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R. (2008). Molecular Biology of the Gene, VI Edition, Cold Spring Harbor Lab. Press, Pearson Pub.

PHYSIOLOGY: CONTROL & COORDINATION:

- Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hercourt AsiaPTE Ltd. /W.B. Saunders Company.
- Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition JohnWiley & sons
- Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott W. & Wilkins.

Practical

Walchand College of Arts and Science (Autonomous), Solapur
Choice Based Credit System (CBCS)
B.Sc.-II Zoology
(w.e.f. June 2022)

Practical-I (Paper-V & VI): Cell Biology and Principles of Ecology (04 Credits)

1. Preparation of temporary stained squash of onion root tip to study various stages of mitosis.
2. preparation of various stages of meiosis in onion flower buds
3. Demonstration/ Observation of Barr body using permanent slide(s) (*spotter*)
4. Study of principle, procedure and technique of following using permanent slide (*spotter*)
 - i) DNA by Feulgen technique.
 - ii) Mucopolysaccharides by Periodic Acid Schiffs Reaction (PAS)
5. Study and construction of ecological pyramid from given data:
 - i) **Members of Grass land ecosystem** –
Grasshopper, Rat Snake, Grass, Herbs, Shrubs, Weeds, Trees, Vulture, Squirrel, Earthworm, Centipede, Scorpion, Rabbit and Indian Bustard.
 - ii) **Members of Pond ecosystem** –
Sponge, Nepa, Leech, Planaria, Hydra, Lymnea, Planorbis, Heron, Kingfisher, Cyclops, Daphnia, Tortoise, Diatoms Vallisneria, Hydrilla, Chara and Spirogyra.
6. Study of social organization in honey bee (Queen, drone and workers; dance language, bee hive)
7. Calculation of Shannon-Weiner diversity index from the given data/ model.
8. Study of an aquatic ecosystem: Identification of Zooplankton with the help of permanent slides (*Spotters*),
9. Estimation of Dissolved Oxygen (Winkler's method) from given sample,
10. Estimation of Carbondioxide (CO₂) from given sample.
11. Estimation of Total Hardness content from given sample.
12. Study Visit: Report on a visit to National / Central / State institutes / Local water bodies/National Park/Biodiversity Park/Wild life sanctuary.

Practical-II
(Paper-VII & VIII)

**FUNDAMENTALS OF BIOCHEMISTRY and ANIMAL PHYSIOLOGY: CONTROLLING
AND COORDINATING SYSTEMS (CREDITS-04)**

1. Qualitative tests of functional groups in carbohydrates, proteins and lipids.
2. Estimation of protein/carbohydrate by colorimetric method.
3. Demonstration of paper chromatography of amino acids.
4. Study of action of amylase or papain enzyme under optimum conditions.
5. Study of effect of pH, temperature and inhibitors on the action of amylase.
6. Demonstration of proteins separation using SDS-PAGE.
7. Recording of simple muscle twitch/ Cardiogram – demonstration. (Virtual frog/ computer generated)
(Analysis of given graph of Frog- muscle twitch or cardiogram In the examination students are provided with any one computer generated graph and supposed to ‘Analyze the given graph and explain details of principle, procedure, result, Inference and viva-voce based on the given practical is expected)
8. Study of permanent slides (T.S./V.S.) - of Mammalian organs using permanent slides:
i) Tooth ii) Salivary gland iii) Stomach iv) Ileum v) Liver vi) Pancreas vii) Kidney
viii) Testis ix) Ovary
9. Study of ABO blood group system and blood group antigens
10. To perform differential count of WBCs
11. Microtomy: Study of principle , procedure and mechanism of micro-technique and microtome :
flow chart of technique, study of procedure and observation of HE staining technique/ whole mount
using permanent slides (study of protocol using flowchart).
12. Study visit: Visit to wetlands, medical college, pathology laboratory and blood bank

OR

13. Preparation and submission of small project/ review on topics related to ecology, cell biology, biochemistry and physiology

****Note:**

As per the guidelines of **UGC notification number F.14-6/2014(CPP-II) dated 1st August, 2014** it is now essential to make necessary modifications to stop dissection and promote and orient students towards the knowledge component rather than skill development. However, ITC based virtual dissections are promoted. Now, the responsibility to discontinue dissections and use of animals in experiments totally rests on concerned authorities of respective colleges/Institutes. As per the notification it is important to encourage the field trips and observations without disturbing the biodiversity. For laboratory observations existing permanent slides and specimens should be shown. As per the guidelines of UGC, all the Zoology departments should be empowered with infrastructure to adopt Information communication technology (ICT) required for the purpose of virtual dissections for which virtual class room / laboratory to be enriched with few computers (according to the strength of students), internet facility, printer etc.

Practical-I (Paper-V & VI) Cell Biology and Principles of Ecology		
Questions		Marks
Q-1:	Preparation of temporary stained squash of onion root tip to study various stages of mitosis OR Study of various stages of meiosis in onion flower buds.	08
Q-2:	Estimation from given sample - of Dissolved Oxygen (Winkler's method) OR Carbondioxide (CO ₂) OR Total Hardness content	08
Q:3:	Study and construction of ecological pyramid from given data: <i>i) Members of Grass land ecosystem –</i> Grasshopper, Rat Snake, Grass, Herbs, Shrubs, Weeds, Trees, Vulture, Squirrel, Earthworm, Centipede, Scorpion, Rabbit and Indian Bustard. OR <i>ii) Members of Pond ecosystem –</i> Sponge, Nepa, Leech, Planaria, Hydra, Lymnea, Planorbis, Heron, Kingfisher, Cyclops, Daphnia, Tortoise, Diatoms Vallisneria, Hydrilla, Chara and Spirogyra.	08
Q:4	Spotting / Identification (Any four) Zooplankton with the help of permanent slides (chart/ model /photo) / Bar body / Honey bee-Casts, bee hive, dance language (Spotters).	08
Q:5	Submission of tour report and viva-voce	04
Q:6	Submission of certified journal	04
Total Marks		40

Practical-II (Paper-VII & VIII) Fundamentals of Biochemistry and Animal Physiology: Controlling and Coordinating Systems		
Questions		Marks
Q-1:	Qualitative tests of functional groups in carbohydrates, proteins and lipids. Or Estimation of protein and carbohydrates by colorimetric method.	08
Q-2:	Action of amylase or papain enzyme under optimum conditions Or Effect of pH, temperature and inhibitors on the action of amylase. Or Study of ABO blood group system and blood group antigens	08
Q:3:	Recording of simple muscle twitch demonstration. / Cardiogram (Virtual frog) / Paper Chromatography Or Microtomy: Study of principle and mechanism of microtechnique: flow chart of technique, study of procedure and observation of Haemotoxylene Eosine staining technique using permanent slides.	08
Q:4	Spotting / Identification (any 4). Mammalian T.S. or V.S. - Tooth / Salivary gland / Stomach/ Ileum / Liver / Pancreas / Kidney / Testis / Ovary / Identification of WBCs	08
Q:5	Submission of tour report / Project/ review and viva-voce	04
Q:6	Submission of certified journal	04
Total Marks		40

Theory Question Paper Pattern: B.Sc.-II Zoology
Scheme of Marking for End Semester Examination

Day and date:
Time: 2 Hrs

Maximum Marks: 40

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

Q.1: Fill in the blanks by choosing correct alternatives (**eight**): 08

- 1)
- 2)
- 3)
- 4)
- 5)
- 6)
- 7)
- 8)

Q.2: Answer the following questions briefly (**any four**): 08

- 1)
- 2)
- 3)
- 4)
- 5)
- 6)

Q.3: Write notes on **any two** of the following 08

- 1)
- 2)
- 3)

Q.4: Attempt the following 08

- 1)
- 2)

Q.5: Answer any one of the following 08

- 1)
- 2)

B O S in Zoology
Chairman BOS

॥ शिक्षण हाच धर्म ॥

Shri Aillak Pannalal Digambar Jain Pathashala's

(Jain Minority Institute)

WALCHAND COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS), SOLAPUR

(Affiliated to Punyashlok Ahilyadevi Holkar Solapur University, Solapur)

Draft Syllabus



Choice Based Credit System

Name of the Faculty: Science

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

Subject: Mathematics

With effect from 2022-23

Walchand College of Arts & Science, Solapur (Autonomous)

Choice Based Credit System: With the view to ensure worldwide recognition, acceptability, horizontal as well as vertical mobility for students completing undergraduate degree, Walchand College of Arts & Science, Solapur has implemented Choice Based Credit System (CBCS) at Undergraduate level. The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. 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 Choice Based Credit System:

1. **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
2. **Elective Course:** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

Discipline Specific Elective (DSE) Course: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective.

3. **Ability Enhancement Courses (AEC):** The Ability Enhancement (AE) Courses may be of two kinds: **Ability Enhancement Compulsory Courses (AECC)** and **Skill Enhancement Courses (SEC)**. "AECC" courses are the courses based upon the content that leads to Knowledge enhancement; (i) Environmental Science and (ii) English/MIL Communication. These are mandatory for all disciplines. SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

Credit: Credit is a numerical value that indicates students work load (Lectures, Lab work, Seminar, Tutorials, Field work etc.) to complete a course unit. In most of the universities **15 contact hours** constitute **one credit**. 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.

The candidate has to appear for In Semester Examination of 20 marks and End Semester Examination for 80 marks.

Walchand College of Arts & Science, Solapur
Faculty of Science (Autonomous)

B.Sc.-Part-II

Choice Based Credit System (CBCS), (w. e. f. 2022-23)

Subject/ Core Course	Name and Type of the Paper		No. of papers/ Practical	Hrs/week			Total Marks Per Paper	ESE	ISE	Credits
	Type	Name		L	T	P (in hrs')				
Class :	B.Sc.- II Semester –III									
Core (*Students can opt any three subjects from the four Subjects offered at B.Sc. I Out of three Subjects offered One Subject will be the CORE subject.)		C-5	Paper-V	3.0	--	--	50	40	10	4.0
			Paper-VI	3.0	--	--	50	40	10	
		C-6	Paper-V	3.0	--	--	50	40	10	4.0
			Paper-VI	3.0	--	--	50	40	10	
		C-7	Paper-V	3.0	--	--	50	40	10	4.0
			Paper-VI	3.0	--	--	50	40	10	
		SEC - I			--	--	--	--	--	--
GE - 3			--	--	--	--	--	--		
Total				18	--	--	300	240	60	12
Class :	B.Sc.- II Semester – IV									
Core (*Students can opt any three subjects from the four Subjects offered at B.Sc. I Out of three Subjects offered One Subject will be the CORE subject.) OR (*Students can opt any two subjects from the four Subjects offered at B.Sc. I Out of two Subjects offered One Subject will be the CORE subject and any one subject among the other will be elective subject.)		C-8	Paper-VII	3.0	--	--	50	40	10	4.0
			Paper-VIII	3.0	--	--	50	40	10	
		C-9	Paper-VII	3.0	--	--	50	40	10	4.0
			Paper-VIII	3.0	--	--	50	40	10	
		C-10	Paper-VII	3.0	--	--	50	40	10	4.0
			Paper-VIII	3.0	--	--	50	40	10	
		SEC - 2								
GE - 4										
		Environmental Studies		3.0			50	40	10	NC
Total (Theory)				21	--	--	350	280	70	12
Practical		C-5 & C-8	Pr III and IV	--	--	8	100	80	20	4.0
		C-6 & C-9	Pr III and IV	--	--	8	100	80	20	4.0
		C-7 & C-10	Pr III and IV	--	--	8	100	80	20	4.0
		GE – 3 & GE - 4								
Total (Practical)						24	300	240	60	12
Grand Total				39		24	950	760	190	36

*Core Subjects:

Walchand College of Arts and Science (Autonomous), Solapur

Department of Mathematics

B.Sc. Second Year

Mathematics

Semester III & IV CBCS (Choice Based Credit System)

With effect from 2022

Preamble:

B.Sc.-II Mathematics is framed to provide the tools to get the easy and precise outcome to various applications of science and technology. Also logical development of the 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, Laplace transformation, differential calculus and differential equations various deductions of the theorems, corollaries and lemmas will be acquired by the students. Change is the universal truth of the nature and it can be presented with the help of dependent and independent variables in the form of functions and differential equations. So our aim is that students should learn various techniques to find solutions of differential equations. Students who opted S.Y. B.Sc. Mathematics have to complete 4 theory courses 2 each semester, two practicals entitled (Numerical Techniques in Laboratory) NTL-II courses (Annual). In the practical course of 100 marks students exercise the problem solving techniques for practical course I and II. The details are mentioned in the syllabus.

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 for developing innovative ideas.
- A student is 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.

Outcome: At the end of the course students will be able:

- To calculate maximum and minimum value of function, Jacobian, curvature of any given curve.
- To calculate tangents and normals of any given curve.
- To know about piecewise continuous functions, Dirac delta function, Laplace transforms and its properties.
- To solve ordinary differential equations using Laplace transforms.
- To learn the concepts of the course in real life problems.
- To understand the genesis of ordinary differential equations.

- To learn various techniques of getting exact solutions of solvable first order differential equations and linear differential equations of higher order.
- To grasp the concept of a general solution of a linear differential equation of an arbitrary order and also learn a few methods to obtain the general solution of such equations.
- To recognize the mathematical objects called groups.
- To link the fundamental concepts of groups and symmetries of geometrical objects.
- To learn about structure preserving maps between groups and their consequences

Programme Outcome: 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.

Eligibility and Admission: A Candidate passing/ ATKT B.Sc. I with mathematics as one of the subjects.

Duration: The duration of the B.Sc.-II course is of 1 year (comprising 2 semesters) and the B.Sc. entire program is of 3 years (06 Semesters)

Medium of Instruction: English

Scheme of Evaluation:

As per the norms of the grading system of evaluation, out of 100 marks, the candidate has to appear for college **In-Semester Examination (ISE)** of 20 marks and **End Semester Examination** of 80 marks.

A) Semester – III: Theory: (100 marks)

a) **End Semester Examination (ESE)** (80 marks): Number of theory papers: 2 (paper V and paper VI of 40 marks each)

b) **In-Semester Examination (ISE):** (20 marks): 10 marks each for two papers. In Semester Examination (ISE): Classroom Examination

B) Semester – IV: Theory: (100 marks):

a) **End Semester Examination (ESE)** (80 marks): No. of theory papers: 2 (paper VII and paper VIII of 40 marks each)

b) **In-Semester Examination (ISE):** (20 marks) and 10 marks each for two papers). In Semester Examination (ISE):- Classroom Examination

C) Practical Examination: (100 marks):

End Semester Examination (ESE) (80 marks): No. of practical course: 1

In-Semester Examination (ISE): (20 marks).

- Internal practical test: 20 marks

B.Sc. II Semester-III & IV–Mathematics

Choice Based Credit System (CBCS) Structure (2022-23)

Semester- III (Theory) [NTL – II A]

Semester-III	Paper	Title of Core papers	Marks
	V	Paper-V: Differential Calculus	50 (40- ESE and 10- ISE)
	VI	Paper-VI: Laplace Transform	50 (40- ESE and 10- ISE)

Semester- IV (Theory) [NTL - II B]

Semester-IV	Paper	Title of Core papers	Marks
	VII	Paper -VII: Differential Equations	50 (40- ESE and 10- ISE)
	VIII	Paper-VIII: Abstract Algebra-I	50 (40- ESE and 10- ISE)

PRACTICAL AT THE END OF SEMESTER-IV

PRACTICAL	Title	Marks
I	Numerical Technique Laboratory [NTL - II] [NTL – II A and II B]	100 (80 ESE and 20 ISE)

Semester – III
Paper-V: Differential Calculus

(45 Periods)

Unit – 1. Tangents and Normals:

Equations of tangents and Normals, Angle of intersection of two curves, Length of tangent, normal, sub tangent, subnormal at any point of a curve, Pedal equations or p, r equations

(Cartesian form), Angle between radius vector and tangent, Length of the perpendicular from pole to the tangent, Length of polar sub tangent and polar sub-normal, Pedal equations (polar form)

[13]

Unit – 2. Curvature:

Definition of Curvature, Length of arc as a function, Radius of curvature, Cartesian Equation, Parametric Equations, Polar Equations, Pedal Equations.

[12]

Unit – 3. Jacobians:

Definition of a Jacobian, Jacobian of a function of function, Jacobian of implicit function, Condition of dependent functions (statement only).

[8]

Unit - 4. Maxima and Minima:

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

[12]

Recommended 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 Prakashan Kolhapur .

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 Griha Prakashan, Poona 30.
7. Tom M. Apostol, Calculus Vol I and II, Wiley Publication.

Paper-VI: Laplace Transform

(45 Periods)

Unit 1: Laplace Transform.

[15]

Integral Transform (Definition), Laplace Transform (Definition), Linearity property of Laplace Transform, Piecewise continuous functions, Existence of Laplace Transform, Functions of exponential order, functions of Class A, First Translation or Shifting Theorem, Second Translation or Shifting Theorem, Change of Scale Property, Laplace Transform of the derivatives of $F(t)$, Laplace Transform of the n th order derivatives of $F(t)$, Initial value theorem, Final value theorem, Laplace Transform of Integrals, Multiplication by t , Multiplication by t^n , Division by t , Evolution of Integrals, periodic functions.

Unit 2: The Inverse Laplace Transform.

[15]

Inverse Laplace Transform, Null Function, Linearity Property, Table of Inverse Laplace Transform, First Translation or Shifting Theorem, Second Translation or Shifting Theorem, Change of Scale Property, Use of Partial function, Inverse Laplace Transform of the derivatives, Inverse Laplace Transform of Integrals, Multiplication by powers of p , Division by powers of p , Convolution (definition), Convolution theorem, Heaviside's expansion formula, Beta function.

Unit 3: Application of Laplace Transforms.

[15]

Ordinary Differential equations with constant coefficients, Ordinary Differential equations with variable coefficients, Partial differential equation.

Recommended Books:

1. Integral Transform by Vasistha A.R., Gupta R.K., Krishna Prakashan Media Pvt. Ltd. 11. Shivaji Road, Meerut India.
2. The Laplace Transform by Rainville E.D.
3. Integral Transform by Dr. J.R. Goyal and K.P. Gupta, Pragati Prakashan Meerut.

4. Differential equation by Sharma and Gupta, Krishna Prakashan Media Co. Meerut
5. Integral Transform and their Applications by Lokenath Debnath, CRC Press.
6. An introduction to Laplace Transforms and Fourier series by Phill Dyke, Springer publication.

Semester-IV
Paper -VII: Differential Equations

(45 Periods)

Unit 1: Differential Equations of the first order and of degree higher than the first:

Equations that can be resolved into factors of the first degree, Equations solvable for x, Equations solvable for y, Clairaut's equation, Equations reducible to Clairaut's form.
[10]

Unit 2: Linear Equations of the second Order:

General form of the second order linear equation, complete solution when one integral belonging to complementary function is known, Rules of getting an integral belonging to complementary function, Removal of the First order Derivative, Transformation of the linear equation of second order by changing the independent variable.
[15]

Unit 3: Homogeneous linear equations:

Homogeneous linear equations, working rule for finding the solution, Equations reducible to Homogeneous form.
[10]

Unit 4: Simultaneous Equations

Nature of the solution of simultaneous equations, Rules of solving the Equation,

Unit 5. Total Differential Equations

Total Differential Equation, Necessary and sufficient condition for the integrability of total differential equation (proof of Necessity only), Condition for exactness, Criterion for exactness, Method of Solving the Equation.
[10]

Recommended Books:

1. Differential Equation: Ordinary and Partial Differential Equations: by M.D. Raisinghania, S.Chand Co. Ltd. Ramanagar, New Delhi-110055 (Edition2002)
2. Dr. Alandkar S. J., Prof. Dhanshetti N. I., Prof. Dhone A. S. and Prof. Mahimkar R.
D., B. Sc. – II (Mathematics) Semester-IV, Paper –VII Differential Equation, 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-IV, Paper –VII Differential Equation, Phadke Prakashan Kolhapur.
4. Differential Equation by Murrey.
5. Differential Equation by Diwan and Agashe.
6. Differential Equation by Sharma-Gupta, Krishna Prakashan Media (Pvt.) Ltd, Meerut.

**Paper-VIII:
Abstract Algebra-I**

(45 Periods)

Unit-1: Introduction to Groups

[10]

Definition and Example of Groups, Permutations, Subgroups, Groups and Symmetry.

Unit -2: Equivalence, Congruence, Divisibility

[13]

Equivalence relation and partitions, Congruence and Division Algorithm, Integer Modulo n, Greatest Common Divisors, The Euclidean Algorithm, Factorization, Euler's Phi Function.

Unit-3:Groups [12]

Elementary Properties of Groups, Generators, Direct products, Cosets, Lagrange's Theorem, Isomorphism, More on Isomorphism, Cayley's Theorem.

Unit-4: Group Homomorphism

[10]

Homomorphism of Groups, Kernels, Quotient Groups, the Fundamental theorem of Homomorphism.

Recommended Books:

1. **Modern Algebra-An Introduction**, by John R. Durbin, John Wiley & Sons, Inc. Fifth Edition

2. Dr. Alandkar S. J., Prof. Dhanshetti N. I., Prof. Dhone A. S. and Prof. Mahimkar R. D., B. Sc. – II (Mathematics) Semester-IV, Paper –VIII: Abstract Algebra-I, 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-IV, Paper VIII: Abstract Algebra-I, Phadke Prakashan Kolhapur.
4. A First Course In Abstract Algebra J. B. Fraleigh, Pearson Education 7th edition
5. University Algebra N.S. Gopalkrishnan.
6. Abstract Algebra David S. Dummit & Richard M. Foote Wiley & Sons, Inc.
7. Fundamentals of Abstract Algebra D. S. Malik & N. Mordeson & M. K. Sen Mc. Graw Hill International Edition.
8. A Course in Abstract Algebra by Vijay K. Khanna and S.K. Bhambri, Vikas Publishing House Pvt. Ltd.

**Numerical Technique Laboratory [NTL - II]
(Differential Calculus, Laplace Transforms, Differential Equations, Abstract Algebra)**

[NTL – II A]

Assignment 1 - Tangents and Normals
 Assignment 2 – Curvature
 Assignment 3 – Jacobians
 Assignment 4 – Maxima and Minima
 Assignment 5 – Laplace Transform
 Assignment 6 – Inverse Laplace Transform I
 Assignment 7 - Inverse Laplace Transform II
 Assignment 8 - Application of Laplace Transform

[NTL – II B]

Assignment 9 - Differential Equations of the first order and of degree higher than the first.
 Assignment 10 - Linear Equations of the second order (Part –I)
 Assignment 11 - Linear Equations of the second order & Homogeneous linear

equations (Part –II)

Assignment 12 - Simultaneous Equations & Total Differential Equations

Assignment 13 - Introduction to Groups

Assignment 14 - Equivalence, Congruence, Divisibility

Assignment 15 - Groups

Assignment 16 - Group Homomorphism

Scheme of Marking for End Semester Examination (Theory)
Walchand College of Arts & Science, Solapur
(Autonomous)

Day and date:

Maximum Marks: 40

Time:

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

Q.1: Fill in the blanks by choosing correct alternatives (Eight).

08

- 1)
- 2)
- 3)
- 4)
- 5)
- 6)
- 7)
- 8)

Q.2: Answer the following questions briefly (any four) 08

- 1)
- 2)
- 3)
- 4)
- 5)
- 6)

Q.3: Write notes on any two of the following. 08

- 1)
- 2)
- 3)

Q.4: Write notes on any two of the following. 08

- 1)
- 2)
- 3)

Q.5: Answer any one of the following 08

- 1)
- 2)

Scheme of Marking for End Semester Examination (Practical)
Walchand College of Arts & Science, Solapur
(Autonomous)

Day and Date:
Time:

Maximum Marks: 80 [70+10]

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

Q.1: Answer any seven of the following 70

- 1)
- 2)
- 3)
- 4)
- 5)
- 6)
- 7)
- 8)

9)
10)

Chairperson
Board of Studies in Mathematics,
Walchand College of Arts and Science (Autonomous), Solapur.

‘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

New Choice Based Credit System

B.Sc. Part II

Subject: Botany

With effect from: 2022-23

Walchand College of Arts & Science, Solapur

(Autonomous)

Choice Based Credit System: With the view to ensure worldwide recognition, acceptability, horizontal as well as vertical mobility for undergraduate degree students, Walchand College of Arts & Science, Solapur has implemented Choice Based Credit System (CBCS) at Undergraduate level.

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core/elective/minor/skill based courses. 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 for potential employers in assessing the performance of the candidates. In order to bring consistency in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations.

Outline of Choice Based Credit System:

1. Core Course: A course, which should be compulsorily studied by a candidate as a core requirement is termed as a core course.

2. Elective Course: Generally a course which can be selected from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain/ care for the candidate's proficiency and skill is generally known as an Elective Course.

Discipline Specific Elective (DSE) Course: Elective courses may be offered by the main discipline/subject of study is referred as Discipline Specific Elective.

3. Ability Enhancement Courses (AEC): The Ability Enhancement (AE) Courses may be of two kinds: Ability Enhancement Compulsory Courses (AECC) and Skill Enhancement Courses (SEC). 'AECC' courses are the based upon the content that leads to knowledge enhancement: i) Environmental Science and ii) English/MIL Communication. These are mandatory for all disciplines. SEC courses are value-based and/or skill-based and are aimed at providing skills, hands-on-training, competencies etc.

Credit: Credit is a numerical value that indicates students work load (Lectures, Lab work, Seminar, Tutorials, Field work etc.) to complete a course unit. In most of the universities **15 contact hours** constitute **one credit**. 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. **The candidate has to appear for In Semester Examination of 20 marks and End Semester Examination for 80 marks.**

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 in still 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 behaviour, 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:

- a) Students will understand the morphological types and species diversity, their classification, cell structure, growth, metabolism, physiology, embryology etc.
- b) 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.
- c) Students will understand the relationship between plant and animals, microbes. Students can performs the procedures as per laboratory standards in the areas of Taxonomy and Economic importance of microorganisms
- d) 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 endeavours.

WALCHAND COLLEGE OF ARTS AND SCIENCE SOLAPUR

(Autonomous College)

B.Sc. Part- II

Choice Based Credit System (CBCS) (w.e.f. 2022-23)

Subject/ Core Course	Name and Type of the Paper		No. of papers/ Practical	Hrs/week			Total Marks Per Paper	UA	CA	Credit s
	Type	Name		L	T	P				
Class:	B.Sc. II, Semester- III									
Core (*Students can opt any three Subjects among the four subjects offered at B.Sc. I, out of three subjects offered one subject will be CORE subject and other Three will be ELECTIVE Subjects.)	DSC 1	Paper- V (Plant Anatomy)	3.0	--	--	50	40	10	4.0	
		Paper- VI (Plant metabolism)	3.0	--	--	50	40	10		
	DSC 2C	Paper- V	3.0	--	--	50	40	10	4.0	
		Paper- VI	3.0	--	--	50	40	10		
	DSC 3C	Paper- V	3.0	--	--	50	40	10	4.0	
		Paper- VI	3.0	--	--	50	40	10		
	AECC Environmental Studies		3.0	--	--	--	--	--	NC	
	SEC- 1		2.5	--	--	50	40	10	2.0	
Total			23.5	--	--	350	280	70	14	
Class:	B.Sc. II, Semester- IV									
Core (*Students can opt any three Subjects among the four subjects offered at B.Sc. I, out of three subjects offered one subject will be CORE subject and other Three will be ELECTIVE Subjects.) OR (Students can opt any Two subjects among the Four Subjects offered at B.Sc.- I out of Two Subjects One Subject will be the core Subject and any one Subject among the other will be ELECTIVE Subject)	DSC 1D	Paper-VII (Plant Physiology)	3.0	--	--	50	40	10	4.0	
		Paper- VIII (Embryology of Angiosperms)	3.0	--	--	50	40	10		
	DSC 2D*	Paper-VII	3.0	--	--	50	40	10	4.0	
		Paper- VIII	3.0	--	--	50	40	10		
	DSC 3D*	Paper-VII	3.0	--	--	50	40	10	4.0	
		Paper- VIII	3.0	--	--	50	40	10		
	SEC- 2		2.5	--	--	50	40	10	2.0	
	Total (Theory)			20.5	--	--	350	280	70	14
Core	DSC 1C & 1D	Practical III & IV	--	--	8	50	40	10	4.0	
	DSC 2C & 2D	Practical III & IV	--	--	8	50	40	10	4.0	
	DSC 3C & 3D	Practical III & IV	--	--	8	50	40	10	4.0	
Total (Practical)			--	--	24	150	120	30	12	
Grand total			44	--	24	850	680	170	40	

*Core Subjects: Chemistry/Physics/Electronics/Mathematics/Statistics/Botany/Zoology/
Microbiology/Geology

1 practical = 4 Lectures

Abbreviations:

L: Lectures
 T: Tutorials
 P: Practicals
 UA: University Assessment
 CA: College Assessment
 DSC / CC: Core Course
 AEC: Ability Enhancement Course
 DSE: Discipline Specific Elective Paper
 SEC: Skill Enhancement Course
 GE: Generic Elective
 CA: Continuous Assessment
 ESE: End Semester Examination

Summary of the Structure of B.Sc. Programme as per CBCS pattern Class	Semester	Marks-Theory	Credits-Theory	Marks-Practical	Credits-Practical	Total – credits
B.Sc.-II	III	300	12	--	--	12
	IV	350	12	300	12	24
Total		650	24	300	12	36

B.Sc. Program:

Total Marks:

Theory + Practical's = 650 + 300 = 950

Credits:

Theory + Practical's = 12 + 24 = 36

Numbers of Papers Theory:

Ability Enhancement Course (AECC): 00

Theory:

Discipline Specific Elective Paper (DSE) : 00

Theory:

CC: 06

Skill Enhancement Courses:

00

GE:

00

Total : Theory Papers:

Practical Papers :

Walchand College of Arts & Science, Solapur
(Autonomous)
Faculty of Science: Choice Based Credit System (CBCS)
(w.e.f. June 2022)

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.

Course 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 organisations 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 abroad.
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 B.Sc. I with all subjects or having ATKT in B.Sc. I.

Duration:

The duration for the B.Sc.-II 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

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

B.Sc. II, Semester- III & IV, BOTANY
Choice Based Credit System (CBCS) Structure (2022-2023)
Semester- III (Theory)

Semester-	Paper	Title of Core papers	Marks
I	V	Plant Anatomy	50 (40 ESE and 10 IE)
	VI	Plant Metabolism	50 (40 ESE and 10 IE)

Semester- IV (Theory)

Semester-II	Paper	Title of Core papers	Marks
	VII	Plant Physiology	50 (40 ESE and 10 IE)
	VIII	Embryology of Angiosperms	50 (40 ESE and 10 IE)

PRACTICAL AT THE END OF SEMESTER-IV

Practical	Title	Marks
I	Practical examination based on Plant Anatomy & Plant Metabolism	50 (40 ESE +10 IE)
II	Practical examination based on Plant Physiology & Embryology of Angiosperms	50 (40 ESE +10 IE)

Outline of Examination:

Internal Theory Examination: Internal examination will consist of **10 marks** per semester per paper. It may be held as **any two components** per semester from (a) to (e).

- a) Presentation
- b) MCQ Test
- c) Field studies / Study visits
- d) Home Assignments
- e) Written Class Test

Internal Evaluation (IE) (Practical): Internal examination will consist of 20 marks (10 for each paper I & II).

End Semester Examination (Theory): The detailed question paper pattern is given as Annexure-I.

End-semester Practical Examination: Practical examination shall be conducted at the end of academic year. Certified journal is compulsory for appearing in the examination.

Details about the course outcomes and Output

Course/Paper	About the course	Course outcomes
V: Plant Anatomy	The course deals with study to get the knowledge about the basic concepts in Plant anatomy, meristematic tissue and its derivatives and theories of structural development. For understanding the internal structure and function of tissue it is important to teach the simple and complex tissue, normal and anomalous growth in plants with examples.	After successful completion of course the students will be able to understand the basic in plant anatomy and functions of tissues, types of woods etc. To know the structure and function of each tissue like meristematic tissues, simple and complex tissue, epidermal tissue, secretory tissue and mechanical tissue.
VI: Plant metabolism	The course deals with study to get the knowledge about the basic concepts in Plant metabolism including the role of enzymes, nitrogen metabolism, N ₂ fixation and its significance, growth regulators, mineral nutrition and metabolism of carbohydrate. For understanding the plant metabolism.	After successful completion of course the students will be able to understand the basic in plant metabolism and its role in plant growth. To know the role of enzymes, nitrogen metabolism, N ₂ fixation and its significance, growth regulators, mineral nutrition and metabolism of carbohydrate.
VII: Plant Physiology	The course is a walk for the second year students through the plant physiology. It enlightens the physiological activities in the plants with their detailed information and role in the plants growth and development.	After successful completion of syllabus the students will be able to learn about physiological activities done in plant and its benefits. The students will also learn about the Photosynthesis, respiration and photorespiration, Plant response to light and temperature.
VIII: Embryology of Angiosperms	The course deals with study to get the knowledge about embryology of angiosperms, though the proper understanding of typical structure of flowers, types of pollination, seed developments and dispersal mechanism of fruits and seeds.	After completion of syllabus the students will be know the types of ovules, pollination and its importance, endosperm and seed development, dispersal mechanism etc.

WALCHAND COLLEGE OF ARTS AND SCIENCE SOLAPUR
(Autonomous College)

Choice Based Credit System (CBCS), (w.e.f June 2022)
Faculty of Science

B. Sc.-I (*Core Subjects: Botany) Semester- III

Paper No- V: Plant Anatomy

35 Lectures

Unit 1: Meristematic tissue

(8 Lectures)

- 1.1. Introduction, Characteristics and Classification of meristems based on position
Classification of meristem based on origin, position and plain of division.
- 1.2. Theories of structural development
 - a) Apical cell theory, b) Histogen theory, c) Tunica Corpus theory.

Unit 2. Permanent tissue

(08 Lectures)

- 2.1. Simple and complex tissue
- 2.2. Structure and function of simple tissues: Parenchyma, Collenchyma, Sclerenchyma
- 2.3. Structure and function of Complex tissue: Xylem, Phloem

Unit 3. Primary structure of plant body

(06 Lectures)

- 3.1. Primary structure of Monocotyledon and Dicotyledon root.
- *3.2. Adventitious roots in air layering.
- 3.3. Primary structure of Monocotyledon and Dicotyledon stem.
- *3.4. Primary structure of Monocotyledon and Dicotyledon leaf.

Unit 04. Secondary structure of plant body

(08 Lectures)

- 4.1. Normal secondary growth in Dicotyledon root and stem
- 4.2. Anamalous secondary growth in *Bignonia* (Dicot.) and *Dracaena* stem.
- 4.3. Vascular cambium – structure and function
- 4.4 Periderm and Lenticel, Tylosis, Wood types.

Unit 5: Tissue system

(05Lectures)

- 5.1. Epidermal tissue system
- 5.2. Secretary tissue system
- 5.3. Mechanical tissue system

Paper VI: Plant metabolism

35 Lectures

Unit 1: Enzymes

(8 Lectures)

- 1.1. Introduction.
- 1.2. Classification of enzymes.
- 1.3. Mechanism of enzyme action.
- 1.4. Properties of enzymes, *coenzymes, cofactors, iso-enzymes.

Unit 2: Nitrogen metabolism

(5 Lectures)

- 2.1. Introduction,
- 2.2. Nitrogen cycle
- 2.3. Biological nitrogen fixation – Definition, types and organisms involved,
- 2.4. Mechanism of biological nitrogen fixation.
- 2.5. Significance of biological nitrogen fixation

Unit 3: Plant growth regulators

(8 Lectures)

- 3.1. Introduction
- 3.2. Discovery
- 3.3. Types of growth regulators and its physiological role
 - a. PGR - auxins, gibberellins, cytokinins, *polyamines
 - b. Growth inhibitors – ABA, Ethylene

Unit 4: Mineral nutrition

(6 Lectures)

- 4.1. Introduction
- 4.2. Types of nutrients, *uptake of nutrients (active and passive absorption)
- 4.3. Role of macronutrients (N, P, K) and micronutrients (Fe, *B and Zn)

Unit 5: Carbohydrate metabolism

(8 Lectures)

- 5.1. Introduction and Broad classification;
- 5.2. Monosaccharides - Properties and examples (Triose, Tetrose, Pentose and Hexose)
oligosaccharides - Properties and examples (Sucrose , Maltose and Lactose)
- 5.3. Polysaccharides - Properties and examples (Starch and Cellulose)

SEMESTER - IV

Paper VII: Plant Physiology

35 Lectures

Unit 1: Plant response to light and temperature

(8 Lectures)

- 1.1. Photoperiodism: Definition, Classification (SDP, LDP, Day neutral plants)
- 1.2. Phytochrome: Definition and its role (red and far red light responses on photo morphogenesis)
- 1.3. Vernalization: Definition, Mechanism, Significance.

Unit 2: Translocation in phloem

(6 Lectures)

- 2.1. Definition of Symplastic transport and apoplastic transport,
- 2.2. Phloem loading and unloading.
- 2.3. Mechanism of translocation in phloem – Mass flow hypothesis
- 2.4. Source and sink relationship during vegetative and reproductive phase.

Unit 3: Photosynthesis

(8 Lectures)

- 3.1. Introduction
- 3.2. Photosynthetic Apparatus
- 3.3. Photosynthetic Pigments (Chlorophyll a & b, xanthophylls, carotene)
- 3.4. Light reaction – Cyclic and non cyclic, *Hills reaction
- 3.5. Dark reaction – C3, C4, CAM Pathway

Unit 4: Respiration

(5 Lectures)

- 4.1. Introduction
- 4.2. Structure of Mitochondrion
- 4.3. Types – *anaerobic and aerobic - Glycolysis, Linkage stage and TCA Cycle,
*structure and significance of ATP
- 4.4. ETS

Unit 5: photorespiration

(8 Lectures)

- 5.1. Introduction
- 5.2. Site of photorespiration
- 5.3. Mechanism of photorespiration
- 5.4. Significance

Paper VIII - EMBRYOLOGY OF ANGIOSPERMS

35 Lectures

Unit 1: Structural organization of flower

(9 Lectures)

- 1.1. Concept of flower as a modified Shoot.
- 1.2. Structure of typical flower.
- 1.3. Structure of typical Androceium: structure of typical anther and pollen grain.
- 1.4. Structure of typical Gynoecium: structure of a typical ovule, Types of ovules.

Unit 2: Pollination and fertilization

(4 Lectures)

- 2.1. Self and Cross pollination: definition, *advantage and disadvantages
- 2.2. Mechanism in Anemophily (*Zea mays*), Entomophily (*Calotropis*) and Hydrophily (*Vallisneria*)

Unit 3: Fertilization in angiosperms

(5 lectures)

- 3.1. Microsporogenesis, and development of male gametophyte
- 3.2. Megasporogenesis and development of female gametophyte: Monosporic (*Polygonum*) and Bisporic (*Allium*)
- 3.3. Fertilization: Entry of pollen tube, double fertilization and triple fusion. Significance of double fertilization.

Unit 4: Embryo and Endosperm Development

(9 Lectures)

- 3.1. Structure and development of embryo in Monocotyledons.
- 3.2. Structure and development of embryo in Dicotyledons.
- 3.3. Development of endosperm.
- 3.4. Types of endosperm- Nuclear, Helobial and Cellular.

Unit 5: Seed and fruit dispersal

(8 Lectures)

- 4.1. Introduction
- 4.2. Agents and mechanism of seed dispersal.
- 4.3. Agents and mechanism of fruit dispersal.

B.Sc. II (Botany)

Practical- I

- 1) Study of shoot and root apex by permanent slides.
- 2) Study of simple tissues.
- 3) Study of complex tissues.
- 4) Study of primary structure of dicot and monocot root
- 5) Study of primary structure of dicot and monocot stem
- 6) Study of anomalous secondary growth in *Bignonia*.
- 7) Study of anomalous secondary growth in *Dracaena*.
- 8) Study of double stained preparation in *Bignonia* and *Dracaena* stem.
- 9) Study of double stained preparation of anomalous secondary growth in *Dracaena*.
- 10) Study of anatomy of porous (ring porous & diffused porous) and non porous wood.
- 11) Maceration technique.
- 12) Study of Epidermal tissue system.
- 13) Study of Secretory Tissue system.
- 14) Study of Mechanical tissue system.
- 15) To study the deficiency symptoms of N, P, K,
- 16) To study the deficiency symptoms of Fe, *Boron & Zn.
- 17) Separation of photosynthetic pigments by ascending paper chromatography.
- 18) Study of Kranz leaf anatomy in C₄ plants.
- 19) Estimation of TAN value in CAM plants.
- 20) Study of evolution of oxygen during photosynthesis.
- 21) Detection of Phosphate, Potassium and Iron in the plant tissue by biochemical tests.
- 22) Determination of sugar percentage by hand refractometer.
- 23) Botanical Excursion Report.

Practical- II

- 1) Study of typical flower and its parts (floral whorls with their functions).
- 2) Study of young / mature anther by permanent slide.
- 3) Study of germination of pollen grains by *hanging drop method.
- 4) Detection of pollen fertility by staining (*acetocarmine) technique.
- 5) Study of types of ovules (by permanent slide or photograph).
- 6) Study of dicotyledon and monocotyledon embryo (by permanent slide or photograph).
- 7) Dissection of embryo (from dicot and monocot plant)
- 8) Study of endosperm from developing seeds (*Grevellia /Cucumis*).
- 9) To study the mechanism of seed dispersal.
- 10) To study the mechanism of fruit dispersal.
- 11) Study of self pollinated plants *eg. *Commelina, cyanotis*.
- 12) Study of cross pollinated plants *eg. *Mirabilis* .
- 13) Study of pollination mechanism (Maize, *Calotropis*)
- 14) Determination of rate of respiration during seed germination by Ganong's respirometer.
- 15) Effect of different concentrations of Auxins, *IBA on seed germination (any suitable dicot seeds).
- 16) Effect of different concentrations of Gibberellic acid (GA) on seed germination (any suitable monocot seeds).
- 17) Breaking of seed dormancy by mechanical and chemical scarification.
- 18) Study of effect of pH on Catalase enzyme activity.
- 19) Study of effect of temperature on Malate dehydrogenase enzyme activity.
- 20) *Study of polyembryony in *Cirtus*
- 21) Demonstration of fermentation.
- 22)* Study of biofertilizers or visit to the biofertilizer unit.
- 23) Separation of Amino acids by Thin Layer chromatography.
- 24) Horticulture Term Paper / Field Visit Report / Project Report

SUGGESTED READING

Plant Physiology and Metabolism

1. Hopkins, W. G. (1995) *Introduction to Plant Physiology*. John Wiley & Sons, USA.
2. Moore, T. C. (1989) *Biochemistry and Physiology of Plant Hormones* (II Ed.). Springer, USA.
3. Salisbury, F.B. and Ross, C. W. (1992) *Plant Physiology* (IV Ed.). Wadsworth Publishing Co., California, USA.
4. Taiz, L. and Zeiger, E. (1998) *Plant Physiology*. (II Ed.) Sinauer Associates, USA.
5. R.C. Grewal – *Plant Physiology*. Campus Books Int., New Delhi.
6. V.K. Jain – *Fundamentals of Plant Physiology*. S. Chand & Company Ltd., New Delhi.
7. Salisbury, F.B. and Ross, C. W. *Plant Physiology*. CBS, Publ. & Dist., New Delhi.
8. Devlin & Witham – *Plant Physiology*. CBS, Publ. & Dist., New Delhi.
9. G. Ray Noggle / G. Fritz- *Introductory Plant Physiology*. Prentice Hall of India Ltd.
10. V.Verma. *Text Book of Plant Physiology*. Emkay Publications., Delhi.
11. V.I. Paladin. *Plant Physiology*. Arihant Publishers. Jaipur (India)
12. Dr. S. Sundara rajan- *Physiology of Transport in Plants*. Anmol Publ. New Delhi.
13. D.O. Hall & K.K. Rao. *Photosyntheis*. Edward Arnold, U.S.A.
14. Bidwell, R.G.S. (1974) *Plant Physiology*. Macmillan P ub. Co., N.Y.
15. Devlin, R.M. and F.H. Witham. 1983. *Plant Physiology*. Willard Grant Press. U.S.A.
16. Hans-W. H. (1997) *Plant Biochemistry & Molecular Biology*. Oxford Univ. Press USA.
17. Jain, V.K. (2000) *Fundamentals Of Plant Physiology* ,S.Chand&Co, New Delhi.
18. Pandey, S.N. (1991) *Plant Physiology*, Vikas Publishing House (P) Ltd., New Delhi.
19. Verma, V. (2007) *Text Book of Plant Physiology*. Ane Books India, New Delhi.
20. Nobel, P.S. (2009) *Physicochemical & Environmental Plant Physiology* (IV Ed.) Academic Press, UK
21. Taiz, L. and Zeiger, E. 2006. *Plant Physiology* (IV Ed.). Sinauers Associates, Saunders land, Massachusetts, USA
22. Helgi O., A.R. Stephen and Willis, A.J. (2005) *The Physiology of Flowering Plants* Cambridge University Press, UK
23. Kirkham, M.B. (2004) *Principles of Soil & Plant Water Relations*. Elsevier, Netherl.
24. Dennis, D.T., Turpin, D.H., Lefebvre, D.D. and Layzell, D.B. (1997) *Plant Metabolism*. (II Ed.) . Longman Group, U.K.
25. Fitter, A. and Hay, R.K.M. (2001) *Environmental Physiology of Plants*. Academic Press, UK.
26. Emil Tmog - *Mineral Nutrition of Plants*. Oxford and IBH Publishing House, Bombay/ New Delhi.
27. S. Sundara Rajan- *Plants Physiology*. Anmol Publications, New Delhi.

Anatomy and Embryology of Angiosperms

1. Vashista, P.C.- *Plant Anatomy*. Pradip Publications, Opposite Sitla mandir, Jalandhar.
2. Pandey, B.P.- *Plant Anatomy*. S.Chand & Company, Ltd. Ram Nagar, New Delhi.
3. Datta A.C.- *Botany For Degree Students*. Press-Delhi, Bombay, Madrass
4. Carlquist, S. (1998) *Comparative Wood Anatomy: Systematic, Ecological and Evolutionary Aspects of dicotyledonous Wood*. Springer – Verlag, Berlin.
5. Culter, E.G. (1969) *Part I.- Cells and Tissues*. Edward Arnold, London.
6. Culter, E.G. (1971) *Part II- Organs- Plant Anatomy: Experiment and Interpretation*. Edward Arnold, London.
7. Esau, K. (1977) *Anatomy of Seed Plants*. 2nd edition, John Wiley and Sons, New York.
8. Fahn, A. (1974) *Plant Anatomy*. 2nd edition. Pergamon Press, Oxford.
9. Lyndon, R.F. (1990) *Plant Development: The Cellular Basis*. Unwin Hyman, London.
10. Mauseth, J.D. (1988) *Plant Anatomy*. The Benjamin/Cummings Publishing Company Inc., Metro Park, California, USA.
11. Nair, M.N.B. (1998) *Wood Anatomy and Major Uses of Wood*. Faculty of Forestry, Universiti Putra Malaysia, 43400 Serdang, Selangor D.E., Malaysia.
12. Rahvan, V. (2000) *Developmental Biology of Flowering Plants*. Springer- verlag, New York.
13. Raven, P.H., Evert, R.F. and Eichhorn, S.E. (1999) *Biology of Plants*. 5th edition. W.H., Freeman and Co., Worth Publishers, New York.
14. Steeves, T.A. and Sussex, I.M. (1989) *Patterns in Plant Development*. 2nd edition. Cambridge University, Press, Cambridge.
15. Thomas, P. (2000) *Trees: Their Natural History*. Cambridge University Press, Cambridge.
16. Chandurkar, P. J. (1971) *Plant Anatomy*. Oxford and IBH publication Co. New Delhi.
17. Greulach, V.A. and Adams J.E. - *An introduction to Modern Biology*. Toppen, Tokyo.
18. Eams and Mc Daniel. *An Introduction to Plant Anatomy*. McGraw-Hills, Japan
19. Adriance, S.F. *Practical Plant Anatomy*. D Van Nostrand Co. INC, Newyork
20. Pijush, Roy. *Plant Anatomy*. New Central Book Agency Ltd, Kolkata
21. Pandey, S.N. & Chadha A. *Plant Anatomy & Embryology*. Vikas Publ. House, Delhi.
22. Bhojwani, S.S. and Bhatnagar S.P. *An Embryology of Angiosperms*.
23. Maheshwari P. *An introduction to Embryology of Angiosperms*.
24. Nair P K K. *Essentials of Palynology*.
25. Datta, S.C. (2015) *Systematic Botany*. New Age Int. Publishers, New Delhi.

Walchand College of Arts and Science, Solapur
(Autonomous)
B.Sc. Part- II (Botany)
Practical Examination, March/April 2023

Paper- I

Centre:

Batch:

Date:

Total Marks -80

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.** Make a double stain permanent micro preparation of a
T.S. of specimen **A** and show it to the examiner (**No written answer**) **07 marks**
- Q.2.** Macerate the given sample **B** and prepare a slide from it and
show the slide to the examiner (**No written answer**) **04 marks**
- Q.3.** Set up the physiological experiment assigned to you and record your observations,
submit the report to the examiner (**written answer**) **07 marks**
- Q.4.** Set up the physiological experiment assigned to you and record
your observations, submit the report to the examiner (**Written answer**) **04 marks**
- Q.5.** Identification **08 marks**
E- Identify & Describe
F- Identify & Describe
G- Identify the role & deficiency symptoms
H- Identify the role & Deficiency symptoms
I- Identify & describe the biochemical test
- Q.6.** A) Journal **05 marks**
B) Excursion Report **05 marks**

Walchand College of Arts and Science, Solapur
(Autonomous)
B.Sc. Part- II (Botany)
Practical Examination, March/April 2023

Paper- II

Centre:

Batch:

Date:

Total Marks -80

-
- 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.** Determine the fertility of pollen / Perform practical for detection of pollen germination of given specimen **A** (**Written answer**) **04 marks**
- Q.2.** Dissect out the given material **B** for describe the dicot/monocot embryo by using permanent slides/photographs (**No written answer**) **03 marks**
- Q.3.** Identify the mechanism of pollination of given material **C** (**written answer**) **03 marks**
- Q.4.** Perform the practical to detect rate of respiration/separate the given sample **D** by paper chromatography to detect amino acids. (**Written answer**) **06 marks**
- Q.5.** Detect the enzyme activity of given sample **E** OR
Detect the mitochondria in given sample **E** by using specific staining method. (**Written answer**) **04 marks**
- Q.6.** Identification **10 marks**
F- Identify & Describe
G- Identify & Describe
H- Identify & describe mode of seed dispersal
I- Identify & describe effect of growth regulators
J- Identify& comment on
- Q.7.** A) Journal **05 marks**
B) Horticulture term paper **05 marks**

Scheme of Marking for End Semester Examination (Theory)

Walchand College of Arts & Science, Solapur

(Autonomous)

B.Sc. Part- II (Botany)

Theory Examination, March/April, Oct./Nov. 2022-23

Day and date:

Maximum Marks: 40

Time: 2 Hrs

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

Q.1: Fill in the blanks by choosing correct alternatives (eight): 08

- 1)
- 2)
- 3)
- 4)
- 5)
- 6)
- 7)
- 8)

Q.2: Answer the following questions in brief (any four): 08

- 1)
- 2)
- 3)
- 4)
- 5)
- 6)

Q.3: Write notes on any two of the following 08

- 1)
- 2)
- 3)

Q.4: Write notes on any two of the following 08

- 1)
- 2)
- 3)

Q.5: Answer any one of the following 08

- 1)
- 2)

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)



Name of Faculty: Science & Technology

New Choice Based Credit System

B.Sc. Part-II

Subject: Microbiology

With Effect from: 2022-23

Walchand College of Arts & Science, Solapur (Autonomous)

Choice Based Credit System: With the view to ensure worldwide recognition, acceptability, horizontal as well as vertical mobility for students completing undergraduate degree, Walchand College of Arts & Science, Solapur has implemented Choice Based Credit System (CBCS) at Undergraduate level.

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. 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 Choice Based Credit System:

1. Core Course: A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

2. Elective Course: Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

Discipline Specific Elective (DSE) Course: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective.

3. Ability Enhancement Courses (AEC): The Ability Enhancement (AE) Courses may be of two kinds: **Ability Enhancement Compulsory Courses (AECC)** and **Skill Enhancement Courses (SEC)**. "AECC" courses are the courses based upon the content that leads to

Knowledge enhancement; (i) Environmental Science and (ii) English/MIL Communication. These are mandatory for all disciplines. SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

4. Credit: Credit is a numerical value that indicates students work load (Lectures, Lab work, Seminar, Tutorials, Field work etc.) to complete a course unit. In most of the universities **15 contact hours** constitute **one credit**. 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. **The candidate has to appear for In Semester Examination of 10 marks and End Semester Examination for 40 marks.**

Program Outcomes:

B.Sc.II Microbiology subject aims to emphasis knowledge in various domains ranging from core studies from microbial cytology, physiology to microbial genetics. Students must use their knowledge in addressing the challenges of global concern such as environmental pollution, vaccine production, food productions by using various branches of microbiology. A graduate in Microbiology must use their knowledge to solve the problems faced by nation such as pandemic situations, food scarcity using industrial microbiology, microbial genetics, immunology 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) Ultra-structure and Functions, growth phases, effect of environmental factors on growth of bacteria and metabolism in bacteria
- b) Structure of DNA, concept of gene and various methods of genetic recombination.
- c) Immunity, Innate and acquired immunity, various defense mechanisms in body working against pathogen.

d) Scope and application of Industrial microbiology, concept of screening, strain improvement, fermentation process, process parameters and product recovery.

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 endeavors.

Walchand College of Arts & Science, Solapur
Faculty of Science (Autonomous)
B.Sc.-Part-II
Structure for B.Sc. II Microbiology (Semester III& IV)

Subject/Core Course	Name and Type of the Paper		No. of papers / Practical	Hrs/week			Total Marks Per Paper	ES E	IE	Credits
	Type	Name		L	T	P				
Class:	B.Sc. II Semester III									
Core (*Students can opt any Three Subjects among the Four Subjects offered at B. Sc. I Out of Three subjects offered One Subject will be the Core Subject OR Students can opt any Two subjects among the Four Subjects offered at B.Sc.I. Out of Two Subjects One Subject will be theCore Subject and any One Subject among the other will be Elective Subject		DSC1C	Paper-V	3.0	-	--	50	40	10	4.0
			Paper-VI	3.0	-	--	50	40	10	
		DSC2C	Paper-V	3.0	-	--	50	40	10	4.0
			Paper-VI	3.0	--	--	50	40	10	
		DSC3C	Paper-V	3.0	-	--	50	40	10	4.0
			Paper-VI	3.0	--	--	50	40	10	
Grand Total				18	--	--	300	240	60	12
Class:	B.Sc.-II Semester-IV									
Core (*Students can opt any Three subjects among the Four Subjects offered at B.Sc.I. Out of Three Subjects offered One Subject will be the Core Subject OR Students can opt any Two subjects among the Four Subjects offered at B.Sc.I. Out of Two Subjects One Subject will be the Core Subject and any One Subject among the other will be Elective Subject		DSC1D	Paper-VII	3.0	--	--	50	40	10	4.0
			Paper-VIII	3.0	--	--	50	40	10	
		DSC2D	Paper-VII	3.0	--	--	50	40	10	4.0
			Paper-VIII	3.0	--	--	50	40	10	
		DSC3D	Paper-VII	3.0	--	--	50	40	10	4.0
			Paper-VIII	3.0	--	--	50	40	10	
		AECC-Environmental Studies		3.0	--	--	50	40	10	NC
Total (Theory)				21	--	--	350	280	70	12
DSE (Practical)		DSC1C&1D	Pr.II	--	--	8	100	80	20	4.0
		DSC2C&2D	Pr.II	--	--	8	100	80	20	4.0
		DSC3C&3D	Pr.II	--	--	8	100	80	20	4.0
Total (Practical)						24	300	240	60	12
Grand Total				39		24	950	760	190	36

Choice Based Credit System (CBCS), (w.e.f. 2022-23)

***CoreSubjects:**

Chemistry/Physics/Electronics/Mathematics/Statistics/Botany/ZoologyMicrobiology/Geology

1 practical = 4 Lectures

Abbreviations:

L: No. of Lectures

P: Practical (Number of lectures/practical/batch)

IE: Internal Evaluation

ESE: End Semester Examination

CC: Core Course

AECC: Ability Enhancement Compulsory Course

NC: Non-credit

C: Subjects for Semester-III

D: Subjects for Semester-IV

Walchand College of Arts & Science, Solapur (Autonomous)

Faculty of Science: Choice Based Credit System (CBCS)

(w.e.f. 2022-23)

Preamble: This course provides a broad overview of microbiology and to produces expert hands that would have sufficient knowledge and expertise to solve the urgent problems of the region by using microbiology. 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.-II 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 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 for Admission:

A Candidate offering Microbiology at B.Sc.I and fulfilling the criterion for admission at B.Sc. II is eligible for admission.

Duration:

The duration of the B.Sc.-II course is of 1 year (comprising 2 semesters) and the B.Sc. entire program is of 3 years (06 Semesters)

Medium of Instruction: English

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

B. Sc. II Semester-III & IV – Microbiology

Choice Based Credit System (CBCS) Structure (2022-23)

Semester- III (Theory)

	Paper	Title of Core papers	Marks
Semester-III	V	Bacterial Cytology and Physiology	50(40- ESE and 10- IE)
	VI	Bacterial Genetics	50(40- ESE and 10- IE)

Semester- IV (Theory)

	Paper	Title of Core papers	Marks
Semester-IV	VII	Immunology & Medical Microbiology	50(40- ESE and 10- IE)
	VIII	Industrial Microbiology	50(40- ESE and 10- IE)

PRACTICAL AT THE END OF SEMESTER-II

PRACTICAL	Title	Marks
II	Practical Course in Microbiology for B. Sc. II	100 (80 ESE +20 IE)

Outline of Examination:

- **Internal Examination (Theory):** Internal examination will consist of **10 marks** per semester per paper. It may be held as **any two components** per semester from (a) to (e).
 - a) Presentation
 - b) MCQ Test
 - c) Field studies / Study visits
 - d) Home Assignments
 - e) Written Class Test
- **Internal Evaluation (IE) (Practical):** Internal examination will consist of 20 marks and may consists of:
 - a) Marks for practical examination: 15 marks
 - b) Oral examination : 03 marks
 - c) Marks for Journal : 02 marks
- **End Semester Examination (Theory):** The detailed question paper pattern is given as Annexure-I
- **End-semester Practical Examination:** Annexure-II
Practical examination shall be conducted at the end of academic year. Certified journal is compulsory for appearing in the examination.

SEMESTER – III
CORE COURSE- I

B.Sc. II-Semester–III

Paper – V: Bacterial Cytology and Physiology		
Theory Course		
Total Lectures :30 L		(02Credits)
About the course: This course is aimed to provide knowledge of ultrastructure, function of bacteria, bacterial growth, bacterial metabolism and effect of environmental factors on bacterial growth		
Unit No.	Content of Unit	Lectures Allotted
I	Bacteria: Ultra-structure and Functions Transport across cell membrane – simple diffusion, facilitated diffusion, active transport & group translocation. Mesosome & its functions. Flagella: Mechanism of movement, Tactic behaviors Pili: Types, Structure and functions Cytoplasmic inclusions: Chlorobium vesicles. Gas vacuoles, Magnetosomes and carboxysomes and their functions Reserve Food Materials: Nitrogenous and Non nitrogenous and their role Bacterial Endospore: Ultra-structure and functions, sporulation as an example of cell differentiation, Germination of endospore	10
II	Bacterial Growth Definitions of Growth, generation time, growth rate and Synchronous Growth, diauxic growth Measurement of growth –Cell numbers, Cell Mass and Cell activity	05
III	Effect of Environmental factors on Bacterial growth Temperature Psychrophiles, Mesophiles, Thermophiles, Thermophilic pH-Acidophiles, Basophiles and Neutrophils Oxygen-Aerobic, Anaerobic, Facultative Anaerobic and Microaerophilic Osmotic pressure- Osmophilic (Halophilic) Hydrostatic Pressure-Barophiles Surface Tension	05
IV	Bacterial Metabolism Fates of Pyruvate: a) Anaerobic: Ethanol Fermentation b) Microaerobic: Lactic Acid Fermentation (Homo lactic acid fermentations and Hetero-lactic fermentation) Modes of ATP generation: Substrate Level Phosphorylation, Oxidative Phosphorylation - Respiratory electron transport chain, components of ETC, aerobic and anaerobic respiration Photophosphorylation: photosynthetic ETC [cyclic & noncyclic]	10

V	Bacteria observed with naked eye: <i>Thiomargarita</i> spp: Occurrence, structure and its applications	
	Reference Books: 1.Powar C.B. and Daginawala H.F. (1986). General Microbiology Vol. I & II (2ndEdition), Himalaya Publishing House, Mumbai. 2.Stanier R.Y, et.al; General Microbiology 3.Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (1993). Microbiology. 5th Edition, Tata Mc Graw Hill Publishing Co., Ltd., New Delhi 4. Dubey, R.C and Maheswari, D.K. (2000) General Microbiology. S. Chand, New Delhi.	

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

- Gain basic knowledge of ultrastructure of bacterial cell
- Develop understanding on bacterial growth
- Develop critical understanding of bacterial metabolism and effect of environmental factors on bacterial growth

Paper-VI Bacterial Genetics		
THEORYCOURSE		
(02Credits)		(30L)
About the course: This course aimed to provide knowledge of bacterial Genetics to students. Concept of mutation and genetic recombination		
Unit No.	Content of Unit	Allotted Lectures
I	Structure of Nucleic acid and Replication of DNA: Experimental evidences for nucleic acid as genetic material- , Griffith Experiment, Avery, Macleod and McCarty's experiment, Hershey and Chase experiment 1. Structure & forms or types of DNA-Watson and Crick's model of DNA. A, B, C and Z form of DNA 2.DNA Replication-Modes of replication (Conservative, semi conservative and Dispersive), Meselson &Stahl's experimental proof of semiconservative replication.	8
II	Genes and Plasmid 1. Definitions and concepts of–Gene, Genome, Genotype, Phenotype, Cistron, Recon &Muton, Split gene-concept of intron and exons 2. Genetic code-Definition and properties of genetic code 3. Plasmid-Definition of plasmid and episome, Properties of plasmid, Types of plasmid-F plasmid, R plasmid, Col plasmid, Ti plasmid, Linear plasmid and Yeast 2μplasmid. Applications of plasmid	5
III	Bacterial Mutation and Repair 1. Mutations & Mutagenesis -Definition of mutation, Mutagen-physical and chemical Mutagens. Types of mutation-Base pair Substitution-Transition and Trans version, Missense mutation, Nonsense mutation, Neutral Mutation, Silent Mutation, Frameshift Mutation	7

	<p>Types of mutation on the basis of molecular mechanism-</p> <ul style="list-style-type: none"> • Spontaneous Mutation- Definition, Fluctuation Test, Replica plate technique • Definition and Mechanism of Induced Mutations caused by- • Physical Mutagen-U. V. rays • Chemical mutagens- 5-Bromouracil, 2-aminopurine, Hydroxylamine, Nitrous acid, alkylating agent and Acridine dyes. 	
VI	<p>Bacterial Recombination</p> <p>1. Definition of recombination, Fate of exogenote</p> <p>2. Types of recombination-</p> <ul style="list-style-type: none"> • Transformation-experimental proof & mechanism of transformation, Definition of transfection • Conjugation-a) Discovery, experimental evidence (Leaderberg & Tatum's & Davis U Tube) • Mechanism of Conjugation-F+X, HfrXF, F'X F- • Transduction-a) Discovery & experimental proof (Zinder & Lederberg) • Types of transduction-Specialized, Generalized and Abortive transduction. 	8
V	<p>Genetically modified microorganisms: <i>E.coli</i> producing clotting factors to treat haemophilia,</p> <p><i>Pseudomonas putida</i> –oil eating bacteria</p>	2
<p>References:</p> <p>1] A J Salle: Fundamentals of Bacteriology</p> <p>2] R Y Stainer, Roger et.al: General Microbiology</p> <p>3] Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (1993). Microbiology. 5th Edition, Tata Mc Graw Hill Publishing Co., Ltd., New Delhi</p> <p>4] Powar and Dagainawala: General microbiology Vol. I, II, Himalaya Publishing House</p> <p>5] Avinash and Kakoli Upadhyay: Molbio, Himalaya Publishing House</p> <p>6] Freifelder David: Microbial genetics, Jones and Bartlett Publications</p> <p>7] James D Watson: Molecular biology of the gene, W. A. Benjamin, Inc.</p>		

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

- Gain basic knowledge of microbial Genetics
- Develop understanding on mutation and mutagenesis
- Develop critical understanding of methods of genetic recombination in bacteria
- Gain awareness about plasmids in microbes and its applications

Semester IV

Paper-VIII Immunology & Medical Microbiology		
THEORY COURSE		
Total Lectures 30L		(02 Credits)
About the course: This course aimed to provide knowledge of Immune system, Immunity and microbial diseases to students		
Unit No.	Content of Unit	Lectures Allotted
I	Immunity Definition and concept, Innate immunity: Definition, Levels of innate immunity: Individual, racial and species immunity, Mechanism of innate immunity-mechanical, chemical, biological barriers[role of normal flora, cells of innate immunity and their role],inflammation and fever, Acquired immunity– definition, types- Active & passive	10
II	Antigen and Antibody Antigen: definition, concept of hapten, antigenic determinant, Types of antigen, factors affecting antigenicity Antibody (immunoglobulin): Historical perspective-Immune sera and concept of immunoglobulin, Basic structure of antibody (immunoglobulin),Classes of immunoglobulins, physicochemical& biological properties and functions of Immunoglobulins.	4
III	Antigen and antibody reactions Purposes of antigen antibody reactions: General features antigen antibody reactions, Measurement of antigen antibody reactions, Mechanism of antigen antibody reactions, Types of antigen – antibody reactions: Agglutination test, precipitation test, flocculation test with examples, complement fixation test, Immunofluorescence test.	7
IV	Microbial Diseases and Clinical Microbiology 1.Bacterial Infections-Enteric fever, Staphylococcal wound	5

	infections. Clinical Microbiology 1. Basic concepts 2. Collection, handling & transportation of specimen 3. Methods of diagnosis of diseases-Microscopic, cultural, biochemical & Serological.	
V	Nutrition and Immunity: Balanced and healthy diet. Role of specific nutrient in maintains optimal immune system. Locally available foods and fruits as source of nutrients. Dietary Guidelines to enhance immunity	4
Reference Books: 1. Ananthanarayana R. and Paniker, C.K.J. (2000). Text Book of Microbiology, 9th Edition, Oriental Longman Publications, USA. 2. Roitt, I.M. (1998). Essentials of Immunology, ELBS and Black Well Scientific Publishers, England. 3. Prescott, M.J., Harley, J.P. and Klein, D.A. (2002). Microbiology. 5th Edition, WCB McGraw Hill, New York. 4. Dugid, J. P. ,Medical Microbiology 5. Kubey - Immunology		

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

- Gain basic knowledge of Innate Immunity and acquired Immunity
- Develop understanding on antigens and antibodies
- Develop critical understanding of antigen and antibody reactions and its application in serodiagnosis
- Gain awareness about plasmids in microbes and its application

Semester-IV

Paper VIII: Industrial Microbiology		
THEORY COURSE (02Credits)		
Total Lectures 30L		
About the course: This course aimed to provide scope of Industrial microbiology, basic concept of fermentation to students		
Unit No.	Content of Unit	Lectures Allotted
I	Industrial Microbiology: Definition and Scope of industrial Microbiology, industrial important organisms with products(lists) Fermentation: Basic Concept, Types–Surface Culture Submerged Culture. Batch, Continuous culture (Chemostat & Turbidostat), Dual and Multiple fermentation. Design of typical Fermenter/ Bioreactor: Parts and their functions	8
II	Fermentation Media Media for industrial Fermentations, Media Components and Optimization, Use of Waste as fermentation Media Inoculum and Production media	5
III	Screening, Inoculum Development and Scale up Screening: Primary and Secondary, Strain Improvement Preservation of industrially important microorganisms, Inoculum Development Scale up of Fermentation	8
IV	Specific Fermentations: 1. Penicillin fermentation (<i>P. chrysogenum</i>), 2. Alcohol (<i>S. cerevisiae</i>) 3. SCP(<i>S. cerevisiae</i>)	5
V	Microbiology based Industries and research institutes in India: Location, Products and role of microbiologists in industry and Research Institutes. Bharat Biotech, Biological E Limited Agharkar Research Institute Pune, National Institute of Immunology, New Delhi	4

Reference Books:

1. Patel, A. H. (1984). Industrial Microbiology, MacMillan India Ltd., Hyderabad.
2. Casida, L.E. (1968). Industrial Microbiology, Wiley Eastern Ltd. & New Age International Ltd., New Delhi.
3. Prescott & Dunn, Industrial Microbiology
4. Purohit, Microbiology-Fundamentals and Applications, sixth edition
5. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd.

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

- Gain basic knowledge of Industrial Microbiology
- Develop understanding on fermentation media
- Develop critical understanding of concept of screening, strain improvements.
- To Gain knowledge of specific fermentations.

B. Sc. II Microbiology

Practical Course

(Credits–08)

1. Stains and staining Procedures

- i. Spore Staining [Dorner's method]
- ii. Flagella Staining [Bailey's Method]
- iii. Nuclear material Staining [Giemsa's method]
- iv. Volutin granule (Alberts method) and lipid granule staining (Burdons method)

2. Preparation of culture media

- a. Wilson and Blair's medium
- b. Gelatin Agar
- c. Amino Acid Decarboxylation Medium

d. Peptone Nitrate Broth

- e. Hugh and Leifson's Medium
- f. Amino Acid Deamination medium
- g. Christensen's urea agar

3. Preparation of Reagents and Solutions

1N NaOH, 1N HCl, 10% Ferric chloride, Nitrate reduction test reagents (α naphthylamine & Sulphanilic acid), 1% Tannic acid, Phosphate buffer solution of pH 7.0, Benedict's reagent, Biuret reagent

4. Biochemical Tests

- a. Gelatin Hydrolysis
- b. Amino Acid Decarboxylation
- c. Amino Acid Deamination
- d. Urea Hydrolysis
- e. Nitrate Reduction
- f. Hugh and Leifson's
- g. Catalase

- h. Oxidase
- 5. Effect of environmental factors on growth of microorganisms
 - a. U V light
 - b. Heavy Metals
 - c. Salt Concentration (NaCl)
 - d. pH
 - e. Temperature
 - f. Antibiotics [Penicillin & Streptomycin]
- 6. Primary Screening:
 - a. Antibiotic Producers –Crowded Plate Technique
 - b. Amylase Producers –Replica Plate Technique
- 7. Isolation & Identification of Pathogenic Microorganisms from Clinical Samples
 - a. *Salmonella* spp.
 - b. *Proteus* spp.
- 8. Determination of Blood Groups –ABO&Rh
- 9. Widal test (slide test): Qualitative
- 10. Glucose Estimation
- 11. Protein Estimation
- 12. Study of Growth phases of *E.coli* by optical density method.
- 13. Isolation of DNA
- 14. Ouchterlony test.

References for Practical course

- 1] Cappuccino, J.G. and Sherman, N. (2005). Microbiology – A Laboratory Manual. 7th Edition. Pearson Education. Published by Dorling Kindersley (India) Pvt. Ltd.
- 2] Mukherjee, K.L. (1996). Medical Laboratory Technology. Vol II. Tata Mc Graw Hill Publishing Co. Ltd., New Delhi
- 3] Dubey, R.C. and Maheswari, D.K. (2002). Practical Microbiology, S. Chand & Co., New Delhi
- 4] Naik Sandesh, Handbook of Practical microbiology

- 6] Frobisher, H., Hinsdill, R. D., Crabtree, K. T. and Goodhert, D. R. (2005) Fundamentals of Microbiology, Saunders and Company, London.
- 7] K. R. Aneja (2008). Experiments in Microbiology plant pathology and Microbial Biotechnology, New Age International Publishers

Learning Outcomes:

- Observational understanding of microorganisms
- Media preparations
- study of Isolation techniques
- Practical based on fundamentals of bacteria and biochemical identification
- Field based learning involving exploration using scientific methods

Annexure-I
Scheme of Marking for End Semester Examination (Theory)

Day and date:
Time: 2 Hrs

Maximum Marks: 40

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

Q.1: Fill in the blanks by choosing correct alternatives (eight): **08**

- 1)
- 2)
- 3)
- 4)
- 5)
- 6)
- 7)
- 8)

Q.2: Answer the following questions briefly (any four): **08**

- 1)
- 2)
- 3)
- 4)
- 5)
- 6)

Q.3: Write notes on any two of the following **08**

- 1)
- 2)
- 3)

Q.4: Attempt the following **08**

- 1)
- 2)

Q.5: Answer any one of the following **08**

- 1)
- 2)

Annexure-II

Scheme of Marking for End Semester Examination (Practical)

Total Marks:80

Identification of Pathogen	20
Biochemical Tests	10
Staining/ Screening	10
Effects/Growth Curve [lag phase]	10
Glucose/Protein / Widal test/ Blood Groups/Ouchterlony test	10
Spotting on Media components, reagents and stains (05 Spots)	10
Journal	05
Tour Report	05

The practical Examination will be conducted for two (2) successive days for 6 hours each day. There will be one batch of maximum 20 students each day.

Internal Practical examination: Total Marks:20. The internal practical examination shall be as per scheme of marking given in syllabus.

Practical Examination will be conducted at the end of Semester IV

B O S in Microbiology
(Dr. V. A. Gargade)
Chairman, BOS

**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

New Choice Based Credit System

B.Sc. Part-II

Subject: Physics

Syllabus

With Effect from: 2022-23

Walchand College of Arts & Science, Solapur

(Autonomous)

Choice Based Credit System: With the view to ensure worldwide recognition, acceptability, horizontal as well as vertical mobility for students completing undergraduate degree, Walchand College of Arts & Science, Solapur has implemented Choice Based Credit System (CBCS) at Undergraduate level.

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. 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 Choice Based Credit System:

1. **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

2. **Elective Course:** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

Discipline Specific Elective (DSE) Course: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective.

3. **Ability Enhancement Courses (AEC):** The Ability Enhancement (AE) Courses may be of two kinds: **Ability Enhancement Compulsory Courses (AECC)** and **Skill Enhancement Courses (SEC)**. "AECC" courses are the courses based upon the content that leads to Knowledge enhancement; (i) Environmental Science and (ii) English/MIL Communication. These are mandatory for all disciplines. SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

4. **Credit:** Credit is a numerical value that indicates students work load (Lectures, Lab work, Seminar, Tutorials, Field work etc.) to complete a course unit. In most of the universities **15 contact hours** constitute **one credit**. 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. **The candidate has to appear for In Semester Examination of 20 marks and End Semester Examination for 80 marks.**

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 & abroad. Also have an opportunity to work in industry, administrative jobs.

Program Specific Outcomes:

- Attains basic principles and phenomenon of general Physics and sound.
- Get the knowledge of basic principles of Electronics
- Understand the phenomenon of optics
- Understand the fundamentals of modern Physics
- 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

Walchand College of Arts & Science, Solapur: Faculty of Science

(Autonomous)

B.Sc.-Part-II

Choice Based Credit System (CBCS), (w.e.f. 2022-23)

Subject/ Core Course	Name and Type of the Paper		No. of papers/ Practical	Lectures/week		Total Marks Per Paper	ESE	IE	Credits	
	Type	Name		L	P					
Class :B.Sc.- II Semester – III										
Core (Students can opt any three Subjects from the four Subjects offered at B.Sc. I)		CC 1C	Paper-V	3		50	40	10	4.0	
			Paper-VI	3		50	40	10		
		CC 2C	Paper-V	3		50	40	10	4.0	
			Paper-VI	3		50	40	10		
		CC 3C	Paper-V	3		50	40	10	4.0	
			Paper-VI	3		50	40	10		
Total				18		300	240	60	12	
Class :B.Sc.- II Semester – IV										
Core Course		CC 1D	Paper-VII	3		50	40	10	4.0	
			Paper-VIII	3		50	40	10		
		CC 2D	Paper-VII	3		50	40	10	4.0	
			Paper-VIII	3		50	40	10		
		CC 3D	Paper-VII	3		50	40	10	4.0	
			Paper-VIII	3		50	40	10		
		Environmental Studies		3	--	50	40	10	NC	
Total (Theory)					21		350	280	70	12
Practical										
Core		CC 1 C & CC 1 D		Practical II		8	100	80	20	4.0
		CC 2 C & CC 2 D		Practical II		8	100	80	20	4.0
		CC 3 C & CC 3 D		Practical II		8	100	80	20	4.0
Total (Practical)					24	300	240	60	12	
Grand Total				39	24	950	760	190	36	

Abbreviations:

L: No. of Lectures

P: Practical (Number of lectures/practical/batch)

IE: Internal Evaluation

ESE: End Semester Examination

CC: Core Course

NC: Non-credit

C: Subjects for Semester-III

D: Subjects for Semester-IV

Walchand College of Arts & Science, Solapur (Autonomous)
Faculty of Science: Choice Based Credit System (CBCS)
(w.e.f. 2022-23)

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.

Eligibility for Admission: A Candidate offering Physics at B. Sc. I and fulfilling the criterion for admission at B. Sc. II is eligible for admission.

Duration: The duration of the B.Sc.-II course is of 1 year (comprising 2 semesters) and the B.Sc. entire program is of 3 years (06 Semesters)

Medium of Instruction: English

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

B.Sc. II Semester-III & IV - Physics
Choice Based Credit System (CBCS) Structure (2022-23)

Semester- III (Theory)

Semester-III	Paper	Title of Core papers	Marks
	V	General Physics and Sound	50 (40- ESE and 10- IE)
	VI	Electronics	50 (40- ESE and 10- IE)

Semester- IV (Theory)

Semester-II	Paper	Title of Core papers	Marks
	VII	Optics	50 (40- ESE and 10- IE)
	VIII	Modern Physics	50 (40- ESE and 10- IE)

PRACTICAL AT THE END OF SEMESTER-II

PRACTICAL	Title	Marks
II	Group I - General Physics and Sound Group II – Electronics Group III - Optics Group IV- Electricity, Magnetism and Modern Physics	100 (80 ESE +20 IE)

Outline of Examination:

- **Internal Evaluation (IE) (Theory):** Internal evaluation will consist of **10 marks** per semester per paper. It may be held as **any two components** per semester from (a) to (e).
 - a) Presentation
 - b) MCQ Test
 - c) Field studies / Study visits
 - d) Home Assignments
 - e) Written Class Test
- **Internal Evaluation (IE) (Practical):** Internal evaluation will carry 20 marks and consists of:
 - a) Practical examination : 15 marks
 - b) Oral examination : 03 marks
 - c) Journal : 02 marks
- **End Semester Examination (ESE) (Theory):** The detailed question paper pattern (40 marks per paper) is given as in Annexure-I.
- **End Semester Examination (ESE) (Practical):** Practical examination 80 marks shall be conducted at the end of academic year. Certified journal is compulsory for appearing in the examination. The detailed scheme is given in Annexure-II.

SEMESTER – III

Paper V: General Physics and Sound

WCS Code: **BSPH230522**

No. of Credits : 02

Lectures:30

Unit No.	Title of topic and contents	Lectures
1	Vectors Scalar and vector triple product ,Scalar and vector fields , Del operator, Gradient of a scalar, Divergence of a vector and its physical significance, curl of vector and their physical significance	06
2	Precessional Motion Graphical representation of plane vectors, Precession, Gyroscope, Nutation, Lanchester's rule, Gyrostatic pendulum, Motion of rolling disc, Gyroscopic applications in brief	06
3	Elasticity 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	06
4	Viscosity Motion in a viscous medium- Stoke's law, Viscosity of liquid by rotating cylinder method, Searle's viscometer, Ostwald's viscometer, Meyer's formula for flow of a gas through capillary.	06
5	Sound Acoustic Transducers 1) Pressure microphone 2) Moving coil loud speaker, Acoustics and its affecting factors, Reverberation time its optimum value, Requirements of good acoustics, Sabine's formula	06

Reference Books :

- 1) Properties of matter- D.S. Mathur
- 2) Physics for degree students- C.L.Arora and P.S. Hemne
- 3) A Text book of properties of matter- N.S. Khare & S.Kumar
- 4) Text book of Sound – Brijlal and Subramanyam
- 5) Sound – Khanna and Bedi
- 6) Sound – Wood A.B.
- 7) Mathematical Physics – Rajput and Gupta
- 8) Engineering Physics Part I – Selladurai PHI Learning Pvt. Ltd, New Delhi

About the course:

The course deals with fundamentals of vectors, some properties of matter and sound. It includes the theory and application of precessional motion. In this course it is tried to explore theories of methods to determine elastic constants and coefficient of viscosity of certain materials. Some aspects of sound are also considered.

Course outcomes: After successful completion of this course the students are able to

- 1) Understand few basics of vector theory
- 2) Understand the theory of precessional motion
- 3) Explain properties of matter
- 4) Describe methods used to determine elastic constants and viscosity
- 5) Understand basics of sound

Paper VI: Electronics		
WCS Code: BSPH230622		
No. of Credits : 02		Lectures: 30

Unit No.	Title of topic and contents	Lectures
1	Transistor amplifier: Transistor biasing: voltage divider bias, Multistage Amplifier, Two stage R-C coupled transistor amplifier, Frequency response curve of an amplifier, Feedback, Effect of positive and negative feedback on the frequency response curve, Differential amplifier, Modes of operation, Common mode and differential mode signals, Comparison between normal amplifier and differential amplifier	08
2	Oscillator: Types of waveforms, Oscillations from tank circuit, Barkhausen's criterion for sustained oscillations, Concept of AF and RF Oscillator, Phase shift oscillator, Wien's Bridge oscillator, Colpitt's oscillator, Hartley oscillator, Crystal Oscillator (qualitative treatment only)	05
3	Unipolar Devices: FET: Construction, operation and characteristics, Parameters of FET, Application of FET as VVR, UJT: Construction, operation and characteristics, UJT as voltage sweep generator.	05
4	Electronic Instruments: Principle, Construction and working of CRT, Block diagram of CRO, Uses of CRO, Digital Multimeter (DMM), Comparison of DMM with Analog Multimeter, Applications of DMM	06
5	Regulated power supply: Regulated power supply (with block diagram) and its need, Line and load regulation, Transistor Series power supply, IC voltage regulators, Fixed output voltage regulators (using IC 78XX and 79XX), IC723, Dual power supply using 3 pin IC.	06

Reference Books :

1. Principles of electronics - V.K. Mehta
2. Electronics principles - (3rd and 6th edition) - Malvino.
3. Op-Amps and linear integrated circuits (4th edition) - Ramakant Gayakwad.
4. A Text book of Electrical Technology Vol. IV – B. L. Theraja, A.K. Theraja

About the Course:

The course is designed to study of Single stage, Multi stage and Differential amplifier circuits. The course includes AF and RF Oscillator circuits. In the course study of Construction, working and applications of Unipolar devices & Principle of working of CRO, Digital Multimeter and Regulated power supply is introduced.

Course outcomes:

After successful completion of this course the students are able to

- 1) Describe circuits of: biasing circuit, single stage amplifier, multi stage amplifier and differential amplifier.
- 2) Explain Oscillator circuits: Phase shift, Wien bridge, Colpitt's, Hartley and Crystal
- 3) Describe construction and working of Unipolar devices: FET, UJT.
- 4) Understand principle of working of electronic instruments: CRO, DMM.
- 5) Explain the working of regulated power supply and parameters of regulated power supply

SEMESTER – IV**Paper VII: Optics**

WCS Code: **BSPH240722**

No. of Credits : **02**

Lectures:**30**

Unit No.	Title of topic and contents	Lectures
1	Cardinal points: Lagrange's equation, Cardinal points of optical system, Properties of cardinal points, Graphical construction of image using cardinal points & Newton's formula, Relation between focal lengths for an optical system, Relations between lateral, axial and angular magnifications, Thick lens (introduction), Combination of two thin lenses.	08
2	Interference of light: Michelson's interferometer, Applications of Michelson's interferometer: a) to measure wavelength of light b) to find difference of wavelengths of two close Spectral lines c) Refractive index of thin film d) to find the thickness of thin transparent film, An Etalon (Introduction Only), Construction and working of Fabry Perot interferometer, Superiority of F.P. interferometer over Michelson's interferometer.	05
3	Diffraction of light & Resolving power: Fresnel's half period zones, Explanation of rectilinear propagation of light Zone plate and Zone Plate as a Convex Lens, Fresnel's diffraction at straight edge, Geometrical and spectral resolution, Distinction between magnification and resolution, Rayleigh's criterion for the limit of resolution and modified Rayleigh's criteria, Modified Rayleigh's criterion. R.P. of plane diffraction grating, R. P. of prism	06
4	Polarization: Concept of Polarization, Double refraction and Huygen's explanation of double refraction through uni-axial crystals, Nicol's prism, optical rotation, Optical Activity and Specific Rotation, Laws of rotation and plane of polarization, Polaroid and their use to Polarization, Construction and principle of working of LCD, Applications of: a) Polarimeter b) Liquid crystal Displays (LCD)	06
5	Optical Fibers: Structure of fibers, Types of optical fiber, Critical angle of propagation, Acceptance angle, Numerical aperture, Pulse dispersion in step index fiber, Fiber optic communication system Advantages of optical fiber.	05

Reference Books :

1. Optics and Spectroscopy – R. Murigation
2. Text book of optics (new edition) – Brijlal and Subramanyam
3. Optics (Second edition) – Ajay Ghatak
4. Geometrical and Physical optics – D. S. Mathur
5. Fundamental of optics – Jenkins and white
6. Optics and Atomic physics – Satya Prakash
7. Engineering Physics – S. Selladurai
8. Optical Communication - Jain, Mathur (Kanpur IIT)

About the Course:

The course is designed to study of Cardinal points and graphical construction of an image, Lagrange's Equation and Newton's formula. The course includes construction, working and applications of interferometer and theory of Fresnel's Half Period Zone and construction of a Zone Plate. In this course derivation for Resolving Power of Prism and Plane Diffraction Grating. In the course Phenomenon of polarization of light, construction and working of polarimeter, construction & principle of working with applications of an optical fibre are introduced.

Course outcomes: After successful completion of this course the students are able to:

- 1) Describe cardinal points, Lagrange's equation, Newton's formula and types of magnification.
- 2) Explain the construction and working of interferometers and applications of interferometer.
- 3) Explain Fresnel's theory of half period zone and construction of a Zone Plate.
- 4) Derive formula for the resolving power of: Prism and Plane Diffraction Grating.
- 5) Describe construction Polarimeter and application of polarimeter to determine angle of specific rotation.
- 6) Explain construction, working and applications of an optical fibre.

Paper VIII :Modern Physics		
WCS Code: BSPH240822		
No. of Credits : 02		Lectures:30

Unit No.	Title of topic and contents	Lectures
1	Theory of Relativity Inertial frame of reference, Galilean transformation, Invariance of laws of mechanics under Galilean transformation, Ether hypothesis, Michelson-Morley experiment, Einstein's postulates of the Special Theory of Relativity, Lorentz transformation, Variation of length with velocity, Variation of time with velocity, Relativity of Simultaneity, Velocity addition theorem, Variation of mass with velocity, Mass energy relation, Postulates of the General Theory of Relativity.	09
2	Matter waves De Broglie's hypothesis of matter waves, De Broglie's wavelength, Particle velocity, group velocity, phase velocity & their interrelationship, Properties of matter waves, Bohr's quantum condition on the basis of matter wave hypothesis, Heisenberg's uncertainty principle.	06
3	Vector Atom Model Space quantization, Spin hypothesis, Stern-Gerlach experiment, Quantum numbers associated with vector atom model, Pauli's exclusion principle, Total angular momentum, L-S coupling, J-J coupling, Zeeman effect, Normal and anomalous Zeeman effect.	07
4	Compton Effect Compton Effect, Expression for change in wavelength for scattered photon, Experimental verification of Compton effect	03
5	Nuclear Energy sources Radioactivity (α , β and γ radiations), Neutron induced nuclear reactions, Nuclear fission, Energy released in fission, Chain reaction, Atom bomb, Nuclear reactor, Nuclear fusion,	05

Reference Books :

1. Introduction to special relativity - Robert Reshnik
2. Perspective of Modern Physics – Arther Beiser
3. Atomic and nuclear Physics – Gupta and Ghosh 2nd Edition
4. Quantum Mechanics – Singh, Bagade, Kamal Singh, Chand and Co.
5. Introduction to Atomic and Nuclear Physics – H. Semat and Albrought
6. Atomic Physics - Rajam
7. Modern Physics – S. H. Patil (IIT)
8. Nuclear Physics –Kaplan

About the Course

This course involves introduction to the special theory of relativity. The course includes the concept of matter waves and phenomena of Compton effect. Vector atom model is also discussed in detail. Some basics of nuclear energy sources are considered in the course.

Course outcomes: After successful completion of this course the students are able to

- 1) Understand the theory of relativity.
- 2) Explain the concept of matter waves.
- 3) Describe the vector atom model.
- 4) Explain the phenomenon of Compton effect.
- 5) Understand some basics of nuclear energy sources

Practical II	No. of credits : 04
WCS Code: BSPHP-222	

Group I: (General Physics and Sound)

Sr. No.	Title of Practical
1	Young's Modulus (Y) by bending of the centrally loaded beam.
2	Y or η of the material in the form of wire by Searle's method
3	Young's modulus (Y) by Vibration of a bar.
4	Kater's Pendulum.
5	Viscosity of liquid by Searle's method
6	Surface Tension of liquid by capillary rise method.
7	Velocity of sound by Kundt's tube
8	Velocity of sound by resonating bottle.

Group II: (Electronics)

Sr. No.	Title of Practical
1	Transistor series voltage regulator.
2	Biasing network.
3	Characteristics of FET.
4	UJT as voltage sweep generator.
5	Colpitt's oscillator.
6	Phase shift oscillator.
7	Use of C.R.O. for measurement of AC, DC voltage and frequency
8	Two stage RC coupled amplifier.

Group III: (Optics)

Sr. No.	Title of Practical
1	Biprism : To determine the wavelength of monochromatic light.
2	Goniometer : Equivalent focal length for different thick lenses.
3	Goniometer : Cardinal points.
4	Determination of Cauchy's Constants.
5	Double refracting prism.
6	Optical activity of sugar solution (Polarimeter).
7	Diffraction at single slit.
8	Wedge shaped film: Measurement of thickness.

Group IV: (Electricity, Magnetism and Modern Physics)

Sr. No.	Title of Practical
1	Determination of constants of B.G.
2	Comparison of Capacities by Deshoty's method.
3	Mutual Induction of two separate coils or transformer coils (Primary & Secondary).
4	Low resistance by Carry fosters method.
5	High resistance by nearly equal deflection method.
6	Solar cell characteristics to determine fill factor and efficiency.
7	Impedance of LCR parallel circuit at resonating state.
8	Sharpness of series resonance circuit.

Reference Books:-

- 1) Advanced Practical physics –Nelkon
- 2) Practical physics - Rajopadhye and Purohit
- 3) Practical Physics – P R Sasi Kumar
- 4) B.Sc. Practical Physics – Harnam Singh and Dr.P.S.Hemne

About the Course:

The course of practical includes variety of experiments from different sub branches of Physics. These experiments are helpful to understand the applications of some concepts and theories of Physics. They also develop skill of measurement and handling the instruments.

Course outcomes:

After successful completion of this course the students are able to:

- 1) Develop the skill of measurements with various scientific instruments
- 2) Handle optical, electrical and electronic instruments for various measurements
- 3) Apply the analytical techniques and graphical analysis to the experimental data
- 4) Verify basic laws in physics by performing practical.

Annexure-I

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

Day and date:

Maximum Marks: 40

Time: 2 hrs

- 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.1: Select the correct alternative from the following: **08**

- 1)
- 2)
- 3)
- 4)
- 5)
- 6)
- 7)
- 8)

Q.2: Attempt the following (any four): **08**

- 1)
- 2)
- 3)
- 4)
- 5)
- 6)

Q.3: Attempt the following (any two): **08**

- 1)
- 2)
- 3)

Q.4: Attempt the following (any two) **08**

- 1)
- 2)
- 3)

Q.5: Attempt the following (any one) **08**

- 1)
- 2)

(NB: Minimum one numerical type sub question must be asked in question number 1 to question number 4.)

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

Total Marks: 80

Practical examination will be at the end of the second semester. Every candidate has to perform four Practicals one from each Group.

- a) Practical from Group I : 15 Marks
- b) Practical from Group II : 15 Marks
- c) Practical from Group III : 15 Marks
- d) Practical from Group IV : 15 Marks
- e) Certified Journal : 10 Marks
- f) Educational trip / industrial visit/ seminar
or conference attendance/ project report : 10 Marks

The breakup of 15 marks for each practical should be given in the examination question slip.
The examination should be of two days with two sessions per day having time duration of 3 hours per session.



(Dr.S.G.Holikatti)

Chairman, 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

New Choice Based Credit System

B.Sc. Part-II

Subject: Electronics

Syllabus

With Effect from: 2022-23

Walchand College of Arts & Science, Solapur

(Autonomous)

Choice Based Credit System: With the view to ensure worldwide recognition, acceptability, horizontal as well as vertical mobility for students completing undergraduate degree, Walchand College of Arts & Science, Solapur has implemented Choice Based Credit System (CBCS) at Undergraduate level.

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. 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 Choice Based Credit System:

1. **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

2. **Elective Course:** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

Discipline Specific Elective (DSE) Course: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective.

3. **Ability Enhancement Courses (AEC):** The Ability Enhancement (AE) Courses may be of two kinds: **Ability Enhancement Compulsory Courses (AECC)** and **Skill Enhancement Courses (SEC)**. "AECC" courses are the courses based upon the content that leads to Knowledge enhancement; (i) Environmental Science and (ii) English/MIL Communication. These are mandatory for all disciplines. SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

4. **Credit:** Credit is a numerical value that indicates students work load (Lectures, Lab work, Seminar, Tutorials, Field work etc.) to complete a course unit. In most of the universities **15 contact hours** constitute **one credit**. 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. **The candidate has to appear for In Semester Examination of 20 marks and End Semester Examination for 80 marks.**

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/She must apply his/her 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 & abroad. Also have an opportunity to work in industry, administrative jobs.

Program Specific Outcomes:

- Get the knowledge of electronic circuits
- Understand the pulse and switching circuits
- Get the basic knowledge of the operational amplifier and its applications
- Understand and explain the different digital techniques and microprocessor
- 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

Walchand College of Arts & Science, Solapur: Faculty of Science
(Autonomous)
B.Sc.-Part-II
Choice Based Credit System (CBCS), (w.e.f. 2022-23)

Subject/ Core Course	Name and Type of the Paper		No. of papers/ Practical	Lectures/wee k		Total Mark s Per Pape r	ESE	IE	Credits	
	Type	Nam e		L	P					
Class :B.Sc.- II Semester – III										
Core (Students can opt any three Subjects from the four Subjects offered at B.Sc. I)		CC 1C	Paper-V	3		50	40	10	4.0	
			Paper-VI	3		50	40	10		
		CC 2C	Paper-V	3		50	40	10	4.0	
			Paper-VI	3		50	40	10		
		CC 3C	Paper-V	3		50	40	10	4.0	
			Paper-VI	3		50	40	10		
Total				18		300	240	60	12	
Class :B.Sc.- II Semester – IV										
Core Course		CC 1D	Paper-VII	3		50	40	10	4.0	
			Paper-VIII	3		50	40	10		
		CC 2D	Paper-VII	3		50	40	10	4.0	
			Paper-VIII	3		50	40	10		
		CC 3D	Paper-VII	3		50	40	10	4.0	
			Paper-VIII	3		50	40	10		
		Environmental Studies		3	--	50	40	10	NC	
Total (Theory)					21		350	280	70	12
Practical										
Core		CC 1 C & CC 1 D	Practical II		8	100	80	20	4.0	
		CC 2 C & CC 2 D	Practical II		8	100	80	20	4.0	
		CC 3 C & CC 3 D	Practical II		8	100	80	20	4.0	
Total (Practical)					24	300	240	60	12	
Grand Total				39	24	950	760	190	36	

Abbreviations:

L: No. of Lectures

P: Practical (Number of lectures/practical/batch)

IE: Internal Evaluation

ESE: End Semester Examination

CC: Core Course

NC: Non-credit

C: Subjects for Semester-III

D: Subjects for Semester-IV

Walchand College of Arts & Science, Solapur (Autonomous)
Faculty of Science: Choice Based Credit System (CBCS)
(w.e.f. 2022-23)

Preamble:

B.Sc. II syllabus is designed to provide an insight into applications of various circuit blocks, design analog and digital systems, methods to analyze working of systems and some of consumer products. Training on system design and simulations. In the theory courses adequate knowledge of analog systems design, digital system design and communication systems will be acquired by the students. Student taking admission at S.Y. B. Sc. Electronics has to complete 4 theory courses 2 each semester, two practical courses (Annual). In the practical course of 100 marks there are compulsory experiments for practical course Sem III and IV. The details are mentioned in the syllabus.

Objectives of the course:

The aim of the course is to generate trained manpower with adequate theoretical and practical knowledge of the various facets of electronic circuits and systems. Due care is taken to inculcate conceptual understanding in basic phenomena, materials, devices, circuits and products and development of appropriate practical skills suitable for industrial needs. Objectives are,

- To design the syllabus with specific focus on key Learning Areas.
- To equip student with necessary fundamental concepts and knowledge base.
- To develop specific practical skills.
- To impart training on circuit design, analysis, building and testing.
- To prepare students for demonstrating the acquired knowledge.
- To encourage student to develop skills for accepting challenges of upcoming technological advancements.

Eligibility for Admission: A Candidate offering Electronics at B. Sc. I and fulfilling the criterion for admission at B. Sc. II is eligible for admission.

Duration: The duration of the B.Sc.-II course is of 1 year (comprising 2 semesters) and the B.Sc. entire program is of 3 years (06 Semesters)

Medium of Instruction: English

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

B.Sc.I Semester-III & IV - Electronics
Choice Based Credit System (CBCS) Structure (2022-23)

Semester- III (Theory)

Semester-III	Paper	Title of Core papers	Marks
	V	Electronic Circuits	50 (40- ESE and 10- IE)
	VI	Pulse and Switching Circuits	50 (40- ESE and 10- IE)

Semester- IV (Theory)

Semester-IV	Paper	Title of Core papers	Marks
	VII	Operational Amplifier and Applications	50 (40- ESE and 10- IE)
	VIII	Digital Techniques and Microprocessor	50 (40- ESE and 10- IE)

PRACTICAL AT THE END OF SEMESTER-IV

PRACTICAL	Title	Marks
II	Group-A : Electronic Circuits Group-B : Pulse and Switching Circuits Group-C: Operational Amplifier Group-D: Digital Techniques and Microprocessor	100 (80 ESE +20 IE)

Outline of Examination:

- **Internal Evaluation (IE) (Theory):** Internal evaluation will consist of **10 marks** per semester per paper. It may be held as **any two components** per semester from (a) to (e).
 - a) Presentation
 - b) MCQ Test
 - c) Field studies / Study visits
 - d) Home Assignments
 - e) Written Class Test
- **Internal Evaluation (IE) (Practical):** Internal evaluation will carry 20 marks and consists of:
 - a) Practical examination : 15 marks
 - b) Oral examination : 03 marks
 - c) Journal : 02 marks
- **End Semester Examination (ESE) (Theory):** The detailed question paper pattern (40 marks per paper) is given as in Annexure-I.
- **End Semester Examination (ESE) (Practical):** Practical examination 80 marks shall be conducted at the end of academic year. Certified journal is compulsory for appearing in the examination. The detailed scheme is given in Annexure-II.

SEMESTER – III

Paper –V-Electronic Circuits

WCS Code: **BSEL230522**

No. of Credits : **02**

Lectures: **30**

Unit No.	Title of topic and contents	Lectures
1	Rectifiers, Filters and Regulators Diode rectifiers: Half wave, full wave and bridge rectifier (circuit diagrams, working and waveforms). derivation of Ripple factor, Efficiency and PIV of half wave and full wave rectifier (center tapped), Capacitor filter, Zener diode as a voltage regulator, Study of IC7805 and LM317, Regulation- line and load regulation.	05
2	Transistor Biasing Transistor biasing, DC load line, AC load line, Operating point, Stability factor, Methods of transistor biasing: Fixed Bias, Emitter Bias, Voltage divider bias with mathematical treatment	05
3	Transistor Amplifiers Basic action of transistor amplifier, DC (Thevenin's) and AC analysis of CB, CE, CC configurations, CB and CE Hybrid parameters comparison of CB, CE, CC configuration, FET as CS amplifier (Analysis and its applications) Multistage Transistor Amplifier: RC Coupled, Transformer Coupled, Direct Coupled amplifier, Darlington pair amplifier Power Amplifiers: Types of power amplifiers - Class A, Class B and Class C amplifiers by Graphical Method, Class B push pull amplifier, cross over distortion, Class AB amplifier, complementary-symmetry amplifier, harmonic distortion in power amplifiers,	10
4	Feedback Amplifiers Theory of feedback amplifier, positive and negative feedback, Effect of negative feedback on Gain, Bandwidth, Distortion, Noise, Input impedance and Output impedance, Types of negative feedback, Analysis of current series feedback circuit (Numerical Examples)	05
5	Transistor Oscillators Barkhausen criterion, RC oscillators: Wien bridge oscillator, Phase shift oscillator, LC oscillators: Hartley oscillator, Colpitt's oscillator (Without mathematical treatment), Piezoelectric crystal and its equivalent circuit, (Circuit description, condition for oscillation and Numerical Examples)	05

Reference Books :

1. Electronic Devices and Circuits, David A. Bell, 5th Edition 2015, Oxford University Press. A text book of Applied Electronics by R. S. Sedha. S. Chand Publication.
2. Electronic Devices and Circuits by Boylestad
3. Basic Electronics (Solid State) by B. L. Theraja, S. Chand & Company Ltd.
4. Basic Electronics and Linear Circuits by N. N. Bhargava D. C. Kulshreshtha & S.C. Gupta TMH
5. Electronic Circuits, S. A. Nasar, Schaum's outline series, Tata McGraw Hill.

About the course:

The course explains about the rectifier, filters and regulators. The course also highlights on transistor biasing , amplifier and feedback amplifier which will helps to students know about the electronic circuits.

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

- Understand the concept of rectifier circuits
- Impart the knowledge of transistor biasing.
- To analyze the performance of amplifier
- Understand the concept of transistor oscillator

Paper –VI- Pulse and Switching Circuits

WCS Code: **BSEL230622**

No. of Credits : 02

Lectures: 30

Unit No.	Title of topic and contents	Lectures
1	Wave shaping Circuits Need of wave shaping circuit, linear wave shaping circuits: Differentiator and Integrator, LPF, HPF, Special Functions of LPF and HPF, Non-linear wave shaping: Diode Clipping and Clamping circuits.	05
2	Time base Circuits General features of Time base signals, Concept of RC time base circuit, UJT as a relaxation oscillator, Linearity considerations with constant current source, Miller integrator and Bootstrap Time Base Generator.	05
3	Multi-vibrators using BJT Transistor as a switch, switching characteristics, Types of multivibrator Astable multivibrator (collector coupled): Operation, Waveforms, Derivation of output frequency. Monostable multivibrator (collector coupled): Operation, Triggering methods, Waveforms, Derivation of gate width. Bistable Multivibrator (collector coupled): Operation, Triggering methods, Wave forms, Schmitt's Trigger: Operation, Hysteresis curve (UTP, LTP), (Uses and Numerical Examples)	10
4	Multi-vibrators using Gates Astable multivibrator using gates, Monostable Multivibrator using gates and IC74121, Sampling Gates.	04
5	IC 555 Timer IC-555 timer- Pin configuration, functional block diagram, Astable multivibrator: Operation, wave forms, Derivation of frequency and duty cycle, Monostable multivibrator: Operation, wave forms, Derivation of gate width, Applications of IC 555 as Sequential Timer, Battery charger, Voltage controlled Oscillator. (Numerical examples)	06

Reference Books :

1. Pulse and Switching circuits by Millman and Taub
2. Hand book of Electronics by Sony Gupta.
3. A Text of Applied Electronics by R.S.Sedha, S. Chand Publication
4. Electronic Devices and Circuit by Boylestead
5. Linear Integrated Circuit – D. Roy Choudhari, Shail Jain (Wiley Eastern Ltd.)

About the Course:

The course helps to students to understand the concept of wave shaping and time base circuits which will helps to generate sinusoidal and different waveforms. The course gives knowledge about multivibrators using different techniques. The course also provide detail information about the IC 555.

Course outcomes:

After successful completion of this course the students are able to,

- To understand the concept of wave shaping and time base circuits
- To analyze performance of multivibrator using Bipolar Junction Transistor
- To understand the concept of multivibrator using gates
- To impart the knowledge about IC 555.

SEMESTER – IV

Paper –VII : Operational Amplifier and Applications

WCS Code: BSEL240722

No. of Credits : 02

Lectures: 30

Unit No.	Title of topic and contents	Lectures
1	Differential Amplifier Need of differential amplifier, Types of differential amplifiers, Emitter coupled differential amplifier, Operation, Common mode gain and Differential mode gain, Derivation of A_d and A_c , Constant current bias, Current mirror bias.	05
2	Operational Amplifier Introduction, Block diagram, Equivalent circuit of op-amp, Ideal and practical characteristics, open loop and closed loop configuration and its need. Op-amp parameters: Output offset voltage, Input offset voltage, Input bias current, Input offset current, Input impedance, Output impedance, CMRR, Slew rate, Maximum power bandwidth, PSRR, Pin configuration and Specifications of IC 741, Applications of Op-amp.	07
3	Operational Amplifier Linear Systems Concept of virtual ground, Inverting amplifier, Non-inverting amplifier, Voltage follower, summing amplifier (Adder), Op-amp differential amplifier (subtractor), Differentiator, Integrator, (mathematical treatment) Current to Voltage converter and Voltage to Current converter	06
4	Operational Amplifier Non-linear Systems Basic comparator, Zero-crossing detector, Active low pass and high pass filter, Regenerative comparator (Schmitt Trigger), Precision rectifier (Half wave).	05
5	Wave form Generators Operational Amplifier as a Oscillators - Phase shift oscillator, Wien Bridge oscillator, (without mathematical treatment) Operational Amplifier as a Multivibrator: Astable multivibrator, Monostable multivibrator (with mathematical treatment) Triangular wave generator, Saw tooth oscillator.	07

Reference Books :

1. Linear Integrated Circuit – D. Roy Choudhari, Shail Jain (Wiley Eastern Ltd.)
2. Integrated Circuit (New Edition) – K. R. Botkar
3. Integrated Electronics – Millman , Halkies (MGH)
4. Op-Amps and Linear circuits – Ramakant A. Gaikwad (PHI)
5. Operational Amplifiers and Linear ICs – Caughlin and Driscoll (PHI)
6. Design with Operational Amplifiers and Analog ICs – Franco (McGraw Hill, 2000)
7. Operational Amplifiers and Linear IC's David A Bell, 3rd Edition, 2011, Oxford University Press.

About the Course:

The course helps to students to understand the concept of differential amplifier with its parameters. The course gives knowledge about linear as well as non-linear operational amplifier and parameters of op-amp. The course also provide information about different waveform generators using different techniques.

Course outcomes:

After successful completion of this course the students are able to,

- To analyze performance of differential amplifier.
- To understand the concept of operational amplifier
- To understand the concept of linear and non-linear op-amp
- To impart the knowledge about waveform generator.

Paper-VIII : Digital Techniques and Microprocessor WCS Code: BSEL240822 No. of Credits : 02			Lectures: 30
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Unit No.	Title of topic and contents	Lectures
1	Semiconductor Memories: Types of semiconductor memory, Memory cell (Static and Dynamic), Memory organization, memory parameters (type, size), Classification of memory (volatile and non volatile) and their comparison, Concept and study of flash memory. Study of memory chips: 6264 (Features & Pin description)	05
2	Data Converters: Basic concepts of Digital to analog conversion (DAC) and Analog to digital conversion (ADC), specifications Digital to analog conversion: Binary weighted and R - 2 R ladder networks Analog to digital conversion: Successive approximation, dual slope ADC, Delta-sigma ($\Delta\Sigma$) ADC, Flash ADC, Study of DAC (IC 0808) & ADC (IC 0804) (Features & functional description)	06
3	Fundamentals of Microprocessor: Introduction to microprocessor, Basic system with Bus Architecture The microprocessor Intel 8085: Salient Features, Block diagram, pin descriptions, Address/data bus, Data bus, control signals, ALU, Accumulator, Flags, Registers, Interrupts, Clock & reset circuit, concepts of T-state, Machine cycle, Instruction cycle and timing diagram	08
4	Programming with Microprocessor: Instruction set of 8085, Instruction format, Addressing modes, Classification of instruction set, as per function, Algorithm, Flowchart, Assembly language programming of Data transfer (Block transfer & exchange), Arithmetic operation (addition, subtraction, multiplication, division), logical operation (AND, OR, NOT, XOR), ALP on Branch operation.	05
5	Interfacing techniques: Concept of Tristate logic, Study of IC 74244, 74245, 74373 (Features and Pindigram) De-multiplexing of Address/data bus using IC74373 Generation of control signal <i>MEMR</i> , <i>MEMW</i> , <i>IOR</i> , <i>IOW</i> (using gates and IC 74138) Need of Interfacing, Interfacing techniques, I/O mapped I/O, Memory mapped I/O and their comparison Address decoding (absolute and linear), Interfacing of memory chips 2764 and 6264 to the 8085 microprocessor	06

Reference Books :

1. Digital Principles and Applications by A. P. Malvino & D.P. Leach (TMH), Delhi
2. Digital Fundamental by Floyd, Pearson Education.
3. Microprocessor Architecture, Programming and Applications with the 8085 by Ramesh S. Gaonkar
4. Microprocessor by A. P. Godse

About the Course:

The course helps to students to understand the concept of semiconductor memories and its parameters. The course gives knowledge about analog to digital and digital to analog conversion. The course also provide detail information about microprocessor and its programming.

Course outcomes:

After successful completion of this course the students are able to,

- To understand the concept of semiconductor memories
- To analyze performance of data converter
- To understand the concept of fundamentals of microprocessor
- To impart the knowledge about interfacing techniques and programming of microprocessor.

WCS Code: BSELP-222	Practical II	No. of credits : 04
----------------------------	---------------------	----------------------------

Group-A: Electronic Circuits

Sr. No.	Title of Practical
1	Designing of biasing network
2	Study of single stage CE / CB amplifier. (Gain, I/P & O/P impedance)
3	FET CS amplifier (Gain, I/P & O/P impedance)
4	Emitter follower (Gain, I/P & O/P impedance)
5	Negative feedback amplifier. (Frequency response & feedback factor)
6	RC Phase shift oscillator (Design & testing)
7	Study of Wein bridge oscillator
8	Hartley oscillator (Design & testing)
9	Colpitt's (Design & testing)
10	Crystal oscillator (Piezoelectric crystal oscillator)

Group-B : Pulse and Switching Circuits

Sr. No.	Title of Practical
1	Study of Miller integrator
2	Study of UJT oscillator with constant current source
3	Study of Astable multivibrator using BJT
4	Study of Monostable multivibrator using BJT
5	Study of Bistable multivibrator using BJT (AC & DC) triggering
6	Study of Schmitt's trigger (hysteresis curve & square wave testing)
7	Study of Astable multivibrator using IC 555
8	Study of Monostable multivibrator using IC 555
9	Study of Astable multivibrator using IC7400
10	Study of Monostable multivibrator using IC74121

Group-C: Operational Amplifier

Sr. No.	Title of Practical
1	Study of Op-amp parameters (O/P offset voltage, I/P offset voltage and slew rate)
2	Study of Inverting and non inverting amplifier using op-amp
3	Study of Op-Amp as a Adder / subtractor
4	Study of Op-amp as voltmeter / ammeter
5	Study of Op-amp as Schmitt's trigger
6	Study of Wein-bridge oscillator using op-amp
7	Study of Phase Shift Oscillator using op-amp
8	Study of Astable multivibrator using op-amp
9	Study of Monostable multivibrator using op-amp
10	Study of Integrator / Differentiator using op-amp

Group-D: Digital Techniques and Microprocessor

Sr. No.	Title of Practical
1	Study of DAC using R-2R Ladder network (4 bits)
2	Study of DAC (IC 0808)
3	Study of ADC (IC 0804)
4	Study of Data transfer using 8085
5	Study of Arithmetic operations using 8085 (8-bit Addition)
6	Study of Arithmetic operations using 8085 (8-bit Subtraction)
7	Study of Arithmetic operations using 8085 (8-bit Multiplication)
8	Study of Arithmetic operations using 8085 (8-bit Division)
9	Study of Logical operations (AND and OR) using 8085
10	Study of Logical operations (NOT and XOR) using 8085

Reference Books:

1. Electronic Devices and Circuit by Boylestead
2. Op-Amps and Linear circuits – Ramakant A. Gaikwad (PHI)
3. Pulse and Switching circuits by Millman and Taub
4. Digital Electronics, S.K.Mandal, 2010, 1st edition, McGraw hill
5. Digital Fundamental by Floyd, Pearson Education.
6. Microprocessor Architecture, Programming and Applications with the 8085 by Ramesh S. Gaonkar

About the Course:

The course helps to students to teach how to draw symbols and circuit diagrams. It enlightens how to develop skill of circuit connections and also student become familiarize with different components and devices used in the laboratory and device manual.

Course outcomes:

After successful completion of this course the students are able to:

- To know the operation of Operational amplifiers.
- To understand operation of different digital techniques.
- To know operation of different instruments used in the laboratory.
- To understand the operation of microprocessor.
- To familiarize students with laboratory instruments like Ammeter, voltmeter, DMM, regulated power supply, dual power supply, Signal Generator, Function Generator, CRO and tools like cutter, stripper etc.

Annexure-I

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

Day and date:

Maximum Marks: 40

Time: 2 hrs

- 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.1: Select the correct alternative from the following: **08**

- 1)
- 2)
- 3)
- 4)
- 5)
- 6)
- 7)
- 8)

Q.2: Attempt the following (any four): **08**

- 1)
- 2)
- 3)
- 4)
- 5)
- 6)

Q.3: Attempt the following (any two): **08**

- 1)
- 2)
- 3)

Q.4: Attempt the following (any two) **08**

- 1)
- 2)
- 3)

Q.5: Attempt the following (any one) **08**

- 1)
- 2)

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

Total Marks: 80

Practical examination will be at the end of the second semester. Every candidate has to perform four Practicals one from each Group

- a) Practical from Group A : 18 Marks
- b) Practical from Group B : 18 Marks
- c) Practical from Group C : 18 Marks
- d) Practical from Group D : 18 Marks
- e) Certified Journal : 08 Marks

The breakup of 18 marks for each practical should be given in the examination question slip.
The examination should be of two days with two sessions per day having time duration of 3 hours per session.



(Dr.S.G.Holikatti)

Chairman, BOS in Electronics

**Shikshan Haach Dharma
Shri. SAPD Jain Pathashala's
(Jain Minority Institute)**

**Walchand College of Arts & Science,
Solapur
Autonomous College**

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



Name of Faculty: Science & Technology

New Choice Based Credit System

B.Sc. Part-II

Subject: Geology

With Effect From: 2022-23

Walchand College of Arts & Science, Solapur

(Autonomous)

Choice Based Credit System: With the view to ensure worldwide recognition, acceptability, horizontal as well as vertical mobility for students completing undergraduate degree, Walchand College of Arts & Science, Solapur has implemented Choice Based Credit System (CBCS) at Undergraduate level.

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill-based courses. 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 Choice Based Credit System:

1. **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

2. **Elective Course:** Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

Discipline Specific Elective (DSE) Course: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective.

3. **Ability Enhancement Courses (AEC):** The Ability Enhancement (AE) Courses may be of two kinds: **Ability Enhancement Compulsory Courses (AECC)** and **Skill Enhancement Courses (SEC)**. "AECC" courses are the courses based upon the content that leads to Knowledge enhancement; (i) Environmental Science and (ii) English/MIL Communication. These are mandatory for all disciplines. SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

Credit: Credit is a numerical value that indicates students work load (Lectures, Lab work, Seminar, Tutorials, Field work etc.) to complete a course unit. In most of the universities **15 contact hours** constitute **one credit**. 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. **The candidate has to appear for In Semester Examination of 20 marks and End Semester Examination for 80 marks.**

Program outcomes:

Geology is a scientific discipline which includes materials, dynamics, history and evolution of earth, its

interaction with life, oceans and the atmosphere. It constitutes fundamentals of the earth viz. minerals, rocks, fossils occurring within the earth along with historical events. It helps students to have knowledge of rocks with respect to their characters, genesis and types. Laboratory and field study of igneous, sedimentary and metamorphic rocks give basic as well as applied knowledge of various disciplines of geology viz. Economic, Engineering Geology to students. Fossils are remains of ancient organisms preserved in the rocks. Study of the fossils along with stratigraphy help students in understanding paleo-climate, paleo-geography, organic evolution and history of the earth from its origin.

Program specific outcome:

At the end of the course student of Geology will learn fundamental aspects of the earth science which mainly includes

- a) Rocks: Definition, types and Rock cycle
- b) Igneous rocks: Formation, magma, lava, classification on different basis, textures and structures
Various Concordant and Discordant forms, Differentiation and Assimilation processes, uni-component, bi-component and ternary magma, petrography of various igneous rocks
- c) Sedimentary rocks: Formation, processes, classification on different basis, textures and structures, petrography of various sedimentary rocks
- d) Metamorphic Petrology: To understand fundamentals of metamorphism process, agents, types of metamorphism, classification, textures and structures, Grade, facies of metamorphism, petrography of various metamorphic rocks
- e) Paleontology: Definition of fossils, various modes of preservation and uses of fossils, Morphology and geological range of Brachiopoda, Lamellibranch, Cephalopods, Gastropods, Trilobites, Significance of Gondwana flora in geology, evolution of Horse
- f) Stratigraphy: Definition, significance, principles,
Geological time scale, stratigraphic units, correlation and methods
Physiographic divisions of India
Stratigraphy of various geological formations of peninsular India – Dharwar, Cuddapah, Vindhyan, Delhi super groups
Stratigraphy of various geological formations of Palaeozoic and Mesozoic successions of Triassic of Spiti, Jurassic of Kutch and Cretaceous of Tiruchirapalli;
Study of Deccan Volcanic Province.
Palaeogene – Neogene sequence of Siwalik supergroup.

The program of Geology aims to integrate all these concepts so that a student is prepared to contribute his understanding, skills and knowledge in his future

Walchand College of Arts & Science, Solapur: Faculty of Science
(Autonomous)

B.Sc.-Part-II Choice Based Credit System (CBCS),(w.e.f. 2022-23)

Subject/ Core Course	Name and Type of the Paper		No. of papers/ Practical	Hrs/week			Total Marks Per Paper	ESE	ISE	Credits
	Type	Name		L	T	P (in hrs’)				
Class :	B.Sc.- II Semester – III									
Core (*Students can opt any three Subjects from the eight Subjects Listed below. Out of these three Subjects One Subject will be CORE and other two will be ELECTIVE Subjects.)		DSC 1A*	Paper-V	3	--	--	50	40	10	4.0
			Paper-VI	3	--	--	50	40	10	
		DSC 2A*	Paper-V	3	--	--	50	40	10	4.0
			Paper-VI	3	--	--	50	40	10	
		DSC 3A Geology (Igneous Petrology Sedi. & Meta. Petrology)	Paper-V (BSGO230522)	3	4	--	50	40	10	4.0
			Paper-VI (BSGO230622)	3			50	40	10	
Total				18	--	--	300	240	60	12
Class :	B.Sc.- II Semester – IV									
Core (*Students can opt any three Subjects from the eight Subjects Listed below. Out of these three Subjects One Subject will be CORE and other two will be ELECTIVE Subjects.)		DSC 1B*	Paper-VII	3	--	--	50	40	10	4.0
			Paper-VIII	3	--	--	50	40	10	
		DSC 2B*	Paper-VII	3	--	--	50	40	10	4.0
			Paper-VIII	3	--	--	50	40	10	
		DSC 3B Geology- (Stratigraphy, Paleontology)	Paper-VII (BSGO240722)	3	4	--	50	40	10	4.0
			Paper-VIII (BSGO240822)	3			50	40	10	
		Environmental Studies		3			50			
Total (Theory)				21	--	--	350	280	70	12
Practical (BSGOP-222)										
Core		DSC 1 A & 1B*	Practical III and IV		--	8	100	80	20	4.0
		DSC 2 A & 2B*	Practical III and IV		--	8	100	80	20	4.0
		DSC 3A & 3B*	Practical III and IV (BSGOP-222)		--	8	100	80	20	4.0
Total (Practical)						24	300	240	60	12
Grand Total				39		24	950	760	190	36

*Core Subjects: Chemistry/Physics/Electronics/Mathematics/Botany/Zoology/ Microbiology/Geology **1 practical = 4 hours**

Abbreviations:

L: No. of Lectures

P: Practical (Number of lectures/practical/batch)

IE: Internal Evaluation

ESE: End Semester Examination

CC: Core Course

AECC: Ability Enhancement Compulsory Course

NC: Non-credit

A: Subjects for Semester-III

B: Subjects for Semester-IV

Walchand College of Arts & Science, Solapur (Autonomous)
Faculty of Science: Choice Based Credit System (CBCS)
(w.e.f. 2022-23)

Preamble:

The present course forms a fundamental part of earth materials viz. rocks, their types, various Textures and structures and significance. It helps students to have applied knowledge in various fields. A study of stratigraphy, fossils and Geological time scale give basic knowledge, various terminology, principles, concepts and its application in various fields to students. The course structure helps students to achieve necessary fundamental concepts of subject.

Objectives of the Course: The main objectives of B.Sc.-II Geology are to

- Provide basic knowledge of various types of rocks to the students.
- Aware about applied aspects of rocks in engineering constructions and ore explorations.
- Develop ability in students to identify rocks in the field and laboratory mega-scopically and under microscope.
- acquaint the students with basics of Fossils, their formation, uses, morphology
- acquaint about stratigraphy, correlation of stratigraphic units, Geological Time scale to know about history of the earth, evolution of organisms

Eligibility for Admission: A Candidate passed B.Sc.- I with Geology as one of the electives subject.

Duration: The duration of the B.Sc.-II course is of 1 year (comprising 2 semesters) and the B.Sc. entire program is of 3 years (06 Semesters)

Medium of Instruction: English

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

B.Sc. II Semester-III & IV - GEOLOGY
Choice Based Credit System (CBCS) Structure (2022-23)

Semester- III (Theory)

Semester-I	Paper	Title of Core papers	Marks
	V	Igneous Petrology (BSGO230522)	50 (40- ESE + 10- IE)
	VI	Sedimentary and Metamorphic Petrology (BSGO230622)	50 (40- ESE +10- IE)

Semester- IV (Theory)

Semester-II	Paper	Title of Core papers	Marks
	VII	Stratigraphy (BSGO240722)	50 (40- ESE +10- IE)
	VIII	Paleontology (BSGO240822)	50 (40- ESE + 10- IE)

PRACTICAL - AT THE END OF SEMESTER-IV
(BSGOP-222)

PRACTICAL	Title	Marks
II	Petrology, Stratigraphy, Paleontology	100 (80 ESE +20 IE)

Outline of Examination:

- **Internal Examination (Theory):** Internal examination will consist of **10 marks** per semester per paper. It may be held as **any two components** per semester from (a) to (e).
 - a) Presentation
 - b) MCQ Test
 - c) Field studies / Study visits
 - d) Home Assignments
 - e) Written Class Test
- **Internal Evaluation (IE) (Practical):** Internal examination will consist of 20 marks and may consists of:
 - a) Marks for practical examination: 15 marks
 - b) Oral examination : 03 marks
 - c) Marks for Journal : 02 marks
- **End Semester Examination (Theory):** The detailed question paper pattern is given as **Annexure-I**.
- **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-II**.

SEMESTER – III
CORE COURSE- II

(Total credits 2.0)	PAPER V: Igneous Petrology (BSGO230522)	(Contact Hrs. 30)
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Total Marks 50 (UA – 40 + CA – 10)

Unit-I: Lectures – 15

Rock cycle

Igneous rocks: definition; Magma: definition, composition, types and origin;

Forms of igneous rocks: concordant and discordant forms;

Points required to describe textures of igneous rocks: 1) crystallinity, 2) granularity,

3) shape of crystal and 4) mutual relations of crystals or of crystal and glassy matter;

Textures of igneous rocks: 1) Granitic, 2) porphyritic, 3) Ophitic, 4) Poikilitic, 5)

Intergranular and 6) glassy.

Structures of igneous rocks: 1) Vesicular and amygdaloidal, 2) ropy, 3) flow, 4) **08**
pillow, 5) columnar

Differentiation: liquid immiscibility, gravitational and filtration. Role of volatiles in **03**
differentiation

Assimilation: reaction between basaltic magma and acid igneous rocks, basaltic
magma and sedimentary rocks, granitic magma and basic igneous rocks, granitic **04**
magma and sedimentary rocks. Bowen's reaction series.

Unit-II: Lectures – 15

Classification of igneous rocks based on: 1) mode of occurrence, 2) color index, 3) **02**
silica percentage

Crystallization of uni-component (augite), **02**

bicomponent [two independent – (diopside – anorthite) and mix-crystals – albite –
anorthite system)] and ternary magma (diopside – albite – anorthite system). **06**

Detailed petrographic description of granite, pegmatite, granodiorite, rhyolite, **03**
syenite, diorite, gabbro, basalt and dolerite with their engineering significance

02

CORE COURSE- II

PAPER VI: Sedimentary and Metamorphic Petrology
(Total credits 2.0) (BSGO230622) (Contact Hrs. 30)

Total Marks 50 (UA – 40 + CA – 10)

Unit-I: Lectures: 15

Sedimentary petrology: definition, processes of formation of sedimentary rocks – lithification and diagenesis. **02**

Classification of sedimentary rocks:

1) based on products of weathering – Residual, sedimentary, chemical and organic deposits **02**

2) based on mineralogy – a) siliciclastic, b) carbonates (Limestone and dolomite), c) non carbonates - ironstones and banded iron formations (limonite, goethite and hematite and), d) phosphorites, evaporites (rock salt, gypsum) and e) organic-rich (carbonaceous) deposits (coal) and **04**

3) based on size and shape of the grains. **01**

Textures of sedimentary rocks – clastic, oolitic and pisolitic **01**

Structures of sedimentary rocks – stratification, lamination, graded bedding, current bedding, Mud cracks and ripple marks. **02**

Petrographic details of important siliciclastic and carbonate rocks such as - conglomerate, breccia, sandstone, greywacke, Arkose, shale and limestones.

Residual rocks – laterite and bauxite with their significance **03**

Unit-II: Lectures: 15

Metamorphic petrology: definition and agents of metamorphism. **01**

Zones and grades of metamorphism, Retrograde and Poly-metamorphism, Anatexis **01**

Type of metamorphism – contact, regional, cataclastic, hydrothermal – with examples **02**

stress and anti-stress minerals.

Structures of metamorphic rocks – granulose, slaty, schistose, gneissose and augen. **02**

Introduction to metamorphic facies: zeolite, hornfels, blue schist, green schist, amphibolite, granulite and eclogite **03**

Petrographic details of some important metamorphic rocks such as - slate, schists, gneiss, quartzite, marble and phyllite with their significance **03**

Books Recommended:

1. Igneous & Metamorphic petrology. Turner, F.J. & Verhoogen, J., McGraw Hill Co.
2. Igneous petrology. Bose, M.K., World press
3. Principles of Petrology. Tyrell, G. W., Methuren and Co (Students ed.).
4. Petrology, Igneous, Sedimentary and Metamorphic rocks. Ehlers, WG, and Blatt, H., CBS Publishers
5. The study of rocks in thin sections. Moorhouse, WW., Harper and sons.
6. Principles of Sedimentology. Friedman & Sanders, John Wiley and sons.
7. Sedimentary rocks. Pettijohn, F.J., Harper & Bros. 3rd Ed.
8. A text book of sedimentology. Prasad, C.,
9. Introduction to sedimentology. Sengupta. S., Oxford-IBH.

10. Metamorphic petrology. Turner, F.J., McGraw Hill.
11. Petrology of Metamorphic Rocks. Mason, R., CBS Publ.
12. Petrogenesis of Metamorphic Rocks. Winkler, H.G.C., Narosa Publications

**SEM-IV
CORE COURSE- II**

(Total credits 2.0)	PAPER VII: Stratigraphy (BSGO240722)	(Contact Hrs. 30)
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Total Marks 50 (UA – 40 + CA – 10) (Credit 2)

Unit-I: Lectures: 15

Stratigraphy: definition, principles of stratigraphy; methods of stratigraphic correlation; Geological Time Scale. **04**

Stratigraphy of Maharashtra

Stratigraphic classification – litho-stratigraphy, chrono-stratigraphy and bio-stratigraphy and their units. Physiographic divisions of India. **03**

Study of following Precambrian succession: Dharwar, Cuddapah, Vindhyan.

Delhi Supergroups with their classification, stratigraphic succession, distribution and economic importance **08**

Gondwana System

Unit-II: Lectures: 15

Brief idea of Palaeozoic and Mesozoic successions of Triassic of Spiti, Jurassic of Kutch and Cretaceous of Tiruchirapalli; **06**

Study of Deccan Volcanic Province, Intra and Infra trapean beds **04**

Palaeogene – Neogene sequence of Siwalik supergroup. **05**

1. Geology of India. Wadia, D., Mc Graw Hill Book co.
2. Geology of India and Burma, 6th Edition. Krishnan, M.S., CBS Publ.
3. Fundamentals of Historical Geology & Stratigraphy of India. Ravindra Kumar, Wiley Eastern.

CORE COURSE- II

(Total credits 2.0)	PAPER VIII: Paleontology (BSGO240822)	(Contact Hrs. 30)
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Total Marks 50 (UA – 40 + CA – 10) (Credit 2)

Unit-I: Lectures: 15

Paleontology: definition, Branches of Paleontology, Fossils: definition, characters, binomial nomenclature in taxonomy, modes of preservation of fossils, condition of fossilization and significance of fossils. **06**

Morphology of hard parts and geological distribution of:

Brachiopoda – *Spirifer*, *Productus*, *Terebratula* **03**

Lamellibranchia: *Cardita*, *Cardium*, *Pectene* **03**

Cephalopoda: *Nautilus*, *Goniatites* **03**

Unit-II: Lectures: 15

Morphology of hard parts and geological distribution of:

Trilobite: *Ogygia*, *Paradoxide*, *Trinucleus* **03**

Echinoidea: *Echinus*, *Micraster*, *Hemiaster* **03**

Gastropoda: *Conus*, *Turritella*, *Voluta*, *Physa* **03**

Evolutionary history of horse and Man **03**

Morphology, distribution and significance of Gondwana flora – *Glossopteris*, *Gangamopteris* and *Ptillophylum* **03**

Books Recommended:

- 1.Principles of Invertebrate Paleontology. Shrock, R.R. & Twenhoffel, W.H., CBS Publ.
2. Outlines of Paleontology. Swinerton, HH., Edward Arnold Publishers
- 3.Paleontology: Evolution & Animal Distribution. Jain, P.C. Vishal Publications.
4. Fossil Invertebrate. Lehmann, U., Cambridge Univ. Press.
5. Organic evolution. Rastogi, Kedarnath and Ramnath Publ.
6. Palaeontology Invertebrate. Woods, Henry. CBS Publishers & Distributors.

Practical Course (BSGOP-222)

Contact hours – 60

Total Marks: 100 (UA – 80, CA – 20)

Credit – 04

CC – V and VI LABORATORY COURSE

PETROLOGY:

Study of optical properties of following minerals present in all types (igneous, sedimentary and metamorphic) of rocks: quartz, orthoclase, plagioclase, microcline, hornblende, augite, muscovite, biotite, olivine, garnet, hypersthene, calcite and chlorite.

IGNEOUS

- A. Megascopic and microscopic identification and description of igneous rocks.
 - 1. Megascopic: granite, porphyritic granite, graphic granite, pegmatite, rhyolite, syenite, gabbro, dolerite, basalt, pitchstone / obsidian and dunite.
 - 2. Microscopic: granite, graphic granite, rhyolite, syenite, gabbro, dolerite, basalt and dunite.
- B. Megascopic and microscopic identification and description of textures and structures of igneous rocks.
 - 1. Megascopic: granitic, porphyritic, graphic, glassy, flow, vesicular and amygdaloidal, columnar and pillow.
 - 2. Microscopic: granitic, porphyritic, graphic, glassy, intersertal (Intergranular) and ophitic.

SEDIMENTARY

- A. Megascopic and microscopic identification and description of sedimentary rocks.
 - 1. Megascopic: conglomerate, breccia, sandstone, ferruginous sandstone, shale, arkose, grit, limestone, fossiliferous limestone, laterite and bauxite.
 - 2. Microscopic: sandstone, arkose, limestone, oolitic limestone and fossiliferous limestone.
- B. Megascopic and microscopic identification and description of textures and structures of sedimentary rocks.
 - 1. Megascopic: clastic, stratification, lamellar, cross bedding, graded bedding, ripple marks and mudcracks.
 - 2. Microscopic: clastic, oolitic

METAMORPHIC

- A. Megascopic and microscopic identification and description of metamorphic rocks.
 - 1. Megascopic: quartzite, marble, chlorite schist, hornblende schist, mica garnet schist, granite gneiss, hornblende gneiss, augen gneiss, banded hematite quartzite slate and phyllite.
 - 2. Microscopic: quartzite, marble, chlorite schist, mica garnet schist, granite gneiss and hornblende gneiss.
- B. Megascopic and microscopic identification and description of textures and structures of metamorphic rocks.
 - 1. Megascopic: granulose, schistose, gneissose, augen and slaty
 - 2. Microscopic: granulose, schistose, gneissose and slaty

CC – VII LABORATORY COURSE

STRATIGRAPHY:

Preparation of lithostratigraphic map of India showing distribution of important geological formations such as Dharwar, Cuddapah, Gondwana, Vindhyan and Deccan Traps with their brief description.

CC – VIII LABORATORY COURSE

PALAEONTOLOGY:

Study of morphological characters of hard parts with description of fossil genera and age of following phylum:

A. PHYLUM MOLLUSCA:

1. Class Pelecypoda (Lamellibranchia): *Cardita*, *Cardium* and *Pectene*.
2. Class Gastropoda: *Conus*, *Turritella* and *Voluta*.
3. Class Cephalopoda: *Nautilus*, *Orthoceras* and *Goniatites*.

B. PHYLUM BRACHIOPODA: *Spirifer*, *Terebratulite* and *Productus*.

C. PHYLUM ECHINODERMATA: *Echinus*, *Micraster* and *Hemiaster*

D. PHYLUM ARTHROPODA:

Class Trilobita: *Ogygia*, *Paradoxida* and *Trinucleus*.

E. PLANT FOSSILS: *Glossopteris* and *Gangamopteris*

***Project and Viva-voce* - on related topic**

Annexure -I
Scheme of Marking for End Semester Examination (GEOLOGY-Theory)

Day and date:

Maximum Marks: 40

Time: 2 Hrs

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

Q.1: Fill in the blanks by choosing correct alternatives (eight): 08

- 1)
- 2)
- 3)
- 4)
- 5)
- 6)
- 7)
- 8)

Q.2: Answer the following questions briefly (any four): 08

- 1)
- 2)
- 3)
- 4)
- 5)
- 6)

Q.3: Write notes on any two of the following 08

- 1)
- 2)
- 3)

Q.4: Attempt the following 08

- 1)
- 2)

Q.5: Answer any one of the following 08

- 1)
- 2)

Annexure - II

Scheme of Marking for Practical Examination

Total Marks: 80

Session – I

Q.No.		Marks
1	Identification and description of minerals under thin section. Table 1 to 5	10
2	Identification and description of fossils kept on table nos. 6 to 10	10

Session – II

3	Microscopic identification and description of rocks from table no. 1 to 5	10
4	Identification and description of rocks megascopically from table no. 6 to 10.	10

Session – III

5	Microscopic identification and description of textures and structures of rocks from table no. 1 to 3	06
6	Identification and description textures and structures of rocks megascopically from table no. 4 to 13.	10
7	Identify, mark and describe following two geological formations on the Map of India. Table nos. 14 and 15	04
	1. _____ 2. _____	

Session -IV

8	Project and Viva-voce	10
9.	Certified completed Journal	10

B O S in Geology
(Dr. P. D. Mali)
 Chairman BOS

Justification for the Enhancement of Portion:

- Basic concept, knowledge of the Rocks is essential in understanding the broad types - Igneous, Sedimentary and Metamorphic along with their genesis, textures, structures
- Classification, mineral composition, various types of rocks help in understanding their significance as a quality of building material
- Stratigraphy is a basic branch which helps to understand past history of the earth along with principles and correlation. Geological time scale gives idea about evolutionary history of earth using fossils
- Correlation helps students to know for various aspects viz. paleo-geography, tectonic history, ore deposits
- Paleontology study is useful in understanding modes of preservation and significance of fossils.
- Study of morphology of hard parts of Invertebrates help to understand the body parts, evolution, geological time range.

Depth of Enhanced Portion in Semester III and IV:

Paper-V: Significance of types of Igneous rocks

Paper-VI: Retrograde and Poly-metamorphism, Anatexis
Significance of Sedimentary and Metamorphic rocks

Paper-VII: Study of Gondwana system and Intra and Infra trapean beds

Paper-VIII: Evolutionary history of Man

Practical: Project and Viva-voce

Outline of Examination:

- **Internal Examination (Theory):** Internal examination will consist of **10 marks** per semester per paper. It may be held as **any two components** per semester from (a) to (e).
 - f) Presentation
 - g) MCQ Test
 - h) Field studies / Study visits
 - i) Home Assignments
 - j) Written Class Test
- **Internal Evaluation (IE) (Practical):** Internal examination will consist of 20 marks and may consists of:
 - a) Marks for practical examination: 15 marks
 - b) Oral examination : 03 marks
 - c) Marks for Journal : 02 marks
- **End Semester Examination (Theory):** The detailed question paper pattern is given as **Annexure-I**.
- **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-II**.

