Godhatma Shaikshanik Bahuuddeshiya Sanstha's
M G Tele Commerce College, Chindha and Baraku Ramaji Tele Science College, and Kesharbai Tele College of Management
Thalner, Tal- Shirpur, Dist- Dhule. Thalner - 425421 (MS)
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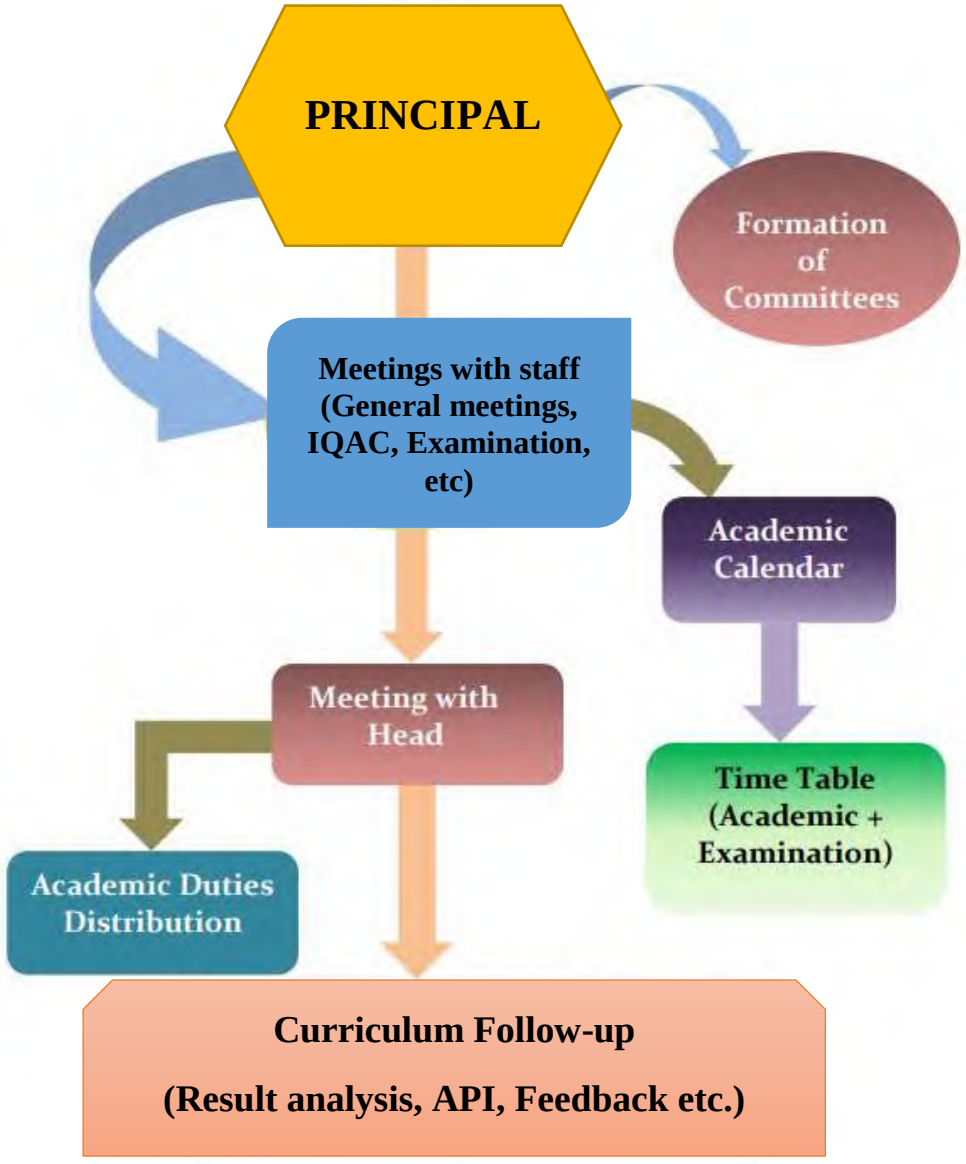
ISO: 9001:2015

Prof. V. S. Shrivastava
Ph.D., D.Lit. (Hon.), Post Doct. (South America)
Principal

Dr. C. G. Tele
M. Sc. (IIT), Ph. D (U.K)
Chairman

1.1.1: The Institution ensures effective curriculum delivery through a well-planned and documented process



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M.G.Tele Com.,C & B.R.Tele Science and K.Tele Management College, Thalner,Tal.Shirpur,Dist.Dhule

2022

Kavayitri Bahinabai Chaudhari North Maharashtra University, Jalgaon

Syllabus

Class : F. Y. B. Sc.

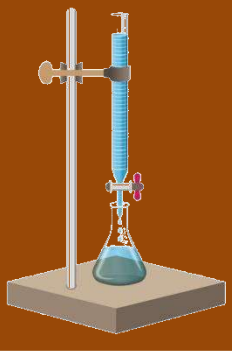
Subject : Chemistry

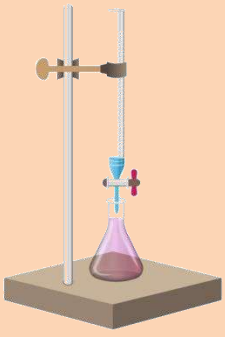
Choice Based Credit System (CBCS)

(With effect from June 2022)

Prepared By

Board of Studies in Chemistry,
Kavayitri Bahinabai Chaudhari North Maharashtra University, Jalgaon





asd;Dr.

Revised Syllabus of F.Y.B.Sc. Chemistry

(With effect from June 2022)

Choice Based Credit System (CBCS) Pattern

In the Faculty meeting chaired by Hon. Dean of Science faculty, the revised syllabus for F.Y.B.Sc. (Chemistry) is accepted and finalized as per guidelines of Academic Council and with reference to the U.G.C. model curriculum. The course structure for F.Y.B.Sc. (Chemistry) is as given below.

Course (Paper code)	Paper	Semester	No. of lectures	Credits	Internal Marks	External Marks
CH-101	**Physical & Inorganic Chemistry (Core Course)**	**I**	**30**	**02**	**40**	**60**
CH-102	**Organic & Inorganic Chemistry (Core Course)**	**I**	**30**	**02**	**40**	**60**
CH-103	**Chemistry Practical**	**I**	**60**	**02**	**40**	**60**
CH-201	**Physical & Inorganic Chemistry (Core Course)**	**II**	**30**	**02**	**40**	**60**
CH-202	**Organic & Inorganic Chemistry (Core Course)**	**II**	**30**	**02**	**40**	**60**
CH-203	**Chemistry Practical**	**II**	**60**	**02**	**40**	**60**

Note:

1. Each lecture is of one hour duration.
2. Each theory paper has two lectures per week.
3. Each practical course has four lectures per week.

Chairman B.O.S. **Dean Science Faculty**

Kavayitri Bahinabai Chaudhari

North Maharashtra University, Jalgaon

Revised Syllabus of F.Y.B.Sc. Chemistry (w.e.f. June 2022)

Choice Based Credit System (CBCS) Pattern

Semester I

Paper- CH: 101 Physical and Inorganic Chemistry

Chapter 1: Atomic Structure (Part-I) (L: 06, M: 12)

a) Atomic Models: Thomson Model, Rutherford's Nuclear Model

b) Emission and Absorption Spectra: Line spectra and band spectra, line spectra of Hydrogen atom,

c) Bohr Model for Hydrogen atom, explanation of line spectra of hydrogen atom, Limitations & Reasons for failure of Bohr Model

d) Quantum Mechanical Model of atom: Dual behaviour of matter, Davisson–Germer experiment, Heisenberg's Uncertainty Principle, Orbitals and quantum numbers and their importance

Ref: 1, 2 (relevant pages)

Learning Outcome

Students will develop knowledge about:

i) Various theories and principles applied to reveal atomic structure.

ii) Nature of matter and experiments which confirmed it.

iii) Significance of quantum numbers.

Chapter 2: Mathematical Preparation in Chemistry (L: 06, M: 12)

a) Logarithm: Rules of Logarithm (without proof), Characteristic and Mantissa of Logarithm, Negative Logarithm, numerical based on applications of Logarithm in calculating pH with change of base of logarithm, antilogarithm.

b) Graphical representation of equations: Rules for drawing graph co-ordinates etc., Equation of straight line, slope and intercept, plotting the graph from the given experimental data and numericals.

c) Derivative: Significance, Rules of differentiation (without proof), Algebraic, Logarithmic and exponential functions and numerical.

d) Integration: Significance, rules of integration (without proof), Integration with limit, Algebraic, Logarithmic and exponential functions and numerical.

e) Numericals of each method related to Chemistry.

Ref: 3 (relevant pages)

Learning Outcome

Students will be able to:

i) Apply the rules of logarithm for solving numericals in chemistry

ii) Draw, calculate the slope of various graphs for chemistry experiments

iii) Calculate derivative and integration of some simple functions especially related to chemical problems

Chapter 3: The Gaseous State (L: 08, M: 16)

a) Molar gas constant R, its values in different units and its significance, the kinetic theory of ideal gases. Assumptions of kinetic theory of gases. Kinetic gas equation and its Significance (Derivation not expected), Deductions of Avogadro's principle, Graham's law, kinetic energy of translation.

b) Deviation of real gases from ideal behaviour. Reasons for deviation, compressibility factor, Van der Waal's equation, its applications. Andrew's isotherms of CO_2, relation between critical constants and Van der Waal's constants, liquification of Gases, Joule Thomson effect, related numerical

Ref. 1, 2 (Relevant pages)

Learning Outcome

Students will develop knowledge about,

i) The basics of kinetics theory and concepts therein.

ii) Factors causing the deviations from ideal behaviour of gases

iii) Compressibility, liquification and related critical constants of a system

Chapter: 4 Atomic structure (Part-II) (L: 05, M: 10)

a) Long form of periodic table, Periodic law, modern periodic law, electronic configuration, Aufbau principle, Hund's rule, Pauli's Exclusion principle, Principle of stability.

b) Classification of elements based on electronic configuration and energy levels

c) Shapes of s, p and d-orbitals.

Ref: 9, 10 (Relevant pages)

Learning outcomes

Students will be able:

i) To know about the structure of atom.

ii) To acquire the knowledge about the arrangement of elements in a periodic table

iii) To familiar with the classification of elements in periodic table.

iv) To know about the principle involved in arrangements of electrons in atoms.

v) To understand the shapes of different types of orbitals present in atoms.

Chapter: 5 Periodic properties (L:05, M:10)

Periodicity in the following properties right through the periodic table:

a) Atomic and ionic size: Definition and explanation of atomic radius, ionic radius, covalent radius and Van der Waals radius, Variation of atomic size along a period and a group.

b) Ionisation energy: Definition and explanation, factors affecting ionisation energy, Variation of ionisation energy along a period and a group. Applications of I. E. to chemical behavior of an element.

c) Electron affinity: Definition and explanation, factors affecting electron affinity, Variation of electron affinity along a period and a group.

d) Electronegativity: Definition and explanation, factors affecting electronegativity, Variation of electronegativity along a period and a group, Pauling's electronegativity scale, Mullikan's approach of electro negativity, electro negativity and percent ionic character.

e) Metallic character: Variation of metallic character along a period and a group.

Ref: 9, 11 (Relevant pages)

Learning outcomes

Students will be able:

i) To understand the periodic law and systematic study of elements.

ii) To find the factors affecting periodic properties.

iii) To understand periodic properties and their general trends in groups and periods. (Atomic size, Ionization energy, Electron affinity, Electro negativity, Metallic properties).

iv) To correlate these periodic properties with the chemical behavior of elements.

v) To understand the different methods used to determine electronegativity.

References:

1. Principles of Physical Chemistry, B. R. Puri, L. R. Sharma, M.S. Pathaniya
2. Essentials of Physical Chemistry, B. S. Bahl, G. D. Tuli, Arun Bahl (S. Chand & Co Ltd.)
3. Mathematical Preparation for Physical Chemistry, Farrington Daniels, Mc Graw- Hill Publication.
4. Barrow, G.M. Physical Chemistry Tata McGraw-Hill (2007)
5. Atkins' Physical Chemistry, 10th edition (2014), Oxford University Press
6. Thomas Engel, Philip Reid; Physical Chemistry, Pearson Education (2006)
7. J. N. Gurtu, A. Gurtu, Advanced Physical Chemistry, Pragati Edition
8. Principles of Physical Chemistry 4th edition Samuel Maron, Carl F. Prutton, Oxford & IBH Publishing.
9. Concise inorganic chemistry – J. D. Lee (5th edition).
10. Principles of Inorganic Chemistry – Puri, Sharma, Kalia.
11. Advanced Inorganic Chemistry (Vol I) (Satyaprakash, G. D. Tuli, S. K. Basu, R. D. Madan) (S. Chand and Co Ltd.) Page Nos. 364-376.
12. Inorganic Qualitative Analysis—A I Vogel
13. Practical chemistry (for B.Sc. I, II and III year students) – O P Pandey, D. N. Bajpai and S. Giri (S Chand and company Ltd)
14. Theoretical Principles of Inorganic Chemistry – G S Manku.
15. Analytical Chemistry – G. D. Christian (6th Edition).
16. A new guide to Modern Valency Theory –G. I. Brown.

Paper- CH: 102 Organic and Inorganic Chemistry

Chapter 1: Basic principles of organic chemistry (L:12, M:24)

a) Introduction, general properties of organic compounds, applications of organic compounds in everyday life.

b) Covalent bond, double and triple bonds, structural formulae of organic compounds

c) Structure of benzene, stability of benzene (heat of hydrogenation), Huckel's rule of aromaticity, derivatives of benzene and their nomenclature (mono & disubstituted benzene only)

d) Structural effects: Inductive effect, resonance, hyperconjugation, steric effect, electromeric effect and their effect on the strength of acids and bases.

e) Fundamentals of organic reaction mechanism: Fission of covalent bond: homolytic and heterolytic fission, reactive intermediates: carbocations, carbanions and carbon free radicals, types of reagents: electrophiles and nucleophiles, types of organic reactions: addition, elimination, substitution and rearrangement reactions.

f) Isomerism, types of isomerism, structural isomerism

g) Purification of organic compounds: recrystallization (by water and alcohol), distillation and sublimation

h) Solvents, properties of solvents, types of solvents i) protic and aprotic ii) polar and nonpolar

Ref. 1,2,3,4,5 (relevant pages)

Learning outcomes

Students will be able to understand:

1. The properties of organic compounds.
2. Different types of bonds and structures of organic compounds.
3. Different types of structural effects and their effect on the strength of acids and bases.
4. Fundamentals of organic reaction mechanism, structural isomerism, methods of purification of organic compounds.
5. Different types of solvents used in organic reactions.

Chapter 2: Hydrocarbons (L:08, M:16)

a) Alkanes: Introduction to alkanes and cycloalkanes, SP^3 hybridization in ethane molecule, nomenclature (common and IUPAC system), isomerism in alkanes

b) Preparation of alkanes: by Wurtz reaction, by hydrogenation of alkenes. Reactions of alkanes: halogenation, nitration, combustion.

c) Alkenes: Introduction, SP^2 hybridization in ethylene molecule, nomenclature (common and IUPAC system), geometrical isomerism in alkenes

d) Preparation of alkenes: by dehydration of alcohols, dehydrohalogenation of alkyl halides, dehalogenation of vicinal dihalides and partial reduction of alkynes by Lindlar catalyst. Reactions of alkenes: Addition of halogen, hydrogen halide, Sulphuric acid and hydration.

e) Alkynes: Introduction, SP hybridization in acetylene molecule, nomenclature (common and IUPAC system), acidity of acetylene and terminal alkynes.

f) Preparation of alkynes: by Double Dehydrohalogenation of vicinal and geminal dihalides, by alkylation of acetylene.

g) Reactions: Addition of halogens, hydrogen halides, hydration, hydrogenation, ozonolysis.

Ref. 1,2,3,4 (relevant pages)

Learning outcomes

Students will be able to understand:

1. SP^3, SP^2 and SP hybridizations.
2. Nomenclature of alkanes, alkenes and alkynes.
3. Different methods of preparation of alkanes, alkenes and alkynes.
4. Different reactions of alkanes, alkenes and alkynes.

Chapter: 3 Hybridization and shapes of covalent molecules (L: 10, M: 20)

a) Hybridization: Definition, need of hybridization, steps involved in hybridization, characteristics of hybridization. Types of hybridizations involving s, p and d orbitals: SP^3d, SP^3d^2, SP^3d^3 and dSP^2 hybridizations.

b) Applications of hybridization concept: geometries of molecules like PCl_5, SF_6, IF_7 and $[Ni(CN)_4]^{2-}$ ions.

c) Valence Shell Electron Pair Repulsion (VSEPR) Theory: assumptions, need of theory, Applications of the theory to explain geometry of irregular molecules like $SnCl_2$, NH_3, H_2O, ClF_3, SF_4, BrF_5, ICl_2^-, ICl_4^-. Limitations of VSEPR theory.

Ref: 8, 9, 10 (relevant pages)

Learning outcomes

Students will be able to understand:

1. Concept of hybridization, steps involved in hybridization, characteristics and types of hybridization.
2. Applications of hybridization concept to understand geometries of different molecules.
3. Valence Shell Electron Pair Repulsion (VSEPR) Theory and its applications to explain geometry of irregular molecules.
4. Limitations of VSEPR theory.

Reference Books

1) Organic chemistry - Francis A Carey (6th Edition)
2) Organic chemistry - Morrison and Boyd (6th Edition)
3) Organic chemistry - Stanley H pine (5th Edition)
4) A Text book of Organic chemistry- Arun Bahl and B S Bahl, S Chand publication.
5) Guide book to mechanism in organic chemistry -Peter Sykes (6th Edition)
6) Undergraduate organic chemistry volume I – Jagdamba Singh and LDS Yadav
7) Organic Chemistry (Volume 1) – I L Finar
8) Concise inorganic chemistry – J. D. Lee (5th edition).
9) Principles of Inorganic Chemistry – Puri, Sharma, Kalia.
10) Advanced Inorganic Chemistry (Vol I) (Satyaprakash, G. D. Tuli, S. K. Basu, R. D. Madan) (S. Chand and Co Ltd.) Page Nos. 364-376.
11) Inorganic Qualitative Analysis—A I Vogel
12) Practical chemistry (for B.Sc. I, II and III year students) – O P Pandey, D. N. Bajpai and S. Giri (S Chand and company Ltd)
13) Theoretical Principles of Inorganic Chemistry – G S Manku.
14) Analytical Chemistry – G. D. Christian (6th Edition).
15) A new guide to Modern Valency Theory –G. I. Brown.

Semester II

Paper- CH: 201 Physical and Inorganic Chemistry

Chapter 1: Liquid State **(L: 06, M: 12)**

a) Introduction, Intermolecular forces in liquid state and their types.

b) Surface tension of liquid, units of surface tension, factors affecting surface tension, Unit of Surface tension, determination of surface tension of liquids by single capillary rise method and Drop formation method.

c) Viscosity of liquid, units of viscosity, measurement of viscosity of liquid by Ostwald's method, related numerical.

Ref. 2, 3 (Relevant pages)

Learning outcomes

Students will be able:

i) To gain knowledge about origin of surface tension.

ii) To determine surface tension.

iii) To get idea regarding viscosity.

iv) To determine viscosity.

Chapter 2: Chemical Equilibrium **(L: 06, M: 12)**

a) Introduction, reversible reaction, characteristics of chemical equilibrium, law of mass action, equilibrium constant: equilibrium law, equilibrium constant in terms of partial pressures, calculations involving Kp, liquid systems, heterogeneous equilibria.

b) Le Chatelier's principle, effect of change in concentration, pressure, temperature, conditions for maximum yield in industrial processes, synthesis of ammonia (Haber process), related numerical.

Ref. 2 (Relevant pages)

Learning outcomes

i) Students will be able to understand equilibrium.

ii) Students will be able to understand different factors affecting equilibrium.

iii) Students gain knowledge about Le Chatelier's principle.

Chapter 3: Second and Third Law of Thermodynamics **(L: 08, M: 16)**

a) Introduction, Limitations of first law of thermodynamics, spontaneous and non-spontaneous process with examples, Statements of second law of thermodynamics,

b) Entropy, Units of entropy, Physical Significance of entropy, entropy changes in isolated systems, entropy changes for systems only, entropy of mixing of gases, entropy changes in ideal gases and physical transformation.

c) Statement of third law of thermodynamics, list its applications, Numerical.

Ref.: 1 and 2

Learning outcomes

h) Students will be able to apply thermodynamic principles to physical and chemical process.

ii) Students will be able to understand spontaneity and non-spontaneity.

iii) Calculations and significance of entropy.

iv) Third law of thermodynamics and its applications.

Chapter: 4 Principles involved in Inorganic Qualitative Analysis (L: 06, M: 12)

a) Difference between crystalline and amorphous substance, meaning of dry and wet tests, precipitate, Group reagents.

b) Ionic product, Solubility product, Common ion effect.

c) Use of Cobalt nitrate, Sodium carbonate, Hydrogen sulphide and Ammonium chloride in qualitative analysis.

Ref: 10, 11 (Relevant pages)

Learning outcomes

Students will be able:

i) To familiar with the Inorganic Qualitative Analysis.

ii) To understand the basic principles behind the group precipitation of basic radicals like solubility product and common ion effect.

iii) To understand the role of some compounds in qualitative analysis viz. Use of Cobalt nitrate, Sodium carbonate, Hydrogen sulphide and Ammonium chloride in detection of basic radicals.

iv) To focus on systematic separation and detection of ions in aqueous solutions.

Chapter: 5 Ionic equilibria (L: 04, M: 08)

a) Strong and weak acids and bases, degree of dissociation, dissociation constants of acids and bases.

b) p^H and p^{OH}, numerical based on p^H and p^{OH} only, ionic product of water, Henderson-Hassalbalch's equation of indicator.

c) Buffer solutions: Definition, types, buffer action, buffer capacity, applications of buffer solutions.

Ref: 8, 11, 12, 13 (Relevant pages)

Learning outcomes

Students will be able:

i) To understand the criteria of classification of acids and bases.

ii) To identify and write different types of equilibria of an electrolyte in solutions.

iii) To calculate the p^H and p^{OH} of different electrolytes.

iv) To know about the buffer solution and its applications.

References

1. Principles of Physical Chemistry, S. H. Maron and C. F. Prutton (4th edition).
2. Essentials of Physical Chemistry, B. S. Bahl, G. D. Tuli, Arun Bahl (S. Chand and Co Ltd.) (25th edition).
3. Elements of Physical Chemistry, S. Glasstone and D. Lewis (The Macmillan Press Ltd. (2nd edition).
4. Essentials of Physical Chemistry, B. S. Bahl, G. D. Tuli, Arun Bahl (S. Chand and Co Ltd.)
5. Physical Chemistry Barrow, G.M. Tata McGraw-Hill (2007)
6. Atkins' Physical Chemistry, 10th edition (2014), Oxford University Press
7. Concise inorganic chemistry – J. D. Lee (5th edition).
8. Principles of Inorganic Chemistry – Puri, Sharma, Kalia.
9. Advanced Inorganic Chemistry (Vol I) (Satyaprakash, G. D. Tuli, S. K. Basu, R. D. Madan) (S. Chand and Co Ltd.) Page Nos. 364-376.
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12. Theoretical Principles of Inorganic Chemistry – G S Manku.
13. Analytical Chemistry – G. D. Christian (6th Edition).
14. A new guide to Modern Valency Theory –G. I. Brown.

Paper- CH: 202 Organic and inorganic chemistry

Chapter 1: Haloalkanes and haloarenes (L:06, M:12)

a) Haloalkanes: Introduction, classification and nomenclature of haloalkanes (common and IUPAC system)

b) Mono halogen derivatives: Classification, methods of preparation: from alcohols (using HX, PX_3, PX_5, $SOCl_2$). Reactions: with aqueous alkali, sodium alkoxide, alc. KCN, silver salt of acid, alc. ammonia, NaSH/ KSH, dehydrohalogenation, formation of Grignard's reagent.

c) Di halogen derivatives: preparation of vicinal and geminal dihalides, reactions: hydrolysis with aq. NaOH.

d) Haloarenes: Introduction, nomenclature, reactions of haloarenes: nucleophilic substitution reactions with $NaNH_2$/ KNH_2, NaOH, NH_3, CuCN, Ullman reaction.

Ref. 1,2,3,4 (relevant pages)

Learning outcomes

Students will be able to understand:

1. Haloalkanes, their classification and nomenclature.
2. Different methods of preparation of mono halogen derivatives.
3. Different reactions of mono halogen derivatives.
4. Different methods of preparation and reactions of di halogen derivatives.
5. Different methods of preparation and reactions of haloarenes.

Chapter 2: Alcohols, phenols and ethers (L:06, M:12)

a) Alcohols: Introduction, classification, nomenclature (common and IUPAC system), methods of preparation of monohydric alcohols: from Grignard's reagent (using aldehydes and Ketones), by reduction of aldehydes and ketones, by hydroboration, by oxymercuration-demercuration. Preparation of dihydric alcohols by hydroxylation of alkenes.

b) Physical properties of alcohols. Reactions of alcohols: reaction with active metals, dehydration, oxidation and ester formation.

c) Phenols: Introduction, nomenclature, acidity of phenols, Preparation of phenol from benzene sulphonic acid, benzene diazonium chloride and from chlorobenzene.

d) Reactions of phenols: ester formation (acylation), formation of aryl ethers, Kolbe reaction, catalytic hydrogenation.

e) Ethers: Introduction, classification, nomenclature (common and IUPAC system), methods of preparation: by Williamson's synthesis, by dehydration of alcohols and from diazomethane. Reactions of ethers: reaction with hot and cold HI, hydrolysis with dil. H_2SO_4. Crown ethers (Introduction only)

Ref. 1,2,3,4 (relevant pages)

Learning outcomes

Students will be able to understand:

1. Alcohols, their classification and nomenclature.
2. Different methods of preparation and reactions of alcohols.
3. Different methods of preparation and reactions of phenols.
5. Different methods of preparation and reactions of ethers.

Chapter 3: Aldehydes and ketones (L:08, M:16)

a) Introduction, structure of carbonyl group, nomenclature of aldehydes and ketones (common and IUPAC system)

b) Aldehydes: Preparation of aldehydes: by reduction of acid chlorides, from Grignard's reagent and HCN, from terminal geminal dihalides and from calcium salt of acids. Preparation of benzaldehyde: by Gattermann Kotch reaction, by oxidation of toluene, by side chain chlorination of toluene.

c) Ketones: Preparation from Grignard's reagent and R-CN, from nonterminal geminal dihalides, from calcium salt of acids. Preparation of acetophenone: by oxidation of ethyl benzene, by F C acylation.

d) Reactions of aldehydes & Ketones: Reducing properties of aldehydes: reaction with Tollen's reagent and Fehling's solution, Clemmenson reduction, Wolff Kishner reduction, Aldol condensation, Cannizzaro reaction, addition of HCN, $NaHSO_3$, addition of derivatives of ammonia (hydroxyl amine, phenyl hydrazine, 2,4 DNP, semicarbazide), hydration, addition of alcohols, benzoin condensation of benzaldehyde.

Ref. 1,2,3,4 (relevant pages)

Learning outcomes

Students will be able to understand:

1. Carbonyl compounds like aldehydes & Ketones, their classification and

nomenclature.

2. Different methods of preparation and reactions of aliphatic and aromatic aldehydes.
3. Different methods of preparation and reactions of aliphatic and aromatic ketones.

Chapter: 4 Chemical bonding and structure (L: 04, M: 08)

a) Attainment of stable configuration, Types of bonds-
   1. Ionic bond-NaCl, $CaCl_2$
   2. Covalent bond (Lewis concept)- H_2, Cl_2, HF, NH_3, H_2O, O_2 and N_2, molecules.
   3. Coordinate bond- NH_4^+, H_3O^+
   4. Metallic bond.

b) Types of overlaps: S-S, S-P and P-P overlaps with examples of H_2, HF, F_2, O_2, and N_2 molecules.

c) Theories of bonding: Valence Bond Theory, Heitler-London theory and Pauling-Slater theory.

Ref: 8, 10, 15 (Relevant pages)

Learning outcomes

Students will be able:

i) To understand different types of bonds.

ii)To understand different types of overlaps

iii)To understand different theories of chemical bonding

Chapter: 5 Metals and Metallurgy (L: 06, M: 12)

Occurrence of metals, various steps involved in metallurgical processes, concentration of ore, Hand picking, gravity separation, Magnetic separation, froth floatation, calcinations, roasting, reduction to free metals, Flux, Types of fluxes, Slag, electrometallurgy, hydrometallurgy, refining of metals.

Ref: 9, 13 (Relevant pages)

Learning outcomes

Students will be able:

i)To understand the importance of metallurgy in industries.

ii)To know the various steps involved in metallurgical processes.

iii)To understand the basic principles involved in separation, extraction and refining techniques of metals.

Reference Books

1) Organic chemistry - Francis A Carey (6th Edition)
2) Organic chemistry - Morrison and Boyd (6th Edition)
3) Organic chemistry - Stanley H pine (5th Edition)
4) A Text book of Organic chemistry- Arun Bahl and B S Bahl, S Chand publication.
5) Guide book to mechanism in organic chemistry -Peter Sykes (6th Edition)
6) Undergraduate organic chemistry volume I – Jagdamba Singh and LDS Yadav
7) Organic Chemistry (Volume 1) – I L Finar
8) Concise inorganic chemistry – J. D. Lee (5th edition).
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13) Theoretical Principles of Inorganic Chemistry – G S Manku.
14) Analytical Chemistry – G. D. Christian (6th Edition).
15) A new guide to Modern Valency Theory –G. I. Brown.

CH:103 Chemistry Practical (Semester I)

A) Physical Chemistry Experiments (Any 2)

1. Determination of integral enthalpy of solution of salts (KNO_3, NH_4Cl)
2. Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter.
3. Determination of dissociation constant of weak monobasic acid (CH_3COOH) by conductance measurement.
4. Determination of relative viscosity of liquid A and B by viscometer.
5. Determination of percentage composition (v/v) of given mixture of ethyl alcohol and water by viscometer.

B) Analytical Chemistry Experiments (Any 3)

1. Preparation of std. 0.1N oxalic acid solution and standardization of NaOH solution.
2. Preparation of std. 0.1N $K_2Cr_2O_7$ solution and standardization of ferrous ammonium sulphate solution.
3. Preparation of std. 0.1N NaCl solution and standardization of $AgNO_3$ solution.
4. Preparation of std. 0.1N $ZnSO_4$ solution and standardization of EDTA solution.
5. Determination of loss per gram and percentage purity of Zinc Carbonate gravimetrically.

(Instruction: Prepare standard solutions preferably by using 50 ml volumetric flask)

C) Organic Qualitative Analysis (Any 5 compounds)

1) Type determination
2) Preliminary tests
3) Physical constant
4) Functional group tests

(Structural formula not expected)

CH: 203 Chemistry Practicals (Semester II)

A) Physical Chemistry Experiments (Any 3)

1. Determination of surface tension of given liquid by drop number method using stalagnometer.
2. Determination of surface tension of given liquid by drop weight method using stalagnometer.
3. Determination of heat of solution of KNO_3 / NH_4Cl by water equivalent method.
4. Determination of normality and strength in g/l of acid (HCl or CH_3COOH) conductometrically.
5. Determination of Solubility of Sparingly soluble salt by conductance measurement.
6. To standardize commercial sample of HCl using Borax and to write material safety data of the chemicals involved.

B) Analytical Chemistry Experiments (Any 2)

1. Preparation of standard 0.1N Na_2CO_3 solution and standardization of HCl solution.
2. Preparation of 0.1 N oxalic acid solution and standardization of $KMnO_4$ solution.
3. Preparation of 0.1 N $Na_2S_2O_3$ solution and estimation of Cu (II) ions iodometrically.
4. Determination of total hardness of water.

(Instruction: Prepare standard solutions preferably by using 50 ml volumetric flask)

C) Inorganic Qualitative Analysis (Any 5 compounds)

Analysis of inorganic compound containing one cation and anion

External Examination Pattern

Chemistry Practical Semester I/ II (CH-103/203)

Time: 3 Hrs.	**Marks 60**
Q. 1. Physical Chemistry / Analytical Chemistry experiment	40 Marks
OR	
Inorganic/ Organic Qualitative analysis	
Q. 2. Oral	10 Marks
Q. 3. Journal	10 Marks
	Total: 60 Marks

Internal Examination Pattern

Chemistry Practical Semester I/ II (CH-103/203)

Time: 3 Hrs.	**Marks 40**
Q. 1. Physical Chemistry/ Analytical Chemistry experiment	30 Marks
OR	
Inorganic/ Organic Qualitative analysis	
Q. 2. Oral	05 Marks
Q. 3. Attendance and Behavior	05 Marks
	Total: 40 Marks

Note: Distribution of Experiments – One fourth of the total students in a batch will be given physical chemistry experiment, one fourth will be given an analytical chemistry experiment and one half of the students will be given an Inorganic / Organic qualitative analysis.

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Kavayitri Bahinabai Chaudhari

North Maharashtra University, Jalgaon

Syllabus

T.Y.B.Sc.

Subject: Chemistry

Choice Based Credit System

With Effect from June -2020

As Per U.G.C. Guidelines

Prepared By

Board of Studies

Chemistry,

Kavayitri Bahinabai Chaudhari

North Maharashtra University, Jalgaon

Syllabus

Class- T.Y.B.Sc. Subject- Chemistry

Choice Based Credit System (CBCS) (60-40) Pattern

with effect from June-2020

Structure of Curriculum of T.Y.B.Sc. (Chemistry)

Semester – V

Course Type	Course code	Course Title	Credits	Hours per week	Teaching Hours
Core I	CH – 501	Principles of Physical Chemistry-I	3	3	45
Core II	CH – 502	Inorganic Chemistry	3	3	45
Core III	CH – 503	Organic Reaction Mechanism	3	3	45
Core IV	CH – 504	Industrial Chemistry	3	3	45
Skill Enhancement (SEC)	CH – 505	Analytical Instrumentation	3	3	45
Elective **(Any One)**	CH – 506 (A)	Biochemistry	3	3	45
	CH – 506 (B)	Green Chemistry	3	3	45
Core course **(Practical)**	CH – 507	Physical Chemistry Practical	2	4 (Per Batch)	60
	CH – 508	Inorganic Chemistry Practical	2	4 (Per Batch)	60
	CH – 509	Organic Chemistry Practical	2	4 (Per Batch)	60
Non-Credit Audit Course **(Any One)**	AC-510	NSS	No Credit	2- Batches	60
	AC-511	NCC		2- Batches	60
	AC-512	Sports		2- Batches	60

Note:

1. Each lecture is of one hour (60 Minutes) duration.
2. Each theory paper has three lectures per week.
3. Each practical course has four lectures per week.
4. An industrial study tour is compulsory for the T.Y.B.Sc. Students. The students should submit their tour reports at the time of practical examination of VIth Semester.

5. Use of Chart/Text book/Hand book of practical is allowed during examination.
6. Scientific calculator (non-programmable) is allowed during theory and practical examination.
7. All units should be in SI unit.

Semester VI

Course Type	Course code	Course Title	Credits	Hours per week	Teaching Hours
Core I	CH – 601	Principles of Physical Chemistry-II	3	3	45
Core II	CH – 602	Chemistry of Inorganic Solids	3	3	45
Core III	CH – 603	Spectroscopic Methods of Structure Determination	3	3	45
Core IV	CH – 604	Chemistry of Industrially Important Products	3	3	45
Skill Enhancement	CH – 605	Analytical Techniques	3	3	45
Elective **(Any One)**	CH – 606 (A)	Polymer Chemistry	3	3	45
	CH – 606 (B)	Research Methodology for Chemistry	3	3	45
Core course **(Practical)**	CH – 607	Physical Chemistry Practical	2	4 (Per Batch)	60
	CH – 608	Inorganic Chemistry Practical	2	4 (Per Batch)	60
	CH – 609	Organic Chemistry Practical	2	4 (Per Batch)	60
Non-Credit Audit Course **(Any One)**	AC-610	Soft Skill	No Credit	2- Batches	60
	AC-611	Yoga		2- Batches	60
	AC-612	Practicing Cleanliness		2- Batches	60

Note:

1. Each lecture is of one hour (60 Minutes) duration.
2. Each theory paper has three lectures per week.
3. Each practical course has four lectures per week.

4. An industrial study tour is compulsory for the T.Y.B.Sc. Students. The students should submit their tour reports at the time of practical examination of VI Semester.
5. Use of Chart/Text book/Hand book of practical is allowed during examination.
6. Scientific calculator (non-programmable) is allowed during theory and practical examination.
7. Values required for spectral problems should be provided in the question paper.
8. All units should be in SI unit.

Chairman B.O.S. **Dean Science Faculty**

Aims and Objectives

To enable the students-

- To promote understanding of basic facts and concepts in Chemistry while retaining the excitement of Chemistry.
- To make students capable of studying Chemistry in academic and Industrial courses.
- To expose the students to various emerging new areas of Chemistry and apprise them with their prevalent in their future studies and their applications in various spheres of chemical sciences.
- To develop problem solving skills in students.
- To expose the students to different processes used in Industries and their applications.
- To develop ability and to acquire the knowledge of terms, facts, concepts, processes, techniques and principles of subjects,
- To develop ability to apply the knowledge of contents of principles of chemistry.
- To inquire of new knowledge of chemistry and developments therein.
- To expose and to develop interest in the fields of chemistry
- To develop proper aptitude towards the subjects.
- To develop the power of appreciations, the achievements in Chemistry and role in nature and society.
- To develop skills required in chemistry such as the proper handling of apparatus and chemicals.

NOTE:

1. There are in all Six theory courses (4 Core courses, 1 Skill Enhancement course, 1 Elective) and Three practical (Core course practical) courses for each semester.
2. Each theory paper carry 100 Marks out of which 40 Marks are allotted for internal assessment and 60 Marks for external assessment.

3. As per the directions given by University, at the end of each semester internal examination will be conducted for 40 marks and University Examination will be conducted for 60 Marks.
4. The student has a right to choose any one of the optional paper for V^{th} semester either CH-506 (A) OR CH-506 (B), Similarly The students has a right to choose any one of the optional paper for VI^{th} semester either CH – 606 (A) OR CH – 606 (B).
5. A student is expected to submit a journal certified by the Head of the Department/Head of the Institution for each semester.
6. A student will not be permitted to appear for the practical examination unless he/she produce a certified journal. If the journal is lost, the student should produce a certificate from Head of the department / Head of the Institution stating that he/she has satisfactorily completed the practical work.
7. Industrial tour is compulsory for all the students.

Rules for Personal Safety in Chemistry Laboratory:

- A long sleeved, knee length laboratory coat/ apron is recommended. Long pants and closed toed shoes must be worn for individual safety. Loose clothing, open style shoes and sandals are prohibited. Long hair must be tied up. Each student will have to get his / her own necessary protection items.
- For eye protection, safety goggles must be worn in the laboratory whenever necessary. If the student wears contact lenses, full protection goggles, which provide total seal around eyes, must be worn. All students are expected to wear safety goggles.
- Prior to the practical examination, the teacher-in-charge will check all protective equipment to ensure that they are in order.
- Pipetting by mouth should be avoided. Use of pro-pipette bulbs is recommended.
    - All laboratories should be equipped with safety chart, adequate first aid requirements and fire extinguishers.

Kavayitri Bahinabai Chaudhari

North Maharashtra University, Jalgaon

T.Y.B.Sc Chemistry Syllabus

(CBCS) Pattern

Semester V **Core Course I**

CH-501

Subject- Principles of Physical Chemistry-I

(Theory: Lectures = 45 hrs. Marks 60) **(Credits: 03)**

Course objectives

- To orient and acquaint the students towards the basic concepts of Quantum Chemistry
- To acquire knowledge about rates of chemical reactions and distinguishing the reaction of different order and their characteristics.
- To understand the basic principles of phase rules and phase diagrams.
- To learn the underlying principles of electrode reactions, electrochemical cells and applications of EMF.

Learning outcomes

After successful completion of this course, students are expected to:

- Understand the significance of wave function and postulates of quantum mechanics.
- Deduce rate equations and half-life equations for first and second order reactions
- Draw and explain the one and two component system phase diagrams.
- Explain the principles of electrode processes and apply them during Practicals.

UNIT-1. Basic Quantum Chemistry **(L-11, M-15)**

Failures of Classical Mechanics, Origin of quantum mechanics, Particle aspect of radiation: Blackbody radiation, Photoelectric effect, Compton Effect, de Broglie's hypothesis: Matter waves, Heisenberg uncertainty principle, Application of Heisenberg's principle,

Interpretation of wave function, Significance of ψ and ψ^2, Normalization of wave function Operators and operator algebra, Eigen functions and Eigen values, various operators in quantum mechanics: Linear momentum, Kinetic energy and Total energy operator (only equations no derivations), Postulates of quantum mechanics.

Ref. 1: 3, 5-10, 12, 13, 30, 31, 36, 37, 79-84, 115-121

Ref. 2: 3-9, 18, 27-29, 36-39, 43-48

Ref. 4: 21, 24, 32-36, 38-44

UNIT-2. Chemical Kinetics (L-11, M-15)

The concept of reaction rates. Effect of temperature, Pressure, Catalyst and other factors on reaction rates. Order and molecularity of a reaction. Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal initial concentrations of reactants) Half–life of a reaction, Pseudo order reactions, General methods for determination of order of a reaction. Effect of temperature on reaction rate, Arrhenius equation (exponential and integrated form), Collision theory, Concept of activation energy and its calculation from Arrhenius equation, Related numerical.

Ref. 3: 732, 734-744, 751-759

Ref. 4: 970-971, 975-978, 984, 988-990, 992, 993

UNIT-3. Phase Equilibrium (L-11, M-15)

Phases, Components and Degrees of freedom of a system, Criteria of phase equilibrium. Gibbs Phase rule and its thermodynamic derivation. Derivation of Clausius –Clapeyron equation and its importance in phase equilibria. Phase diagrams of one-component systems (water and sulphur) and two component systems involving eutectics, Congruent and Incongruent melting points (lead-silver, $FeCl_3$-H_2O only), Related Numerical.

Ref. 3: 697-714, 719-721

Ref. 4: 605-607, 609-614, 616, 617, 623, 626, 627, 631, 632

UNIT- 4. Electrochemical Cell (L-12, M-15)

Introduction, overview of electrode processes, Faradaic and Non-Faradaic Processes, Introduction to electrical double layer, Factors affecting electrode reaction rate and current.

Classification of electrochemical cell, EMF expression for chemical cell with and without transference, Liquid junction potential, Types of liquid junction potential, Minimization of liquid junction potential.

Application of EMF measurement for pH using Hydrogen gas electrode, Quinhydrone electrode and Glass electrode, Related numerical.

Ref. 5: 1-4, 9, 10, 12-14, 23, 24, 64, 72, 73, 74

Ref. 4: 807, 808, 811, 812, 816-818

References and Suggested Readings

1. *Quantum Chemistry, Donald A. McQuarie, , Viva student edition, Viva Books*
2. *Quantum Chemistry, 4th edition, R. K. Prasad, New Age international Publishers.*
3. *Essentials of Physical Chemistry, Arun Bahl, B. S. Bahl, G. D. Tuli, S., Multicolor edition, S. Chand Publication.*
4. *Principles of Physical Chemistry, 44th edition, Puri, Sharma and Pathaniya, Vishal Publishing Co.*
5. *Electrochemical Methods Fundamentals and Applications, 2nd edition, Allen J. Bard and Larry R. Faulkner, John Wiley & Sons.*
6. *Chemical Kinetics, 2nd edition, K. J. Laidler,*
7. *An Introduction to Electrochemistry, S. Glasstone, East-West Press.*

Semester VI **Core Course I**

CH-601

Subject- Principles of Physical Chemistry-II

(Theory: Lectures = 45 hrs, Marks 60) **(Credits: 03)**

Course objectives

- To learn the basics of molecular spectroscopy and rotational spectra.
- To understand the basic principles and applications of nuclear chemistry.
- To learn the consequences of light absorption by atoms and molecules and photochemical reactions.
- To learn the laws of crystallography and basics of crystal structure.

Learning outcomes

After successful completion of this course, students are expected to:

- Analyze the rotational spectra of diatomic molecules and determine the bond length.
- Explain and apply the radioactivity principles for various chemical and biological investigations.
- Describe the mechanism of fluorescence, phosphorescence and photochemical reactions.
- Analyze the given crystal structure and determine the indices of planes, inter-planer distances and type of crystal structure.

UNIT-1. Investigation of Molecular Structure **(L-11, M-15)**

Introduction, Dipole Moment, Induced dipole moment, Electrical polarization of molecules. Orientation of dipole in an electric field, Debye equation. Method of determination of dipole moment, Vapour temperature method, Molecular structure and dipole moment

Interaction of electromagnetic radiation with molecules, Various types of spectra Rotational, Vibration and Electronic energy levels; with principle and example of each type.

Rotational spectroscopy: Rigid and non-rigid rotor diatomic molecule-Moment of inertia, Energy Levels, Selection rule, Intensities of spectral lines, Determination of bond lengths of diatomic and linear triatomic molecules, Isotopic substitution. Related numerical

Ref. 1: 253-257, 259-261

Ref. 3: 5-9, 33-46

UNIT-2. Nuclear Chemistry (L-12, M-15)

Introduction, Radioactive elements, Types of radioactive decay, Decay schemes, General characteristic of radioactive decay, Decay kinetics, Decay constant, Half-life period, Mean life, Units of radioactivity.

Application of radioactivity – Radiochemical principle of tracer technique; Application of tracer technique – Chemical investigation reaction mechanism- esterification, hydrolysis, Oxidation - Oxidation of CO, Structure determination - PCl_5 molecules, Thiosulphate ion, C-14 dating and tritium dating, Medical applications- Thyroditis, Bone fracture Healing, Brain tumor location, Defects in Blood Circulation.

Nuclear Fusion / Fission as source of energy with example

Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its management with case study. Related numerical

Ref. 4: 118-125, 225, 247, 248, 373-378, 402, 403, 407-411

Ref. 1: 103-105, 108-110, 113-115, 120-122, 136-138

Ref 6: 87-94, 108-112

UNIT-3. Photochemistry (L-11, M-15)

Laws of photochemistry, Quantum yield, Examples of low and high quantum yields, Consequence of light absorption by atoms and molecules, Jablonski diagram, Fluorescence, Phosphorescence, Quenching. Experimental setup for determination of quantum yield with actinometer as detector

Photochemical gas reactions, Photolysis of ammonia, Combination of H_2 and Cl_2 reaction, Reaction between H_2 and Br_2, Photosensitized gas reaction, H_2 and O_2, H_2 and CO, Chemiluminescence, Related numerical.

Ref. 1: 1045-1055

Ref. 2: 1044, 1045, 1048, 1049, 1054, 1055, 1059-1061

UNIT-4. Crystal Structure (L-11, M-15)

Forms of solids. Symmetry elements, unit cells, crystal systems, Bravais lattice types and identification of lattice planes. Laws of Crystallography - Law of constancy of interfacial angles, Law of rational indices. Miller indices. X–Ray diffraction by crystals, Bragg's law and Bragg's method. Structures of NaCl, KCl and CsCl (qualitative treatment only). Defects

in crystals: Shottkey and Frenkel defects. Liquid Crystal, Types and Applications. Related numerical

Ref. 1: 449-454, 456-463, 472-474

Ref. 2: 1085-1087, 1099, 1100, 1104-1107, 1123, 1130, 1131

References and Suggested Readings

1. *Essentials of Physical Chemistry, Arun Bahl, B. S. Bahl, G. D. Tuli, S. Multicolor edition, S. Chand Publication.*
2. *Principles of Physical Chemistry, 44th edition, Puri, Sharma and Pathaniya, Vishal Publishing Co.*
3. *Fundamentals of Molecular Spectroscopy, 4th Edition, C. N. Banwell and E. M. McCash, Tata McGraw-Hill: New Delhi*
4. *Essentials of Nuclear Chemistry, Revised 4th Edition, H. J. Arnikar, New Age International Publishers.*
5. *Advance Physical Chemistry, Gurtu and Gurtu, Pragati Publication.*
6. *Environmental Pollution and Health, V. K. Ahluwalia, The Energy and Resources Institute (TERI), 2005.*

Semester V **Core Course II**

CH-502

Subject-Inorganic Chemistry

(Theory: Lectures = 45 hrs, Marks 60) **(Credits: 03)**

Course objectives:

- To describe the VSEPR theory to predict shape of molecules from electron pairs.
- To describe the bonding in simple compounds using VBT.
- To describe the principles of VBT to predict hybridization of orbitals.
- To understand how CFT explains electronic structure, colour and magnetic properties of co-ordination compounds.
- To introduce the basic principles of MOT and electronic geometry of molecules.

Learning outcomes:

- Learn about the VSEPR theory and how it can be used to explain molecular shapes.
- Learn about the VBT to describe the formation of covalent bonds in terms of atomic orbital overlap.
- Learn about stability of complexes using CFSE.
- Learn about MOT to draw energy diagrams and to predict bond order.

UNIT-1: Structure and Reactivity of Molecules **(L-09, M-12)**

Valence Shell Electron Pair Repulsion Theory (VSEPR), Shapes of simple molecules and ions containing lone-and bond-pairs of electrons multiple bonding, prediction of shapes of irregular molecules and ions like - Sulphur tetra fluoride, Bromine trifluoride, Dichloroiodate (I) anion, Penta fluoro telluurate (IV) anion, Tetrachloroiodate (III) anion, Nitrogen dioxide, Phosphorus trihalides, Carbonyl fluoride, Summary of VSEPR rules Drawbacks of VSEPR theory.

Ref.1: 206-207

Ref. 3: Relevant pages.

UNIT 2: Modern Theories of Coordination Compound Part –A (L-09, M-12)

Assumptions, Werner theory and isomerism, EAN, Stability of complex ion, Factors affecting stability of complex ion, Irving William series, Stabilization of unstable oxidation state, Stereochemistry of coordination compound with C.N. 4 and 6, Isomerism in coordination compounds.

Ref. - 1: 735-737, 742-745, 748--757.

Ref. - 2: Relevant Pages.

UNIT 3: Modern Theories of Coordination Compound Part –B (L-09, M-12)

Assumptions of V.B.T., V.B. Theory as applied to structural and bonding in complexes of 3d series elements. Examples of square planar, Tetrahedral and Octahedral complexes, inner and outer orbital complexes, Magnetic properties of complexes of 3d series elements, limitations of V.B.T., Assumptions of CFT, Degeneracy of 'd' orbital's, Application of CFT to octahedral complexes, Weak and strong ligand field splitting, spectrochemical series.

Ref. 1: 759 - 766

Ref.2: Relevant Pages

UNIT 4: Modern Theories of Coordination Compound Part –C (L-09, M-12)

Definition of C.F.S.E., Calculation of C.F.S.E. in weak and strong field octahedral complexes, Evidences of C.F.S.E., Factor's affecting 10 Dq, CFT and magnetic properties, spin only magnetic moment equation, Electron occupancy in CFT, Application of CFT to tetrahedral a nd Calculation of C.F.S.E. in tetrahedral complexes. Tetragonal distortions from octahedral geometry, Jahn-Teller theorem Application of CFT to square planer complexes, Problems related to calculation of spin only magnetic moment for square planer, tetrahedral and octahedral complexes (for high spin and low spin complexes).

Ref.1: 766 -772,

Ref.2: Relevant pages

UNIT 5: Modern Theories of Coordination Compound Part –D (L-09, M-12)

Crystal field effects- Variation of lattice energies, enthalpies of hydration and crystal radii variations in halides of first and second row transition metal series and spinel structures, limitations of CFT, experimental evidences in support of metal ligand bond overlaps. ACFT,

Assumptions of Molecular orbital theory, composition of ligand group orbitals, Molecular orbital treatment (Qualitative) of octahedral complexes (strong & weak field), Effect of pi-bonding, Charge transfer spectra, Comparison of VBT, CFT and MOT.

Ref. 1: 794-796,774-778

Ref. 2: Relevant Pages

References:

1. *Principle of Inorganic Chemistry, B. R. Puri, L. R. Sharma, K. C. Kalia, Milestone Publisher and distributor.*
2. *Concise Inorganic Chemistry, 5th Edition, J. D. Lee.*
3. *Inorganic Chemistry Principles of Structure and Reactivity, 4th Edition, James E. Huheey,*
4. *Ellen A. Keiter. Richard L. Keitler.*

Semester VI **Core Course II**

CH-602

Subject- Chemistry of Inorganic Solids

(Theory: Lectures = 45 hrs, Marks 60) **(Credits: 03)**

Course Objectives:

- To describe basic principles of nanomaterials.
- To describe basic synthesis of nanoparticles.
- To describe composition and technological importance of inorganic solids.
- To describe composition of cement, lime and alloys.
- To describe manufacture of fertilizers.

Learning Outcomes:

- Learn about basic principles and synthesis of nanomaterials.
- Learn about classification, composition and processing of cement.
- Learn about classification and composition of alloys.
- Learn about types manufacture and applications of fertilizers.

UNIT 1: Synthetic Methods of Nanomaterials **(L-09, M-12)**

Introduction to Nano science, nanostructure and nanotechnology (basic idea), Size dependent properties of nanomaterials (basic idea) a) Semiconducting nanoparticles b) Metallic nanoparticles. Synthesis routes of nanomaterials: a) Bottom up approaches i) Chemical vapor deposition (CVD) ii) Spray pyrolysis iii) Sol gel process b) Top down approaches: mechanical alloying, Role of surfactant in shape and size control of nanomaterials

Ref:1: 602-604, 624, 653-655.

Ref:2: 66-70,74-77, 79,85-87.

Ref.3: 656-658, 707-712,721-724

UNIT 2: Inorganic Solids of Technological Importance **(L-09, M-12)**

Inorganic pigments, Coloured solids**,** White and black pigments, Molecular materials and fullerides, Molecular material chemistry – One dimensional metals, Molecular magnets,

Inorganic liquid crystals, Solid electrolytes (a) solid cationic electrolytes (b) solid anionic electrolytes .

Ref:- 1: 607-609,642-644,647-650.

Ref.3: 661-664,696-699,703-707.

UNIT 3: Cement and Lime **(L-09, M-12)**

Classification of cement, Ingredients and their role, Manufacture of cement and the setting process, Quick setting cements. Manufacture of lime and applications

Ref.4: Relevant pages

Ref.5: Relevant pages

UNIT 4: **Fertilizers** **(L-09, M-12)**

Plant Nutrients, Different types of fertilizers, need for fertilizers, requisite qualities of fertilizers, symptom of deficiency, Manufacture of following fertilizers:- Urea, Ammonium nitrate, Calcium ammonium nitrate, Ammonium phosphate, Super phosphates, Compound and Mixed fertilizers, Potassium chloride and Potassium sulphate.

Ref.5: Relevant pages

Ref.6: Relevant pages

UNIT 5: **Alloys** **(L-09, M-12)**

Classification of alloys, Ferrous and Non-ferrous alloys, Specific properties of elements in alloys, Manufacture of steel, Removal of silicon, decarburization, demagnetization and desulphurization. Composition and properties of different types of steels

Ref.7: Relevant pages

Ref.8: Relevant pages

Reference:

1. *Inorganic Chemistry, 4^{th} /5^{th} edition, Shriver and Atkins*
2. *Textbook of Nano Science and technology, B. S. Murthy, P. Shankar, Badev Raj, B. B. Rath and James Murday, University Press III M, Metallurgy and Material Sciences.*
3. *Inorganic Chemistry, 6^{th} Edition, Weller, Overton, Rourke & Armstrong.*
4. *Shriver Chemical Process Industry, 5^{th} edition, George T. Austin.*
5. *Industrial Chemistry, 14^{th} edition, B. K. Sharma,2004.*
6. *Riegels Handbook of Industrial chemistry, 9^{th} Edition, James A. Kent, CBS Publishers and Distributors*

7. *Engineering Chemistry, S. S. Dara.*
8. *Engineering Chemistry, B. K. Sharma, Goel Publishing House, Meerut.*
9. *Engineering Chemistry, P. C. Jain and M. Jain Dhanpat Rai and Sons Delhi.*

Semester V **Core Course III**

CH-503
Subject- Organic Reaction Mechanism

(Theory: Lectures = 45 hrs, Marks 60) **(Credits: 03)**

Learning Objectives

- To study different types of organic reactions.
- To understand the mechanisms of different types of reactions.
- To distinguish between types of substrates and types of reagents.
- To understand ways of attack of reagent, breaking and formation of bonds in different reaction mechanisms.
- To study kinetics, evidences and factors affecting different types of reactions.
- To study stereochemistry of different reactions.
- To understand role of different reagents in different reactions.

Course Outcomes

- Students will learn organic reactions like nucleophilic substitution, electrophilic substitution, nucleophilic addition, electrophilic addition and elimination.
- Students will be able to write/ explain mechanisms of those types of reactions.
- Students will understand how a reaction takes place in one or more steps.
- Students will understand the types of intermediates formed in different reactions.
- Students will learn how reagent attacks the substrate molecule and accordingly how bonds break and formed.
- Students will learn how change in structure of substrate, reagent and solvent changes the product formed and its stereochemistry.

- Students will be able to predict the products and to suggest the mechanisms.

UNIT 1. Nucleophilic Substitution at Saturated Carbon (9 L, 12M)

SN^1, SN^2 and SN^i reactions, Mechanism and stereochemistry, regioselectivity and stereo specificity of substitution reaction. Scope at saturated carbon, allylic carbon and vinylic carbon. Factors affecting rate of SN^1, SN^2 and SN^i reactions (Effect of nature of substrate, nucleophile, leaving group and solvent).Neighboring group participation (norbornyl & norbornenyl systems), Non-classical carbocation's.

Ref:- 1: 328-359, 931-937.

Ref:- 2: 293-369.

Ref: - 3: 257-328.

Ref: - 4: 179-200.

UNIT 2. Electrophilic Addition to C=C (9 L, 12M)

Introduction, Mechanism of electrophilic addition to C=C bond ($Ad_{2}{}_{E}$Mechanism)**,** addition of hydrogen halides, orientation of addition: Markownikoff's and Anti Markownikoff's addition (peroxide effect), stereochemistry, addition of halogens: experimental evidences for two step mechanism, mechanism of addition of bromine, factors affecting anti-stereoselectivity, effect of substituents on rate of addition, addition of hypohalous acids (HOX), Hydroxylation (Mechanism of formation of cis and trans 1,2-diols), Hydroboration- Oxidation (Formation of alcohol), Hydrogenation (Formation of alkane), Ozonolysis (formation of aldehydes & ketones).

Ref:- 1: 427-447.

Ref:- 2: 734-742, 783-788.

Ref: - 4: 323-360, 425-440

UNIT 3. Nucleophilic Addition to C=O (9 L, 12M)

Introduction, Structure of carbonyl group, reactivity of carbonyl group,

Addition of Hydrogen cyanide, alcohols, thiols, water, ammonia derivatives.

Aldol and Cannizzaro Reaction, Perkin reaction, Wittig reaction, Reformatski reactions,

Reduction reactions using $NaBH_4$, $LiAlH_4$ with mechanism.

Ref:- 1: 222-239.

Ref:- 2: 879-919.

UNIT 4. Aromatic Substitution Reactions **(09 L, 12M)**

Electrophilic substitution

Introduction, arenium ion mechanism, Effect of substituent group (Orientation, o/p directing and meta directing groups). Classification of substituent groups (activating and deactivating groups) Mechanism of: Nitration, Sulfonation, Halogenation, Friedal-Crafts reactions (alkylation and acylation), Diazo Coupling reactions, Ipso-substitution.

Nucleophilic substitution

Addition- elimination (SNAr), Elimination-addition (Benzyne) mechanism with evidences, Chichibabin reaction

Ref:- 1: 471-527.

Ref:- 2: 501-521, 641-653.

Ref: - 4: 517-545, 943-967.

UNIT 5. Elimination Reactions: **(9 L, 12M)**

Introduction, The reaction mechanisms: E1, E2, E1CB with evidences and factors affecting the reaction.E1 v/s E2 and Elimination v/s substitution. Anti and Syn elimination, Stereo electronic factors. Bredt's rule. Dehydrohalogenation, Dehalogenation, Dehydration, Hoffmann and Saytzeff's elimination, Pyrolytic elimination.

Ref:- 1: 382-406.

Ref:- 2 : 982-1010.

Ref: -4 : 273-310.

References

1. *Organic Chemistry, Second Edition. J. Clayden, N. Greeves & S. Warren and P. Wothers (Oxford).*
2. *Advanced Organic Chemistry-Reactions, Mechanisms and Structure, 5th Edition, Michael B. Smith, Jerry March.,Wiley-VCH, Weinheim, 2000,*
3. *Advanced Organic Chemistry Part A- Structure and Mechanisms, 3rd Edition, A. Carey and R.J. Sundberg. Springer US, Third Edition*
4. *Organic Chemistry, 6th Edition, R. T. Morrison and R. N. Boyd.*
5. *Web- Organic Chemistry Portal*

Semester VI **Core Course III**

CH-603

Subject- Spectroscopic Methods of Structure Determination

(Theory: Marks 60 Lectures = 45 hrs) **(Credits: 03)**

Course Objectives

- To study principle of spectroscopy and to understand wave parameters and terms involved in spectroscopy.
- To study different types of spectroscopy.
- To understand principle, concept and the terms used in each type of spectroscopy.
- Interpretation of UV, IR, NMR spectra.
- Use of spectral data for determination of structure of unknown organic compounds.
- To study different applications of each type of spectroscopy.

Learning Outcomes

- Students will learn interaction of radiations with matter. They will understand different regions of electromagnetic radiations. They will know different wave parameters.
- Students will learn principle of mass spectroscopy, its instrumentation and nature of mass spectrum.
- Students will understand principle of UV spectroscopy and nature of UV spectrum. They will learn types of electronic excitations.
- Students will be able to calculate maximum wavelength for any conjugated system. And from the value of λ-max they will be able to find out extent of conjugation in the compound.
- Students will understand principle of IR spectroscopy, types of vibrations and the nature of IR spectrum.

- From IR spectrum, they will be able to find out IR frequencies of different functional groups. And thus, they will be able to find out functional groups present in the compound.
- Students will understand principle of NMR spectroscopy and will understand various terms used in NMR spectroscopy. They will learn measurement of chemical shift and coupling constants.
- Students will be able to interpret the NMR data and they will be able to use it for determination of structure of organic compound.
- Students will be able to determine structure of simple organic compounds on the basis of spectral data such as λ max values, IR frequencies, chemical shift (δ values).

UNIT 1. A) Introduction to Spectroscopy (9L, 12M)

Introduction, meaning of spectroscopy, nature of electromagnetic radiation, wave length, frequency, energy, amplitude, wave number, and their relationship, different units of measurement of wavelength and frequency, different regions of electromagnetic radiations. Interaction of radiation with matter. Excitation of molecules with different energy levels, such as rotational, vibrational and electronic level. Types of spectroscopy, advantages of spectroscopic methods

Ref:- 2: 1-19.

Ref:- 4 : 13-19.

B) Mass spectroscopy

Basic theory, Nature of mass spectrum, Importance of molecular ion peak, isotopic peaks, base peak, nitrogen rule, rule of 13 for determination of empirical formula and molecular formula.

Ref:- 1: 170-186.

Ref:- 2: 415-424.

Ref:- 3 : 2-15.

Ref:- 4 : 401-417.

UNIT 2. Ultra Violet Spectroscopy (9L, 12M)

Introduction, nature of UV spectrum, Beer's law, absorption of UV radiation by organic molecule leading to different excitations. Terms used in UV Spectroscopy: Chromophore,

Auxochrome, Bathochromic shift (Red shift), hypsochromic shift (Blue shift), hyperchromic and hypochromic effect. Effect of conjugation on position of UV band. Calculation of λ-max by Woodward and Fisher rules: for dienes and enone system, Applications of UV Spectroscopy: Determination of structure, determination of stereo chemistry (cis and trans), problems.

Ref:- 1: 1-27.

Ref:- 2: 9-53.

Ref:- 4: 367-398.

UNIT 3. Infra-red Spectroscopy (9 L, 12M)

Introduction, Principle of IR Spectroscopy, fundamental modes of vibrations (3N-6, 3N-5) Types of vibrations (Stretching and bending), Regions of IR Spectrum: functional group region, finger print region and aromatic region, Characteristic IR absorption of functional groups: Alkanes, alkenes, alkynes, alcohol, ethers, alkyl-halides, carbonyl compounds (-CHO, C=O, -COOR, -COOH), amines, amides and Aromatic Compounds and their substitution Patterns. Factors affecting IR absorption: Inductive effect, resonance effect, hydrogen bonding. Applications of IR Spectroscopy: determination of structure, chemical reaction and hydrogen bonding, Problems.

Ref:- 1 : 28-57.

Ref:- 2 : 65-154.

Ref:- 3 : 71-109.

Ref:- 4 : 26-93.

UNIT 4. NMR Spectroscopy (9L,12M)

Introduction, Principles of NMR Spectroscopy, Magnetic and nonmagnetic nuclei, Precessional motion of nuclei without mathematical details, Nuclear resonance, chemical shift, shielding, & deshielding effect. Measurement of chemical shift, delta and Tau-scales. TMS as reference and its advantages, peak area, integration, spin-spin coupling, coupling constants, *J*-value (Only first order coupling be discussed), problems.

Ref:- 1: 63-145.
Ref:- 2 : 185-356.
Ref:- 3 : 144-216.
Ref:-4 : 108-160.

UNIT 5. Combined Problems Based on UV, IR, NMR & Mass (9 L, 12M)

Determination of structure of simple organic compounds on the basis of spectral data such as λ max values, IR frequencies, chemical shift (δ values), coupling constant, peak values provided to the students.

Reference Books:

1. *Spectroscopic Methods in Organic Chemistry, D. H. Williams & I. Fleming, 5th Ed.*
2. *Spectroscopy of Organic Compounds, P. S. Kalsi, New Age Int. Pub., 6th Ed., 2007*
3. *Spectrometric Identification of Organic Compounds, R. M. Silverstein and F. X. Webster , John Wiley and Sons Inc, 7th Edition.*
4. *Introduction to Spectroscopy, Donald L. Pavia, Gary M. Lampman, George S. Kriz and J. R. Vyvyan. Indian Edition. Cengage Learning; 5th edition (2015)*

Semester V **Core Course IV**

CH-504

Subject- Industrial Chemistry

(Theory: Lectures 45 hrs, Marks 60) **(Credits: 03)**

Course objectives

- To produce graduates with enhanced skills, applied knowledge, aptitude to carry out higher studies or research and development in the various industrial areas.
- To make the student cognizant about important aspects of Chemical Industries, Industrial work culture and environment.
- To prepare the students for immediate entry to the workplace with sound theoretical knowledge and some basic experimental concepts in the area of various industries viz. Sugar Industry, Fermentation Industry, Petroleum and Petrochemicals.
- To offers the synergism between basic concepts of Chemistry with Industrial applications.
- To equip the students with knowledge of some industrial organic synthesis as requirement of diverse chemical industries.
- Empower the students to understand the concepts in chemical processing, engineering and industrial development.

Learning outcomes

From the course CH: 504 Industrial Chemistry**,** the student will be able to understand….

- Basic requirements of Chemical Industry, different terms, operations and processes involved in chemical Industry.
- Describe Copy Right Act, Patent Act and Trade Marks, Bureau of Indian Standards (BIS) and International Organization for Standardization (ISO).

- Basic requirements, raw materials, different processes and operations involved in Sugar Industry and also different grades of sugar and uses of by-products of sugar industry.
- Importance of fermented products, basic requirements, theory and process of alcohol making, fractional distillation and various terms involved in Fermentation Industry.
- Understand Occurrence of Petroleum, theories of formation of Petroleum and different terms Viz. Knocking, Anti-Knock Compounds, Octane number, Cetane number, Gasohol and Power alcohol etc.
- Manufacturing processes involved in Industrial Organic Synthesis such as Methanol, Isopropanol, Glycerol, Acetylene and Aromatic hydrocarbon i.e. Toluene from petroleum with their uses.

UNIT 1: General Aspects of Industrial Chemistry (L-9, M-12)

Introduction, Basic Requirements of Industrial Chemistry, Chemical Production, Raw Materials, Unit Process and Unit Operations, Quality Control, Quality Assurance, Process Control, Research and Development, Pollution Control, Human Resource, Safety Measures, Classification of Chemical Reactions, Batch and Continuous Process, Conversion, Selectivity, Yield, Copy Right Act, Patent Act and Trade Marks. Bureau of Indian Standards (BIS), International Organization for Standardization (ISO)

Ref.1: Chapter 2(26, 27, 31 to 36)

Ref.4: Chapter 1 and 2 (Relevant Pages)

Ref.6: Chapter 1, 2 and 3 (Relevant Pages)

Ref: Websites and Web Pages

www.wikipedia.org/wiki/patentact , www.wikipedia.org/wiki/trademarks, www.wikipedia.org/wiki/trademarks,www.wikipedia.org/wiki/bis www.wikipedia.org/wiki/iso

UNIT 2: Sugar Industry (L-9, M-12)

Introduction, Sugar Industry in Maharashtra and India, Manufacture of Cane Sugar- [Refining (with flow sheet)], General Idea of Sulphitation and Carbonation, Concentration /Evaporation, Crystallization Separation of crystals. Grades, Baggase, Cellotex

Ref.3: Chapter 38 1208 to 1218 (Relevant Points Only)

UNIT 3: Fermentation Industry **(L-9, M-12)**

Introduction, Alcohol fermentation, Uses of alcohol, Theory underlying process of making alcohols beverages, Manufacture of Beer, Manufacture of Spirit, Alcohol from Cane Sugar Molasses, Theory of fractional distillation – Coffey'still, Rectified spirit, Absolute alcohol, Fusel oil, Proof spirit, Denatured alcohol.

Ref.2:578-596.

Ref.3: Chapter 36, 1175-1190 (Relevant Points Only)

UNIT4: Petroleum Industry. **(L-9, M-12)**

Occurrence, Petroleum producer countries in the world, Exploration Methods, Composition of Petroleum, Refining or Distillation of Petroleum, Anti-Knock Compounds, Octane number, Cetane number, Petrohol (their definitions only), Manufacture of Petrol or Gasoline by Bergius Method, Cracking process- Thermal, Catalytic, Hydro cracking.

Ref.1: 340 to 352, 356 to358 and 363 to 368.

Ref.3: Chapter 4, 217 to 311 and Chapter 5, 312 to 342 (Relevant Points only)

UNIT 5: Industrial Organic Synthesis **(L-9, M-12)**

Manufacture of methanol from synthesis gas, Isopropanol from propylene, Glycerol from propylene via allyl chloride, Acetone by catalytic dehydrogenation of isopropanol. (with flow sheet diagram), Unsaturated Hydrocarbon –preparation of Acetylene from Natural gas (with flow sheet), Aromatic hydrocarbon- Preparation of toluene (with flow sheet)

Ref.3: Chapter 11, 439 to 451 and Chapter 14, 493 to 522 (Relevant Points Only).

References:

1. *Principles of Industrial Chemistry, Chris A Clausen III and Guy Mattson, John Wiley and Sons, Inc. Somerset, 1978, New York.*
2. *Shreve's Chemical Process Industries, George T. Austin, 5 th Edition, The McGraw-Hill, 1984, New York.*
3. *Industrial Chemistry, B. K. Sharma, 16th Edition, Goel Publishing House, Meerut,(U.P.) 2011, India.*
4. *Comprehensive Industrial Chemistry, P.G. More, 1st Edition, Pragati Prakashan, Meerut, (U.P.) 2010, India.*

5. *Chemistry and Technology of the Cosmetics and Toiletries Industry, D.F. Williams and W.H. Schmitt Blackie Academic & Professional First edition 1992 Second edition 1996 © Chapman & Hall ISBN-13 :978-94-0 10-7194-9 e-ISBN-13:978-94-009-1555-8*
6. *Handbook of Industrial Chemistry Organic Chemicals, Mohammad Farhat AIi, Bassam M. El AIi, James G. Speight, The McGraw-Hill Companies, 2005, ISBN 0-07-141037-6*

Semester VI **Core Course IV**

CH-604

Subject- Chemistry of Industrially Important Products

(Theory: Lectures 45 hrs, Marks 60) **(Credits: 03)**

Course objectives

- To make student perceptive about various commodity industries viz. Cosmetics and Perfumes, Dyes and Pharmaceuticals, Pesticides, Soaps and Detergents, related diversified and multidisciplinary fields of chemical industry.
- To produce graduates with enhanced skills, knowledge and research aptitude to carry out higher studies or research and development in the various industrial areas.
- To equip students with advance knowledge about various industrially important products.
- To makes students ready for immediate entry to the workplace with sound theoretical and basic experimental knowledge in the areas of various industries.
- To engender the substantial interest in the students to understand the concepts in chemical processing, engineering and industrial development of present era viz. Cosmetics and Perfumes Industry, Dyes and Pharmaceuticals, Pesticides, Soaps and Detergents, related multidisciplinary and diversified fields of chemical industry.
- To describe the industrial production of a number of important organic and inorganic compounds / chemicals and products of end use.
- To gain comprehensive knowledge of cutting-edge developments in a field of different chemical industries by discussions and exchange of experiences and knowledge.
- To develop proficiency in application of current aspects of industrial chemistry.

Learning Outcomes

On successful completion of the course **CH: 604 Chemistry of Industrially Important Products**, the student will be able to understand….

- Describe the industrial production of a number of important organic and inorganic compounds / chemicals and products of end use.
- Gain comprehensive knowledge of cutting-edge developments in a field of different chemical industries.
- Importance of Cosmetics Industry and a general study including preparation and uses of the Hair dye, hair spray, shampoo, suntan lotions, lipsticks, talcum powder, nail enamel, creams (cold, and shaving creams).
- Perfumes and identify the distinguishing features of its components and also an essential oils and their importance in cosmetic industries with reference to Eugenol, Geraniol, sandalwood oil, eucalyptus, rose oil, 2-phenyl ethyl alcohol, Jasmone, Civetone, Muscone etc.
- Know about pesticides both natural and synthetic, benefits and adverse effects of it, also synthesis, manufacture and uses of pesticides viz. Organochlorines (DDT, Gammexene,); Organophosphates (Malathion, Parathion); Anilides (Alachlor and Butachlor).
- Definition, classification, raw material used in soaps and detergents, reaction involved in it, Manufacture of Soaps and cleansing action of soaps and detergents.
- Definition, properties of good dyes, relation between colour and constitution, classification of dyes according to their mode of application and chemical constitution.
- Importance's, definition and meaning of the different terms involved in Drugs and Pharmaceuticals Industry and also synthesis, uses, properties and industrial manufacture of Paracetamol, Aspirin, and Chloramphenicol.

UNIT 1: Chemistry of Cosmetics (L-9, M-12)

Introduction, Raw materials and general study including preparation and uses of the following: Hair dye, shampoo, suntan lotions, lipsticks, talcum powder, nails enamel, creams (cold and shaving creams).

Ref.: 6 Chapter -1, 1 to 34, Chapter -2, 36 to 100, Chapter -3, 104 to 145, Chapter - 4 149 to 181 and Chapter- 9, 290 to 309. Relevant Points Only

UNIT 2: Chemistry of Perfumes (L-9, M-12)

Essential oils A general study including properties, uses and importance in cosmetic industries with reference to Eugenol, Geraniol, sandalwood oil, eucalyptus, rose oil, 2-phenyl ethyl alcohol, Jasmone, Civetone, Muscone and antiperspirants and artificial flavours.

Ref. 3: Chapter 53, 1520 to1544 Relevant Points Only.

Ref.6: Chapter 8, 272 to 289, Chapter 10, 310 to 344, Relevant Points Only.

UNIT 3: Pesticide Chemistry (L-9, M-12)

General introduction to pesticides and their changing concepts (natural and synthetic), benefits and adverse effects of pesticides, structure activity relationship, synthesis and uses of representative pesticides in the following classes: Organochlorines (DDT, Gammexene,); Organophosphates (Malathion, Parathion); Anilides (Alachlor and Butachlor).

Ref.3: Chapter 41, 1280 to1318 Relevant Points Only.

Ref.7: Chapter 11, 381 to 426 Relevant Points Only.

UNIT 4: Soap and Detergents (L-9, M-12)

Soaps, Surfactants and its Importance, Raw Materials used in Soap Manufacture, Manufacture of Soaps (Continuous Process), Cleansing action of Soap, Classification of Soaps, Detergents, Principal group of Synthetic Detergents, Detergents builders and Additives, Comparison between Soap Detergent.

Ref.3: Chapter 39, 1219 to1251 and Chapter 40,1252 to1279 Relevant Points Only.

Ref. 6: Chapter- 5, 123 to160 Relevant Points Only.

UNIT 5: Dyes, Drugs and Pharmaceuticals. (L-9, M-12)

(a) Dyes: Introduction, properties of dyes, Otto Witts theory only, Classification of dyes according to their mode of application and Chemical Constitution.

Ref.3: Chapter 54, 1545 to1608 Relevant Points Only.

Ref.6: Chapter 8, 259 to 288 Relevant Points Only.

(b) Drugs and Pharmaceuticals: Introduction, Importance, Qualities of good drugs, Functional and chemotherapeutic drugs, Meaning of the terms: Prescriptions, Doses, Analgesic, Antipyretics, Antibiotics, Anti-inflammatory, Anti-viral, Cardiovascular, Cough and Cold Preparations, Sedatives and Hypnotics, contraceptives. Synthesis, uses, manufacture and properties of Paracetamol, Aspirin, Chloramphenicol

Ref.4: Chapter 8, 144 to194 Relevant Points Only.

Ref.6: Chapter 10, 331 to 379 Relevant Points Only.

References:

1. *Principles of Industrial Chemistry, Chris A Clausen III and Guy Mattson, John Wiley and Sons, Inc. Somerset, 1978, New York.*
2. *Shreve's Chemical Process Industries, George T. Austin, 5 th Edition, The McGraw-Hill, 1984, New York.*
3. *Industrial Chemistry, B. K. Sharma, 16th Edition, Goel Publishing House, Meerut,(U.P.) 2011, India.*
4. *Comprehensive Industrial Chemistry, P.G. More, 1stEdition, Pragati Prakashan, Meerut,(U.P.) 2010, India.*
5. *Chemistry and Technology of the Cosmetics and Toiletries Industry, D.F. Williams and W.H. Schmitt Blackie Academic &. Professional First edition 1992 Second edition 1996 © Chapman & Hall ISBN-13 :978-94-0 10-7194-9 e-ISBN-13:978-94-009-1555-8*
6. *Handbook of Industrial Chemistry Organic Chemicals, Mohammad Farhat AIi, Bassam M. El AIi, James G. Speight, The McGraw-Hill Companies, 2005, ISBN 0-07-141037-6*

Semester V **Skill Enhancement Course**

CH-505

Subject- Analytical Instrumentation

(Theory: Lectures = 45 hrs, Marks 60) **(Credits: 03)**

Course Objectives

- To develop an understanding of the range and uses of analytical methods in chemistry.
- To understand and establish the role of chemistry in quantitative analysis.
- To enhance the Analytical instrumental skill of the students.

Learning Outcomes

- Explain the fundamentals of analytical methods and instruments for qualitative and quantitative Analysis.
- Express the role of analytical chemistry in science.
- Students will be able to function as a member of an interdisciplinary problem solving team.

UNIT 1:-Spectrometry **(9L, 12M)**

Origin of spectra Interaction of electro-magnetic radiation with matter, Electro-magnetic Spectrum, The Absorption of Radiation, Solvents for Spectrometry, Quantitative Calculations, Beer's Law, Principles of instruments - Sources, Monochromators (prism, diffraction gratings, Optical filters), Cells, detectors, Slits Width, Single Beam Spectrometer, Spectrometric Errors, Deviation from Beer's Law - Chemical deviation, Instrumental deviation, Problems.

Ref.-1:- 398-401, 410-411, 413--435, 439-443.

Ref. 2 -6:-Relevant Pages

UNIT 2: Infrared Spectrometry **(9L, 12M)**

Infra red Spectrometry – Principles, Theory, Instrumentation, Source, monochromator, detectors, Single beam, Double beam, Types, Sampling Technique, Solvents, Spectrometric error, FTIR introduction, General applications.

Ref.-2: 447 – 458

Ref.-4: 527-576

Ref. 2-6: Relevant Pages

UNIT 3. A: Emission Spectrometry (9L, 12M)

Flame Emission Spectroscopy – Principles, Theory, Instrumentation, Experimental techniques, Interferences and applications , Advantages and disadvantage, Plasma Emission Spectrometry – Principles, Plasma as excitation source, inductively coupled Plasma source, ICP-AES Instrumentation, Applications.

Ref.-1: 462 - 467

Ref. 2-6: Relevant Pages

B:-Atomic Absorption Spectrophotometry

Introduction, Principles, Advantages over FES, Instrumentation – Sources, Burners, Flames, Interferences – Spectral Interferences, Ionization Interferences, Refractory Compound Formation,Hallow cathode lamps, Physical Interferences, Use of Organic Solvents, Sample Preparation, Applications of AAS. Comparison of AAS with atomic emission methods

Ref.-1: 467 - 475

Ref. 2-6:Relevant Pages

UNIT 4:-Potentiometry (9L, 12M)

Potentiometer, The Cell for Potential Measurements, Combination Electrode, Theory of Glass Membrane Potential, The Alkaline Error, The Acid Error, Standard Buffers, Ion-selective Electrodes - Glass Membrane Electrodes, Precipitate Electrodes, Solid-State Electrodes, Liquid-Liquid Electrodes, Plastic Membrane/Ionophore Electrodes, Coated Wire electrodes, Enzyme Electrodes.

Ref.-1: 312-313,316-325

Ref.-2 -6: Relevant Pages

UNIT 5:-P^Hmetry (9L, 10M)

Introduction to pH meter, The Glass pH Electrode Principle, Accuracy of pH Measurements, Measurements with the pH-meter, Making the pH Measurement, Fundamental limitations, Maintenance.

Ref.-8: 327-333

Ref.-2 - 8: Relevant Pages

Reference Books:-

1. *Analytical Chemistry, G.D. Christian, 5th Edition.*
2. *Analytical Chemistry Principal- J. H. Kennedy. 2nd Edition (1990)*
3. *Analytical Chemistry, An Introduction, Skoog, West and Holler, 6 th Edition*
4. *Instrumental Method of Chemical Analysis, Chaitwal and Anand, 5th Edition.*
5. *Basic Concept of Analytical Chemistry, S.M. Khopkar*
6. *Instrumental Methods of Chemical Analysis- Willard, Merritt, Dean and Settle, 6th Edition*
7. *Introduction to Instrumental Analysis, R.D. Braun*
8. *Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R. C. Denney, J. D. Barnes, M. J. K. Thomas, 6th Edition,*

Important Instrument web links

Instruction Manual Operation Guide UV-1800 Shimadzu Spectrophotometer,
http://www.sustainable-desalination.net/wp-content/uploads/2013/05/UV-1800.pdf

Instruction Manual Operation Guide Agilent 5500 Series FTIR,
https://www.agilent.com/cs/library/usermanuals/public/5500_series_ftir_operation_manual.pdf

Instruction Manual Operation Guide Agilent 700 Series ICP Optical Emission Spectrometers,
https://www.agilent.com/cs/library/usermanuals/public/8510230100_700SeriesICP_UserManual.pdf

Instruction Manual Operation Guide Flame Atomic Absorption Spectrometry,
https://www.agilent.com/cs/library/usermanuals/Public/0009.pdf

Instruction Manual Operation Guide Potentiometry,
http://nhp.mowr.gov.in/docs/HP2/MANUALS/Water%20Quality/5014/-download-manuals-WaterQuality-WQManuals-32PotentiometricAna.pdf
http://shop.hannasingapore.com/media/pdf/2016-01-11-HI901C-Full.pdf

User Manual pH meter F-71, HORIBA, Ltd. 2011
http://library.metergroup.com/Manuals/Horiba/BenchtopPh/F-71%20Manual.pdf

Semester VI **Skill Enhancement Course**

CH-605

Subject- Analytical Techniques

(Theory: Lectures = 45 hrs, Marks 60) **(Credits: 03)**

Course Objectives

- To provide knowledge of instruments which are used in Chemical, Pharma, Petroleum, and insecticide and pesticide industry
- To increase student technical skill as per industry need.
- To develop an understanding of the range and uses of analytical methods in chemistry.

Learning Outcomes

- Compare the Instrumental methods and non instrumental methods and there advantages.
- Solve the problem of detection and separation using analytical instruments.
- Students will be able to explore new areas of research in both chemistry and allied fields of science and technology.
- Students will be able to explain why chemistry is an integral activity for addressing social, economic, and environmental problems.

UNIT 1:- Solvent Extraction **(9L, 12M)**

The Distribution Co-efficient, The Distribution Ratio, Percent Extracted, Solvent Extraction of Metals - Ion Association Complex and Metal Chelates, The Extraction Process, The Separation Efficiency of Metal Chelates, Analytical Separations, Multiple Batch Extractions, Countercurrent Distribution, Simple numerical problems on Percent Extracted and Multiple Extraction, Problems

Ref.1: 484 to 498.

Ref. 2-6: Relevant Pages

UNIT 2:- High-Performance Liquid Chromatography (9L, 12M)

Introduction, Principles, Equipment for HPLC, Choice of Column Materials for HPLC, Application

Ref.1: 537 to 545

Ref.2-6: Relevant Pages

UNIT 3:- Gas Chromatography (9L, 12M)

Introduction, Principles, Gas chromatography Columns, Gas Chromatography Detectors, Column Efficiency in Chromatography- Theoretical Plates, 1) Van Deemter Equation, 2) Capacity Factor and 3) Resolution, Problems

Ref.1: 522 to 528, 511 to 515

Ref.2-6:- Relevant Pages

UNIT 4:- Ion Exchange Chromatography (9L, 12M)

Introduction, Cation Exchange Resins, Anion Exchange Resins, Cross-linkage, Effect of pH Separation of Amino Acids, Effect of Complexing Agents-Separation of Metal ions on Anion Exchange Columns, Applications of Ion Exchange Chromatography

Ref.1: 517 to 522

Ref. 2-6: Relevant Pages

UNIT 5:-Thermal Methods (9L, 12M)

General Discussion, Thermogravimetry- Instruments for thermogravimetry, Applications of thermogravimetry, Differential Techniques- Differential Thermal Analysis (DTA) and Differential Scanning Calorimetry (DSC), Instruments for DTA and DSC, Experimental and Instrumental Factors, Applications of DTA and DSC, Problems

Ref.-6: 503 - 519

Ref. 1-6: Relevant Pages

Reference Books:-

1. *Analytical chemistry, G.D. Christian, 5th Edition,*
2. *Instrumental Methods of Chemical Analysis, Chatwal and Anand*
3. *Basic Concept of Analytical Chemistry, S.M. Khopkar, 2nd edition,*
4. *Chemical Analysis by A. K. Shriwastawa, P. C.Jain, S. Chand and Company.*
5. *Quantitative Analytical Chemistry, James S. Fritz, George H.Schenk,5th Edition.*
6. *Vogel's Text Book of Quantitative Chemical Analysis, J. Mandham, R.C.Denney, J. D. Barnes, M. Thomas, B. Shivashankar, 6th Edition.*

Important Instrument web links

The LC Handbook Guide to LC Columns and Method Development,

https://www.agilent.com/cs/library/primers/public/LC-Handbook-Complete-2.pdf

Handbook and user manual of Gas chromatography

https://www.agilent.com/cs/library/usermanuals/Public/G3430-90011.pdf

Handbook and user manual of Ion Exchange Chromatography

https://www.agilent.com/cs/library/primers/Public/5991-3775EN_BioIEX_HowTo_LR.pdf

Handbook and user manual of Ion Differential Scanning Calorimetry

https://www.perkinelmer.com/CMSResources/Images/46-74542GDE_DSCBeginnersGuide.pdf

Semester V **Elective Course**

CH-506(A)

Subject- Biochemistry

(Theory: Lectures = 45 hrs, Marks 60) **(Credits: 03)**

Learning Objectives

- To study different types of biomolecules.
- To study structure of biomolecules.
- To study classification of each type of biomolecules.
- To study reactions of the biomolecules.
- Study of metabolism and thus, study of metabolic processes and reactions involved.
- To study energetics of the metabolic processes.
- Students should understand: Structure and role of Carbohydrates, Amino acids, Proteins, Enzymes, lipids, Nucleic Acids and energy rich compounds in biochemical reactions.

Course Outcomes

- Students will study biomolecules like carbohydrates, amino acids, proteins, enzymes, lipids and nucleic acids.
- Students will understand definitions, classifications and examples of these biomolecules.
- Students will learn the detailed structure of these biomolecules along with types of bonds or linkages present in their molecules.
- Students will learn the chemical properties of these biomolecules and the action of some reagents on them in the form of reactions or graphical presentation.
- Students will understand biochemical energetics of common energy rich compounds along with hydrolytic reactions.

- Students will learn metabolisms like Glycolysis, TCA cycle, Transamination, deamination and β- oxidation through reactions, enzymes involved, outlines and energetics.

Unit 1. Carbohydrates (L-09, M-12)

a) Introduction, definition, classification.

b) Monosaccharaides: structure of glucose (open chain and ring structures). Kiliani Fischer synthesis of D-glucose. Reactions of glucose: oxidation with bromine water and nitric acid, reduction, acetylation, addition of HCN, NH_2OH and phenyl hydrazine, mutarotation.

c) Disaccharides: structure of sucrose, lactose and maltose.

d) Polysaccharides: storage polysaccharides, structure of starch, Structural polysaccharides, structure of cellulose.

Ref 1 and 2: Relevant pages

Unit 2. Amino Acids and Proteins (L-09, M-12)

a) Amino acids: Introduction, structure of ammo acids, classification of amino acids, amphoteric nature of amino acids, reactions of amino acids: with FDNB and Dansyl chloride, formation of peptide bond

b) Proteins: Introduction, classification of proteins: based on functions and based on shape, structure of proteins: primary, secondary, tertiary and quaternary structure). Study of some proteins: α keratins and hemoglobin. Separation of amino acids and proteins by paper electrophoresis and dialysis

Ref 1 and 2: Relevant pages

Unit 3. Enzymes and Lipids (L-09, M-12)

a) Enzymes: Introduction, specificity of enzymes, classification, role of enzymes in biochemical reactions, Michaelis Menten equation (no derivation). Effect of substrate concentration, P^H and temperature on enzyme catalyzed reactions. Enzyme inhibitors: introduction and types.

b) Lipids: Introduction, classification of lipids, fatty acids, nomenclature of fatty acids, triacyl glycerols, hydrogenation of oils, Saponification value and iodine value of oils, phospholipids and waxes.

Ref 1 and 2: Relevant pages

Unit 4. Nucleic Acids and Energy Rich Compounds (L-09, M-12)

a) **Nucleic acids**: Introduction, Components of nucleic acids: sugars, bases, nucleosides and nucleotides. Watson and Crick model of DNA, types of RNA (structure not expected)

b) **Energy rich compounds**: Introduction, Pyrophosphates, acyl phosphates, enolic phosphates, thiol esters (structure, hydrolytic reaction and energetics). Energy carriers in biological redox systems: NAD^+ and FAD

Ref 1 and 2- Relevant pages

Unit 5. Metabolism (L-09, M-12)

Definition of metabolism,

a) Carbohydrate metabolism: Glycolysis: reactions involved and energetics, TCA cycle (Kreb cycle): Reactions involved and energetic

b) Amino acid Metabolism: Transamination, deamination (by enzymes - glutamic dehydrogenase, ammonia lyases, deaminases and deamidases), decarboxylation

c) Lipid Metabolism: β- oxidation of fatty acids, reactions involved in β –oxidation, energetics of β –oxidation of palmitic acid.

Ref 1 and 2- Relevant pages

Reference Books

1. *Outlines of Biochemistry, Conn and Stumpf (4^{th}Edition)*
2. *Principles of Biochemistry, A. L. Lehninger (2^{nd} Edition)*

Semester V **Elective Course**

CH-506(B)

Subject- Green Chemistry

(Theory: Lectures = 45 hrs, Marks 60) **(Credits: 03)**

Course Objectives:

- There is rising concern since 1970 about environmental pollution, depleting resources, climate change, ozone depletion, legislation which is getting stringent with strict environmental laws, rising cost of waste deposits, health concern and so on.
- We are facing the challenge to work towards sustainable development. Since 1990, today's society is moving towards becoming more and more environmentally conscious.
- Green chemistry has been introduced in1990 for overall sustainable development against the environmental concerns.
- Green chemistry is not a new branch of chemistry, but it is a new way chemistry, which should be practiced regularly.
- Innovations and applications of green chemistry in education has helped companies not only to gain environmental benefits but at the same time to achieve economic and societal goals also.
- This is possible because these undergraduate students are ultimate scientific community of tomorrow.

Learning Outcomes:

- With this course, the graduate students will be able to understand the twelve principles of green chemistry that will help to build the basic understanding of toxicity, hazards and risk of chemical substances.
- The course will help to understand stoichiometric calculations and relate them to green chemistry metrics. The students will learn about atom economy and understand its importance over percentage yield.

- The students will learn to design safer chemicals, products and processes that are less toxic than the conventional chemistry, understand significance of catalysis, use of renewable feed stock, renewable energy sources, importance of green solvents, etc.
- The course will train the students to appreciate green chemistry and boost the students to think and develop the skills to innovate and search for the solutions to environmental problems.
- Green chemistry is only way of future chemistry to ensure sustainability with absolute zero waste. The success stories and real-world cases will motivate the young generation to practice green chemistry.

UNIT 1. Introduction to Green Chemistry (L-04, M-04)

Definition of Gr**e**en Chemistry. Drawbacks of conventional chemistry. Need of Green Chemistry, Minamata Disease. Goals of Green Chemistry

Ref:1 Relevant Pages

Ref:6 Relevant Pages

UNIT 2. Principles of Green Chemistry and Designing a Chemical Synthesis (L-12, M-18)

Twelve principles of Green Chemistry, role of Paul T. Anastas, importance of green chemistry with examples: Prevention of waste/by-products, Atom economy, Prevention or Minimization of hazardous products, Designing safer chemicals, Energy requirements for synthesis, Selection of suitable solvents, Selection of starting materials, Use of protecting groups, Use of catalysts, Designing of biodegradable products, Prevention of chemical accidents, Strengthening of analytical techniques, industrial safety.

Ref:1 Relevant Pages

Ref:2 Relevant Pages

UNIT 3. Techniques in Green Chemistry (L-12, M-16)

a) Microwave assisted synthesis- Introduction and importance, Applications- Esterification, Fries rearrangement, Orthoester Claisen Rearrangement, Diels-Alder Reaction,Hofmann Elimination.

b) Ultrasound assisted reactions- Introduction and importance, Application- Esterification, saponification, aromatic substitution reactions, alkylation, oxidation, reduction.

Ref:1 Relevant Pages

Ref:3 Relevant Pages

UNIT 4. Solvents, Reagents and Catalysts in Green Chemistry (L-14, M-18)

a) Solvents- Introduction and Importance, Examples-Michael Addition in water, Bis-indolyl methane in ionic liquid, tetrazole synthesis in deep eutectic solvent.

b) Reagents- Introduction and Importance, Examples- Alkylation using dimethyl carbonate, Solid phase peptide synthesis using Merrifield reagent.

c) Catalysts- Introduction and Importance, Examples- Reduction of carbonyl group using Baker's yeast, Esterification using Lipase enzyme, Zeolite clay and Cyclodextrin.

Ref:1 Relevant Pages

Ref 2: Relevant Pages

UNIT 5. Future Trends in Green Chemistry (L-03, M-04)

Biomimetic, Photochemical reactions, Multifunctional Reagents, Green chemistry in sustainable development.

Ref:1 Relevant Pages

Ref 3: Relevant Pages

Ref 5: Relevant Pages

Reference Books:

1. *New Trends in Green Chemistry, V.K. Ahluwalia and M.R. Kidwai: Anamalaya Publishers (2005).*
2. *Green Chemistry- Theory and Practical, P.T. Anastas and J.K. Warner: Oxford University Press (1998).*
3. *Introduction to Green Chemistry, A. S. Matlack: Marcel Dekker (2001).*
4. *Real-World Cases in Green Chemistry, M.C. Cann & M.E. Connely: American Chemical Society, Washington (2000).*
5. *Introduction to Green Chemistry, M. A. Ryan & M. Tinnesand, American Chemical Society, Washington, (2002).*
6. *Silent Spring, Rachel Carson, Houghton Mifflin Company, (1962).*

* * * * *

Semester VI **Elective Course**

CH-606(A)

Subject- Polymer Chemistry

(Theory: Lectures = 45 hrs, Marks 60) **(Credits: 03)**

Learning Objectives

- The course offers the basic concepts of polymer, polymerization, classes of polymers, important properties, and poly(lactic acid) as a biodegradable polymer.
- The course also offers to study preparation, properties, and applications of industrially important selected polymers.
- The course will give chance to study various mechanisms of polymerization and learn different techniques of polymerization.
- The student will be able to understand glass transition temperature and factors affecting on it and various ways to express molecular weight of polymers.

Course Outcomes

After completing this course, the graduate should be able to

- Define terms like monomer, polymer, polymerization, polydispersity index, etc., classify polymers based on their origin, native backbone chain, and thermal response.
- Know glass transition temperature and its determination, various ways to express molecular weights of polymers and polydispersity index.
- Identify different mechanisms of polymerizations *viz*. free radical, ionic, and condensation polymerizations.
- Distinguish techniques of polymerization based on physical conditions required for the preparation of polymers in laboratory or industry.
- Familiar with preparation, properties, and applications of industrially important selected polymers.

UNIT 1. Basic Concepts of Polymers **(L-09, M-12)**

Introduction, brief history, monomers and polymers, degree of polymerization, functionality, linear, branched and cross linked polymers, homopolymers, Types of copolymers:- random, alternate, block and graft copolymers, Tacticity (stereochemistry) of polymers: isotactic, syndiotactic and atactic polymers. Classification of polymers:- based on a) origin- natural and synthetic polymers b) native backbone chain – organic and inorganic polymers c) thermal response – thermoplastic and thermo setting polymers d) ultimate form and use – plastic, elastomer, fibre and liquid resin, Degradation of polymers:- types of degradation: chain end and random degradations.

Ref. 1 and 2: Relevant pages

UNIT 2. Chemistry of Polymerization **(L-09, M-12)**

Introduction, chain growth polymerization (initiation, propagation, termination, and kinetics): free radical polymerization, ionic (cationic and anionic) polymerizations, step growth polymerization (mechanism and kinetics), ring opening polymerization.

Ref. 1 and 2: Relevant pages

UNIT 3. Polymerization Techniques & Polymer Processing Techniques

(L-9, M-12)

Polymerization techniques: - Bulk polymerization, solution polymerization, suspension polymerization, emulsion polymerization, interfacial condensation polymerization.
Polymer processing techniques:- Calendaring, die casting, film casting, and compression moulding.

Ref. 1 and 2: Relevant pages

UNIT 4. Study of Some Important Polymers **(L-09, M-12)**

Preparation, properties and applications of - Polyethylene [PE], Polypropylene [PP], Poly(vinyl chloride) [PVC], Polystyrene [PS], Polyacrylonitrile [PAN], Polycarbonates [PC], Phenol-formaldehyde resins [PF], Epoxy resins, Polyester - Polyethyleneterephthalate[PET], Polyamides (Nylon-6 and Nylon-6,6), Poly(vinyl alcohol) [PVA], Poly(lactic acid) [PLA], Polyaniline, and Polybutadiene.

Ref. 1 and 2: Relevant pages

UNIT 5. Glass Transition Temperature **(L-09, M-12)**

Glass transition temperature:- Definition and explanation, factors affecting glass transition temperature, Glass transition temperature and molecular weight, Glass transition temperature and melting point, importance of glass transition temperature, determination of glass transition temperature by dilatometry.

Molecular weights of polymers:-types of molecular weights-number average molecular weight, weight average molecular weight, viscosity average molecular weight, sedimentation average molecular weight, and poly dispersity index.

Ref. 1 and 2: Relevant pages

Reference Books

1. *Polymer Science, V. R. Govarikar, N. V. Viswanathan, JayadevSreedhar, New Age International (P) Ltd., New Delhi, 1997.*
2. *Text books of Polymer Science, F. W. Billmeyer, John Wiley & Sons; 3rd edition,1984.*

Semester VI **Elective Course**

CH-606(B)

Subject- Research Methodology for Chemistry

(Theory: Lectures = 45 hrs, Marks 60) **(Credits: 03)**

Course Objectives:

- To familiarize students towards basics of research, process of research and methods.
- To enable the student in conducting research work and formulating research synopsis and report.
- To learn the analysis of primary research articles and peer review articles.
- To improve student understanding of how scientific questions are developed and posed through proposals and dissemination of research results.
- To learn the scientific method of collecting and analyzing information.
- To learn the presentation of scientific information
- To aware the students about proper laboratory safety and techniques.

Learning outcomes:

The learning outcomes for this course of the following Chemistry Graduate Program Goals:

- Students will learn about what is research, research methods and impact of chemical research on society through pure and applied research.
- Students will learn how to analyze research in chemistry drawn from contemporary primary chemical literature.
- Student will formulate thesis topic, explain its significance and propose the methodology to be used in the thesis topic research.
- Student will demonstrate proficiency in scientific writing which includes:

- Ability to interpret and synthesize primary research literature related to the student's thesis topic.
- Ability to write a coherent narrative that explains the significance of the thesis research with regard to the primary research literature.
- Ability to report original research results in a coherent narrative.
- Ability to explain and defend conclusions draw from original results in narrative form.
- Prepare and present scientific topics orally utilizing presentation software such as PowerPoint.

- Students will be able to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments.
- Students will be skilled in problem solving, critical thinking and analytical reasoning as applied to scientific problems.
- Students will be able to communicate the results of scientific work in oral, written and electronic formats.
- Students will appreciate the central role of chemistry in our society and use this as a basis for ethical behaviour in issues facing chemists including an understanding of safe handling of chemicals, environmental issues and key issues facing our society in energy, health and medicine.

UNIT 1: Introduction to Research **(L-9, M-12)**

Definition of Research, Objectives of Research, Importance, and need for Research in a related field. Motivation in Research Methods versus Methodology, Classification and types of Research, Pure and applied Research, Difference between Computational lab and wet lab research, theoretical and experimental models, Criteria of Good Research Application of theoretical knowledge in designing of experiments. Methods of Data Collection

List of National Importance Institutes and List of CSIR Laboratories

Ref. 3: 1-24.

UNIT 2: Print Literature Resources **(L-9, M-12)**

Sources of information: Primary, secondary, tertiary sources; Journals: Journal abbreviations, abstracts, current titles, reviews, monographs, dictionaries, text-books, current contents, Introduction to Chemical Abstracts and Beilstein, Subject Index, Substance Index, Author Index, Formula Index with examples.

Ref. 1: 299-317;

Ref. 2: 1569-1603

UNIT 3: Digital Literature Resources (L-9, M-12)

The Internet and World Wide Web. Internet resources for chemistry. Finding and citing published information. Web resources, E-journals, Journal access, TOC alerts, Citation index, Impact factor, H-index, UGC infonet, E-books. The introduction of Search engines, Scirus, Google, Google Scholar, Chem Industry, Wiki- Databases, ChemSpider, American Chemical Society, Royal Society of Chemistry, Wiley-inter science, Science Direct, Springer, SciFinder, Scopus, C&EN News Reaxys.

Ref. 1: 299-317;

Ref. 2:1569-1603

UNIT 4: Writing Scientific Reports (L-9, M-12)

Writing Skills, Reporting practical and project work, Referencing, Organizing a poster display. Communication Skills, Body Language, Giving an oral presentation. Content of Research Papers, How to download Research Paper? How to Read Research Paper, Abstract and Summary. What are Paper, Patent and Review? Introduction of Plagiarism and self Plagiarism.

Ref. 1: 325-348; Ref. 3: 344-360.

UNIT: 5 Chemical Safety and Ethical Handling of Chemicals (L-9, M-12)

Safe working procedure and protective environment, protective apparel, emergency procedure and first aid, laboratory ventilation. Safe storage and use of hazardous chemicals, procedure for working with substances that pose hazards, flammable or explosive hazards, disposal of waste chemicals, recovery, recycling and reuse of laboratory chemicals, incineration and transportation of hazardous chemicals.

Ref. 6: 1.31–1.36, 1.40, 2.1-2.16, 5.79-5.85, 7.41-7.50, 8.25-8.31.

Reference Books:

1. *Practical Skills in Chemistry, 2nd Ed, .Dean, J. R., Jones, A. M., Holmes, D., Reed, R., Weyers, J. and Jones, A. Prentice-Hall, Harlow (2011)*
2. *APPENDIX A: The Literature of Organic Chemistry March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure, Seventh Edition, by Michael B. Smith and Jerry March Copyright John Wiley & Sons, Inc. (2013)*
3. *Research Methodology: Methods And Techniques, 3rd edition, Kothari, C.R. Published by New Age International (P) Ltd., Publishers (2004),*
4. *How to Use Excel in Analytical Chemistry and in general Scientific Data Analysis. Levie, R. de, Cambridge Univ. Press (2001).*
5. *Chemical Safety Matters – IUPAC – IPCS, Cambridge University Press, (1992).*
6. *OSU Safety Manual 1.01*
7. *Laboratory Safety for Chemistry Students, Hill R. H., Finster D. C. 8th ed.; John Wiley and Sons: Hoboken, NJ, March (2017).*

T.Y.B.Sc. Chemistry

Semester -V **Course No:- CH-507**

Subject: Physical Chemistry Practical

(Practical: Lectures = 60 hrs, Marks 60) **(Credits: 02)**

Course Objectives

- To develop skills required in chemistry such as the appropriate handling of apparatus, instruments and chemicals.
- The student will learn the laboratory skills needed to design, safely conduct and interpret chemical research.
- To expose the students to an extent of experimental techniques using modern instrumentation.
- The student will develop the ability to effectively communicate scientific information and research results in written and oral formats.

Learning Outcomes

- Students will get basic analytical and technical skills to work effectively in the various fields of chemistry.
- Students will able to calibrate and handle instruments like conductometer, potentiometer, pH meter, colorimeter, spectrophotometer, polarimeter.
- They have ability to perform accurate quantitative measurements with an understanding of the theory and use of contemporary chemical instrumentation, interpret experimental results, perform calculations on these results and draw reasonable, accurate conclusions.
- They get skills required in chemistry such as the proper handling of apparatus and chemicals.
- They will have ability to present scientific and technical information resulting from laboratory experimentation in both written and oral formats.

- Students will apply conductometer, potentiometer, pH meter, colorimeter, spectrophotometer, polarimetery techniques for analysis and measurement.

Instructions:

- The student should perform at least 10 experiments from each semester. It is expected to perform at least one experiment from each technique.
- Use dilute solutions and in minimum amount.
- Use 50 ml volumetric flasks for preparation of solutions
- Scientific calculators (non-programmable) and practical handbooks are allowed during practical examination.

Conductometry:

1. Conductometric titration of mixture of acids and hence determine the strength of acids.
2. Determine the degree of hydrolysis and hydrolysis constant of sodium acetate conductometrically.

Potentiometry:

1. Determine Ecal and pH of buffer solution (Citric acid + Na_2HPO_4) using quinhydrone electrode.

2. Determine the pKa and Ka of weak monobasic acid by potentiometric titration.

P^Hmetry:

1. Determine the amount of aspirin in the given tablet.
2. Determine the pKa of various mixtures of sodium acetate and acetic acid in solution and hence to find the dissociation constant.

Polarimetry:

1. To study the kinetics of inversion of cane sugar by polarimeter.
2. Determine the concentration of given solution of an optically active substance (cane sugar) by polarimetric measurement.

Flame Photometry:

3. Estimation of Na / K by flame photometer in the given sample.

Refractometery:

1. Determine the refractive indices of series of KCl solution and hence unknown concentration of given KCl solution**.**

Chemical Kinetics:

1. Study the hydrolysis of methyl acetate in presence of hydrochloric acid.
2. Determine the energy of activation of the reaction between $K_2S_2O_8$ and KI. (Equal initial concentration)
3. Investigate the kinetics of iodination of acetone (zero order reaction).

Viscosity:

1. Determine the molecular weight of high polymer using its solution of different concentration.

Partition coefficient:

1. Determine the partition coefficient of iodine between carbon tetrachloride and water**.**

T.Y.B.Sc. Chemistry

Semester -VI **Course No:- CH-607**

Subject: Physical Chemistry Practical

(Practical: Lectures = 60 hrs, Marks 60) **(Credits: 02)**

Instructions:

- The student should perform at least 10 experiments from each semester. It is expected to perform at least one experiment from each technique.
- Use dilute solutions and in minimum amount.
- Use 50 ml volumetric flasks for preparation of solutions.
- Scientific calculators (non programmable) and practical handbooks are allowed during practical examination

Conductometry:

1. Determine the relative strength of monochloro acetic acid and acetic acidconductometrically.
2. Determine the basicity of organic acid by conductometric measurement.

Potentiometry:

1. Determine the amount of sodium chloride in a given solution by potentiometric titration with silver nitrate.
2. Determine formal redox potential of Fe^{2+} to Fe^{3+} by potentiometric titration.

Colorimeter / Spectrophotometer:

1. Determination of λ max and concentration of unknown Cu^{2+} solution and verify Beer's law.
2. Verify Beer's law, determine unknown concentration and molar extinction coefficient of Potassium permanganate.

P^Hmetry:

1. Determine the pKa and Ka of weak monobasic acid by pH metric titration.
2. Determine the degree of hydrolysis and hydrolysis constant of aniline hydrochloride pH metrically.

Polarimetry:

1. Determine the percentage of two optically active substances (d- sucrose and d-tartaric acid) in a mixture polarimetrically**.**

Radioactivity:

1. Determine the E_{max} of Beta particle.

Refractometry:

1. Determine the refractive index of four liquids, hence specific and molarrefraction.
2. Determine the molar refraction of homologous methyl, ethyl and propylalcohol and show that constancy configuration to molar refraction by $–CH_2$group.

Chemical Kinetics:

1. Investigate the reaction between H_2O_2 and KI by gas burette method.
2. Determine the order of the reaction between potassium persulphate and potassium iodide by fractional change method.

Viscosity:

1. Determine the radius of glycerol/sucrose molecule by viscosity measurement.

References:-

1. *Findley's Practical Physical Chemistry, B.P.Levitt, 9th Edition, Longman group Ltd.*
2. *Advanced Physical Chemistry Experiments, J.N.Gurtu and Amit Gurtu, Pragati Prakashan*
3. *Systematic Experimental Physical Chemistry S.W. Rajbhoj, Dr. T.K. Chondekar, 3rd edition, Anjali Publication, Aurangabad.*
4. *Experimental Physical Chemistry, V.D.Athawale, P. Mathur, New age International Ltd,New Delhi.*
5. *Advanced Practical Physical Chemistry, J. B. Yadav, Goel Publishing House, Meerut*
6. *Advanced Practical's in Physical Chemistry. Dr. Pande, Dr. Mrs. Datar, Dr. Mrs. Bhadane, 4th revised Edition, Manali Publication, Pune.*
7. *Experimental Physical Chemistry, R.C. Das, B.Behra, Tata McGrawHill.*

STRUCTURE OF INTERNAL PRACTICAL EXAMINATION

Time allowed – 3 Hours **Marks – 40**

Q.1 Any One experiment from (CH-507/607)	**30 Marks**
Q.2 Oral	**10 marks**

Total: 40 Marks

STRUCTURE OF EXTERNAL PRACTICAL EXAMINATION

Time allowed: 3 Hours **Marks: 60**

Semester V (CH-507)

Q. 1. Any One experiment from CH-507	**40 Marks**
Q.2 Oral	**10 Marks**
Q.3 Certified Journal	**10 Marks**

Total: 60 Marks

STRUCTURE OF EXTERNAL PRACTICAL EXAMINATION

Time allowed: 3 Hours **Marks: 60**

Semester VI (CH-607)

Q. 1. Any One experiment from CH-607)	**40 Marks**
Q.2 Oral	**10 Marks**
Q.3 Certified Journal	**05 Marks**
Q.4 Industrial Tour Report	**05 Marks**

-

Total: 60 Marks

T.Y.B.Sc. Chemistry

Semester -V **Course No:- CH-508**

Subject: Inorganic Chemistry Practical

(Practical: Lectures = 60 hrs, Marks 60) **(Credits: 02)**

Course Objectives:

- To analyze the inorganic mixtures.
- To determine metal from ore and alloy analysis.
- Using colorimetric analysis to determine amount of metal.

Learning outcomes:

- Student will able to determine cation & anion from inorganic mixtures by using qualitative analysis.
- Student will able to determine metal from ore & alloys.
- Students will be able to design & carry out scientific experiments as well as accurately record & analyze the results of experiments.
- Students will be able to handle colorimeter for estimation of metal ions.

1. **Inorganic Qualitative Analysis: (Any Five)**
   Binary mixtures containing common anions (Excluding phosphates and borates)
2. **Ore Analysis: (Any Two)**
   i) Heamatite ore - Estimation of Iron volumetrically
   ii) Pyrolusite ore- Estimation of Manganese volumetrically
   iii) Dolomite ore - Estimation of Calcium volumetrically
3. **Alloy Analysis: (Any Two)**
   i) Estimation of Zn from Brass alloy .
   ii) Estimation of Tin gravimetrically as SnO_2 from solder alloy.
   iii) Estimation of Copper iodometrically from nichrome alloy.
   iv) Determination of iron gravimetrically from stainless steel.
4. **Colourimetric analysis (any one)**
   i) Colourimetric titration of Cu(II) against EDTA method .
   ii) Estimation of Titanium using hydrogen peroxide.

IMPORTANT NOTE:

- For volumetric analysis pipette out solution should be 10 ml
- Preparation of stock solution or standard solution should be in **100/50ml volumetric flask** in order to avoid wastage of chemicals.

References

1. *A Text Book of Quantitative Inorganic Analysis, A. I. Vogel, 4th edition*
2. *Vogel's Qualitative Inorganic Analysis, A. I. Vogel.*
3. *Practical Chemistry, O. P. Pandey, D. N. Bajpai, S. Giri, S. Chand Publication, New Delhi.*
4. *Post Graduate Practical Chemistry, H. N. Patel, S. P. Turakhia, S. S. Kelker, S. R. Puniyani, Himalaya Publishing House.*
5. *College Practical Chemistry, H. N. Patel, S. P. Turakhia, S. S. Kelker, S.R. Puniyani, Himalaya Publishing House.*
6. *Practical Chemistry, K. K. Sharma, D. S. Sharma, Vikas Publication.*

T.Y.B.Sc. Chemistry

Semester -VI **Course No:- CH-608**

Subject: Inorganic Chemistry Practical

(Practical: Lectures = 60 hrs, Marks 60) **(Credits: 02)**

Course Objectives:

- To determine metal from gravimetric estimations.
- To determine amount of metal by volumetric analysis.
- To determine preparation /synthesis of co-ordination compound.
- To study separation techniques of metals.
- To use colorimetric analysis of metal.

Learning Outcomes:

- Students will be able to prepare co-ordination compounds.
- Students will be able to determine amount of metal by using quantitative analysis.
- Students will be able to calculate Rf value of metal.
- Students will be able to design & carry out scientific experiments as well as accurately record & analyze the results of experiments.
- Students will be able to explain why chemistry is an integral activity for addressing social, economic & environmental problems.

1. Gravimetric Estimations: (Any Two)

i) Fe as Fe_2O_3

ii) Zn as $Zn_2P_2O_7$

iii) Pb as lead chromate

iv) Al as Al_2O_3

2. Volumetric Analysis: (Any Two)

i) Manganese by Volhards method.

ii) Estimation of Nickel by EDTA method.

iii) Determination of strength of NaOH and Na_2CO_3 in a given solution.

iv) Estimation of ferrous and ferric by dichromate method.

3. **Inorganic Preparations: (Any Three)**
   i) Bis (ethylenediamine) copper (II) sulphate.
   ii) Potassium trioxalato chromate (III).
   iii) Tris (acetylacetonato) Iron (III).
   iv) Hexaaquonickel (II) chloride.
   v) Potassium tris oxalatoaluminate (III)trihydrate.
   vi) Synthesis of ZnO nanoparticles using Zinc acetate dihydrate

4. **Colourimetric Analysis: (Any One)**
   i) Estimation of iron using thiocynate method.
   ii) To determine the concentration of cobalt in the given solution using R-nitroso salt by colourimetry.

5. **Paper Chromatography: (Any Two mixtures)**
   Separation and identification of binary mixture of cations (Fe^{3+},Ni^{2+}, Cu^{2+},Co^{2+}, Mn^{2+},Zn^{2+})

IMPORTANT NOTE:

- For volumetric analysis pipette out solution should be 10 ml
- Preparation of stock solution or standard solution should be in **100/50 mL volumetric flask** in order to avoid wastage of chemicals.

References:

1. *A Text Book of Quantitative Inorganic Analysis, 4th edition, A. I. Vogel,*
2. *Vogel's Qualitative Inorganic Analysis, A. I. Vogel.*
3. *Practical Chemistry, O. P. Pandey, D. N. Bajpai, S. Giri, S. Chand Publication, New Delhi.*
4. *Post Graduate Practical Chemistry, H. N. Patel, S. P. Turakhia, S. S. Kelker, S. R. Puniyani, Himalaya Publishing House.*
5. *College Practical Chemistry, H. N. Patel, S. P. Turakhia, S. S. Kelker, S.R. Puniyani Himalaya Publishing House.*
6. *Practical Chemistry, K. K. Sharma, D. S. Sharma, Vikas Publications.*

STRUCTURE OF PRACTICAL EXAMINATION

Inorganic Chemistry Practical

CH-508, Semester-V

Internal Examination Pattern

Time Allowed: 3Hrs. **Max. Marks: 40**

Q 1. Inorganic Qualitative Analysis/Ore Analysis/ Alloy Analysis	**30 Marks**
Q 2. Oral	**10 Marks**
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	40 Marks

External Examination Pattern

Time Allowed: 3Hrs. **Max. Marks: 60**

Q 1. Inorganic Qualitative Analysis/Ore Analysis/ Alloy Analysis	**40 Marks**
Q 2. Oral	**10 Marks**
Q 3. Journal (completed and certified)	**10 Marks**
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	60 Marks

Inorganic Chemistry Practical

CH-608, Semester-VI

Internal Examination Pattern

Time Allowed: 3Hrs. **Max. Marks: 40**

Q 1. Gravimetric Estimations/Volumetric Analysis/colorimetric Analysis/ Inorganic Preparation and Paper Chromatography	**30 Marks**
Q 2. Oral	**10 Marks**
	40 Marks

External Examination Pattern

Time Allowed: 3Hrs. **Max. Marks: 60**

Q 1. Gravimetric Estimations/Volumetric Analysis/colorimetric Analysis/ Inorganic Preparation and Paper Chromatography	**40 Marks**
Q 2. Oral	**10 Marks**
Q 3. Journal (completed and certified)	**05 Marks**
Q 4. Industrial Tour Report	**05 Marks**
	60 Marks

T.Y.B.Sc. Chemistry

Semester -V **Course No: - CH-509**

Subject: Organic Chemistry Practical

(Practical: Lectures = 60 hrs, Marks 60) **(Credits: 02)**

Course Objectives

- To develop skills required in chemistry such as the appropriate handling of apparatus and chemicals.
- The student will learn the laboratory skills needed to design, safely conduct and interpret chemical research.
- To expose the students to an extent of experimental techniques using modern instrumentation.
- The student will develop the ability to effectively communicate scientific information and research results in written and oral formats.

Learning Outcomes

- Separate and analyze binary water insoluble mixture.
- Separate and analyze binary water soluble mixture.
- Estimate - Acetamide, Glucose and Glycine by volumetric method,
- Estimate basicity of various acids.
- Synthesis of various organic compounds through greener alternatives.
- Understand Thin Layer Chromatographic techniques and physical constant.
- Understand the purification technique use in organic chemistry.

I) Separation of Binary Mixtures and Qualitative Analysis (Any 6)

a) Solid-Solid (4 Mixtures) b) Solid-Liquid (1 Mixture) c) Liquid-Liquid (1 Mixture)

At least one mixture from each of the following should be given-Acid-Base, Acid-Phenol, Acid-Neutral, Phenol-Base, Phenol-Neutral, Base-Neutral and Neutral- Neutral. (Solid-solid mixtures must be insoluble in water)

Note:

- Students are expected to determine type of the mixture and to separate the mixture.
- Separation of the Mixture should be done by chemical method only.
- It is expected to perform preliminary tests, physical constants, detection of elements and determination of functional groups of separated compounds.
- On the basis of above tests, students are expected to determine structure of compounds.
- The separated compounds should be purified and then melting point of purified compound should be determined. The purified samples of the separated components should be submitted.
- Separation and qualitative analysis of the binary Mixtures should be carried out on micro scale using micro scale.

II) Organic Estimations (Any 2)

1. Estimation of acetamide
2. Estimation of basicity (Number of -COOH groups) of acid
3. Estimation of glycine
4. Saponification value of oil

III) Green Chemistry Preparation (Any 2)

1. Synthesis of acetanilide from aniline by using Zn dust / acetic acid.
2. Synthesis of dibenzalpropanone from benzaldehyde and acetone. using $LiOH.H_2O$/NaOH
3. Synthesis of p- bromo acetanilide from acetanilide by using KBr.
4. Synthesis of dihydropyrimidinone from ethyl ace to acetate, benzaldehyde and urea
5. Diels-Alder reaction between furan and maleic acid [4+2] Cycloaddition Reaction

T.Y.B.Sc. Chemistry

Semester -VI **Course No:- CH-609**

Subject: Organic Chemistry Practical

(Practical: Lectures = 60 hrs, Marks 60) **(Credits: 02)**

I) Organic preparations **(Any 6)**

1. Benzoquinone from Hydroquinone (Oxidation by $KBrO_3$ or $K_2Cr_2O_7$)
2. Preparation of Sudan-I (Diazocoupling)
3. p-nitroacetanilide from Acetanilide (Nitration)
4. 2-Naphthyl ether from 2-Naphthol (Methylation by DMS, NaOH)
5. Hippuric acid from Glycine (Benzoylation)
6. p-Iodonitrobenzene from p-Nitroaniline (Sandmeyer Reaction)
7. m- Nitro aniline from m-Dinitrobenzene (Reduction)
8. Benzoic acid from Ethyl benzoate (Ester hydrolysis)
9. Isolation of Starch from Potato
10. Adipic acid from Cyclohexanone (Oxidation by Con. HNO_3)

II) Preparation of derivatives **(Any 3)**

1. Oxime derivative of aldehydes or Ketones
2. Aryloxy acetic acid derivative of Phenol
3. 2, 4 DNP derivative of aldehydes or Ketones
4. Glucosazone derivative of Glucose
5. Anilide derivative of acid

III) Purification techniques **(Any 1)**

1. Solvent extraction using separating funnel
2. Preparative TLC
3. Steam distillation

Note:

- The Preparation or derivative should be carried out on small scale and the starting compound should not be given more than one gm.

- Purity of the sample in Preparation and derivative can be checked by thin layer Chromatography (TLC).
- If product is impure, it should be purified.
- The Head of the Department must see that the industrial tour will be arranged collectively by the Department staff members.

Reference Books

1. *Practical Organic Chemistry, A. I. Vogel, Pearson, 5th Edition, 2005.*
2. *Practical Organic Chemistry, O. P. Agarwal, Krishna Prakashan Media (P) Ltd, 2014.*
3. *University Practical Chemistry, P. C. Kamboj, Vishal Publishing Co.; 1st (Reprint) Edition, 2013.*
4. *Comprehensive Practical Organic Chemistry-Qualitative Analysis, V. K. Ahluwalia and Renu Aggarwal, Universities Press, 2016.*
5. *R.B. Woodward and H. Baer, J. Am. Chem. Soc. 1948, 70, 1161.*
6. *D. C. Rideout and R. Breslow, J. Am. Chem. Soc. 1980, 102, 7816.*
7. *Green Chemistry: Theory and Practice, Anastas, P.T and Warner, J.C. Oxford University Press (1998).*
8. *Monograph on Green Chemistry Laboratory Experiments, Green Chemistry Task Force Committee, DST*

STRUCTURE OF INTERNAL PRACTICAL EXAMINATION

Time allowed – 3 Hours **Marks – 40**

Q.1 Any One experiment from CH-509/609) **30 Marks**

Q.2 Oral **10 marks**

STRUCTURE OF EXTERNAL PRACTICAL EXAMINATION

Time allowed: 3 Hours **Marks: 60**

Semester V (CH-509)

Q.1 Separation of Binary Mixtures and Qualitative Analysis of any one Compound
OR Organic Estimation
OR Green Chemistry Experiment **40 Marks**

Q.2 Oral **10 Marks**

Q.3 Journal (completed and certified) **10 Marks**

Semester VI (CH-609)

Q.1 Organic Preparation / Derivative / Purification technique **40 Marks**

Q.2 Oral **10 Marks**

Q.3 Journal (completed and certified) **05 Marks**

Q.4 Industrial Tour Report **05 Marks**

Instructions

- In case of binary mixture experiment, examinee should identify type of mixture and should separate the mixture. After separation, examiner should ask the examinee to analyze any one compound from the mixture.
- In case of preparation of organic compounds and derivatives, product should be purified by recrystallization.
- Industrial tour is compulsory for each student.

Kavayitri Bahinabai Chaudhari
North Maharashtra University, Jalgaon
T.Y.B.Sc Chemistry
(CBCS) Pattern equivalence

Equivalence in accordance with titles and contents of papers (for revised syllabus from June 2020) are as follows…

Sr. No.	Title of Old Paper		Title of New Paper	
	Semester-V			
1.	CH -351	Physical Chemistry	CH – 501	Principles of Physical Chemistry-I
2.	CH -352	Inorganic Chemistry	CH – 502	Inorganic Chemistry
3.	CH -353	Organic Chemistry	CH – 503	Organic Reaction Mechanism
4.	CH -354	Analytical Chemistry	CH – 504	Industrial Chemistry
5.	CH -355	Industrial Chemistry	CH – 505	Analytical Instrumentation
6.	CH -356 (A)	Bio Chemistry	CH – 506 (A)	Biochemistry
7.	CH -356 (B)	Environment Chemistry	CH – 506 (B)	Green Chemistry
8.	CH -357	Physical Chemistry Practical	CH – 507	Physical Chemistry Practical
9.	CH -358	Inorganic Chemistry Practical	CH – 508	Inorganic Chemistry Practical
10.	CH -359	Organic Chemistry Practical	CH – 509	Organic Chemistry Practical
11.	Non-Credit Audit Course **(Any One)**		AC-510	NSS
			AC-511	NCC
			AC-512	Sports
	Semester-VI			
1.	CH -361	Physical Chemistry	CH - 601	Principles of Physical Chemistry-II
2.	CH -362	Inorganic Chemistry	CH - 602	Novel Inorganic Solids
3.	CH -363	Organic Chemistry	CH - 603	Spectroscopic Methods of Structure Determination
4.	CH -364	Analytical Chemistry	CH - 604	Chemistry of Industrially Important Products
5.	CH -365	Industrial Chemistry	CH - 605	Analytical Technique
6.	CH -366 (C)	Polymer Chemistry	CH – 606 (A)	Polymer Chemistry
7.	CH -366 (D)	Chemistry In Every Day Life	CH – 606 (B)	Research Methodology for Chemistry
8.	CH -367	Physical Chemistry Practical	CH – 607	Physical Chemistry Practical
9.	CH -368	Inorganic Chemistry Practical	CH – 608	Inorganic Chemistry Practical
10.	CH -369	Organic Chemistry Practical	CH - 609	Organic Chemistry Practical
11.	Non-Credit Audit Course **(Any One)**		AC-610	Soft Skill
			AC-611	Yoga
			AC-612	Practicing Cleanliness

FACULTY OF SCIENCE & TECHNOLOGY

KAVAYITRI BAHINABAI CHAUDHARI NORTH MAHARASHTRA UNIVERSITY, JALGAON

'A' Grade
NAAC Re-Accredited
(3rd Cycle)

SYLLABUS
FOR
S. Y. B. Sc. (PHYSICS)

(AS PER CHOICE BASED CREDIT SYSTEM PATTERN OF UGC)

(With effect from June - 2019)

Preamble

The University Grants Commission (UGC) has initiated several measures to bring equity, efficiency and excellence in the Higher Education System of country. The important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process and examination and evaluation systems.

In that context in the last decade, North Maharashtra University, Jalgaon has taken several initiatives to upgrade and enhance the academic excellence, examination reforms and developing the skilled minds and skilled hands. As per the directions of UGC, from last year our KBC North Maharashtra University, Jalgaon has implemented the Choice Based Credit (CBCS) pattern to undergraduate programs run by various colleges affiliated to NMU, Jalgaon. As per the directions given by the Honorable Vice Chancellor, Pro-Vice Chancellor and Dean of the Faculty of Science and Technology of our university, one day workshop was organized for syllabus framing. The teachers of the affiliated colleges and university department were participated in the workshop of re-structuring the syllabi of S.Y.B.Sc. (Physics) as per the CBCS pattern and it has been finalized during the workshop and the same will be effectively implemented from the academic year 2019-20.

The main objective of the re-structuring the syllabus of S.Y.B.Sc. (Physics) is to create skilled minds and therefore expectation is to equip the students with the knowledge and understanding of concepts of physics rather than the ability to remember facts so that they may have a reasonable comprehensive and complete grasp of principles of physics. It is expected that the students should study physics with keen interest, develop their experimental skill and problem solving ability. The students should communicate their knowledge of Physics to the Society, to make them to understand physics around us. The students should use their knowledge of Physics for betterment of our Society, our nation and the World.

Board of Studies (Physics),
North Maharashtra University, Jalgaon

OBJECTIVES

1. To provide education in physics of the highest quality at the undergraduate level and generate graduates of the caliber sought by industries and public service as well as academic teachers and researchers of the future.
2. To acquire deep knowledge in fundamental aspects of Physics and basic knowledge in the specialized thrust areas like Thermodynamics, Basic electronics, Waves, Sound, Optics, LASERS, Energy harvesting and electrical circuit skills.
3. To develop ability among the students to identify, remember and grasp the meaning of basic facts, concepts and principles of Physics.
4. To develop observational skills, confidence in using scientific equipment and relate the knowledge of scientific concepts to quantitative and physical measurement.
5. Acquire knowledge, skills, working methods and ways of expression which will reflect on all round development of the students' attitudes towards scientific thinking and its applications.
6. To develop attitudes such as concern for accuracy and precision, objectivity, and Enquiry.
7. The overall aim is to provide comprehensive knowledge and understanding in the relevant fields and enable students to pursue the physics subject at an advanced level later and to attract outstanding students from all back grounds.

BOS (PHYSICS)-Faculty of Science & Technology

Kavayitri bahinabai Chaudhari
North Maharashtra University, Jalgaon

Class: **S. Y. B. Sc.** Subject: **Physics**

Choice Base Credit System (With effect from June 2019)

The Board of Studies in Physics in its meeting held on **4th July 2018** has unanimously accepted the revised syllabus (as per CBCS pattern) prepared by different committees, discussed and finalized in workshop restructuring of S.Y.B.Sc. Syllabus.

The titles of the papers for S.Y.B.Sc. (Physics) are as given below:

Semester	Course		No. of Credits	Hours per semester	Marks	
	Course code	Course Title			Internal marks	External marks
III	PHY 301	Thermodynamics and Kinetic theory of gases	02	30	40	60
	PHY 302(A) OR PHY 302(B)	Electronics-I OR Instrumentation	02	30	40	60
	PHY 303	LAB-III	02	60	40	60
	PHY 304: (Skill Enhancement course I)	Renewable energy and Energy Harvesting	02	30	40	60
IV	PHY 401	Waves, Oscillations and acoustics	02	30	40	60
	PHY 402	Optics and LASERS	02	30	40	60
	PHY 403	Lab IV	02	60	40	60
	PHY 404: (Skill Enhancement course II)	Electrical Circuits and Network Skills	02	30	40	60

Note: The industrial/study tour is compulsory for students of S. Y. B. Sc. (Physics).

Semester III: Physics paper I

PHY 301: Thermodynamics and Kinetic theory of gases

(Credits: 02) :(30 Lectures 60 Marks)

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Course description:

This course is aimed at introducing the fundamentals of Thermodynamics and kinetic theory of gases to Under Graduate students.

Course objectives:

1. To impart knowledge of basic concepts in Thermodynamics and kinetic theory of gases.
2. To provide the knowledge and methodology necessary for solving problems in Physics.
3. The course also involves the related experiments based on the theory.

Course outcome:

Learner will be able to ….

1. Apply the concept of use of knowledge of Thermodynamics and kinetic theory of gases to real life problems.
2. Understanding of the course will create scientific temperament.

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Unit 1: Basics of thermodynamics and its First Law: (08 L, 15 M)

Thermodynamic Description of system, Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermodynamical Processes, Applications of First Law: General Relation between C_P and C_V, Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Coefficient, Reversible and irreversible processes.

Unit 2: Second and Third Law of Thermodynamics and Entropy: **(08 L, 15 M)**

Second law & Entropy, Carnot's cycle & theorem, Entropy changes in reversible and irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero, Enthalphy.

Unit 3: Heat Engines: (07 L, 15 M)

Carnot's Engine, Otto Engine and Cycle, Diesel Engine and Cycle, Efficiencies of all heat engines.

Unit 4: Kinetic Theory of Gases: (07 L, 15 M)

Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases.

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Reference Books:

- Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.
- A Treatise on Heat, Meghnad Saha, and B.N. Srivastava, 1969, Indian Press.
- Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications.
- Heat and Thermodynamics, M. W. Zemasky and R. Dittman, 1981, McGraw Hill 13
- Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W. Sears & G. L. Salinger. 1988, Narosa
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
- Thermal Physics, A. Kumar and S.P. Taneja, 2014, R. Chand Publications

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Semester III: Physics paper II
PHY 302 (A): Electronics –I
(Credits: 02) :(30 Lectures 60 Marks)

Course description:
This course is aimed at introducing the fundamentals of Electronics of gases to Under Graduate students.

Course objectives:
1. To impart knowledge of basic concepts in Electronics.
2. To provide the knowledge and methodology necessary for solving problems in Physics.
3. The course also involves the related experiments based on the theory.

Course outcome:
Learner will be able to ….
1. Apply the concept of use of knowledge of Electronics to real life problems.
2. Understanding of the course will create scientific temperament.

Unit 1 Semiconductor diodes (07 L, 14 M)

(Revision on metal, insulator and semiconductors, Intrinsic and Extrinsic semiconductor), Semiconductor Diodes: p and n type semiconductors. Barrier Formation in PN Junction Diode. Qualitative Idea of Current Flow Mechanism in Forward and Reverse Biased Diode. PN junction and its characteristics. Static and Dynamic Resistance. Principle, Construction, Working and Characteristics of (1) LEDs (2) Photodiode (3) Solar Cell (P-N Junction), (4) Zener Diode

Unit 2: **Rectifiers and Power Supplies (05 L, 10M)**

Introduction to Rectifiers, Types: Half-wave & Full-Wave Rectifiers (Centre-tapped and Bridge Rectifiers), Calculation of Ripple Factor and Rectification Efficiency, Basic idea about capacitor filter, D.C. power Supply (unregulated and regulated), Zener Diode as a voltage regulator.

Unit 3: Bipolar junction transistor (06L, 12M)

Bipolar Junction transistors: n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC configurations. Active, Cutoff, and Saturation Regions. Current gains α and β. Relations between α and β. Load Line analysis of Transistors. DC Load line and Q point.

Unit 4: Digital Electronics (12 L, 24 M)

Binary Numbers, Decimal to Binary and Binary to Decimal Conversion, Binary Addition, Binary Subtraction using 2's Complement Method, AND, OR and NOT Gates (Realization using Diodes and Transistor), NAND and NOR Gates as Universal Gates, XOR and XNOR Gates,

De Morgan's Theorems, Boolean Laws, Simplification of Logic Circuit using Boolean Algebra, Fundamental Products, Min terms and Max terms, Conversion of a Truth Table into an Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh's Map,

Half Adders and Full Adders and Subtractors, 4-bit binary Adder-Subtractor.

Reference Books:

1. Electronic Principles – A. P. Malvino, Mc Graw-Hill Publishing House
2. Electronic fundamentals and applications – J. D. Ryder, Prentice Hall 4th Edition
3. Principles of Electronics – V. K. Mehta, S. Chand Publications, New Delhi
4. Electronic Devices and Circuits – Allen Mottershead, Good year Publishing Company
5. Digital Principles and Applications – Malvino and Leach, Mc Graw-Hill Publication.
6. Modern Digital Electronics – R. P. Jain, Tata Mc Graw-Hill Pvt. Ltd., New Delhi
7. Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
8. Electronic devices and circuits, S. Salivahanan and N. Suresh Kumar, 2012, Tata Mc-Graw Hill.
9. Microelectronic Circuits, M.H. Rashid, 2ndEdn.,2011, Cengage Learning.
10. Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, 2014, 6th Edn., Oxford University Press.
11. Fundamentals of Digital Circuits, A. Anand Kumar, 2nd Edition, 2009, PHI Learning Pvt. Ltd.

Semester III: Physics paper II

PHY 302 (B): Instrumentation

(Credits: 02) :(30 Lectures 60 Marks)

[Note: For students opting electronics as one of the subjects at F. Y. B. Sc. Class]

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Course description:
This course is aimed at introducing the fundamentals of Instrumentation to Under Graduate students.

Course objectives:
1. To impart knowledge of basic concepts in Instrumentation.
2. To provide the knowledge and methodology necessary for solving problems in Physics.
3. The course also involves the related experiments based on the theory.

Course outcome:
Learner will be able to ….

1. Apply the concept of use of knowledge of Instrumentation to real life problems.
2. Understanding of the course will create scientific temperament.

…….

Unit-I Fundamentals of Measurements: (04L, 8M)

Functional elements of typical measurement system, Standards of measurements and calibration, Static performance characteristics: Accuracy, Precision, Accuracy versus precision, Sensitivity, Linearity, Concept of Errors and their types.

Unit-II Measurement of Temperature: (10L, 20M)

Non - electrical Methods : Liquid- in-glass Thermometer, Pressure Thermometer construction and their types: constant volume gas thermometer and Vapour pressure Thermometer, **Electrical Methods :** Thermo-electric Sensors (Thermocouple), Metallic resistance Thermometer (Platinum resistance thermometer), Semiconductor resistance sensors (Thermistor).

Radiation Methods (Pyrometry) : Total Radiation Pyrometer, Selective Radiation Pyrometer.

Unit-III: **Measurement of Pressure: (08L, 16M)**

High pressure Measurement, Measurement of low pressure (Vacuum): McLaud Guage, Pirani Gauge, Calibration & Testing (Dead - weight tester)

Unit-IV: Acoustics (Sound) Measurement: (08L, 16M)

Characteristics of sound, Sound pressure level, Sound power level, Variation of intensity of sound with distance, Typical sound measuring system (Sound level Meter), Microphones : Condenser or capacitor type Microphone, Electrets Microphone, Electrodynamics types of Microphone, Carbon granules type Microphone

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Reference Books :

1. Instrumentation, Measurement & Analysis by (Nakra and Chaudhary), 2nd Edition
2. Instrumentation : Devices & Systems by (Rangan, Mani & Sarma), 2nd Edition
3. Basic Electronics by B. L. Thereja.
4. A Course In Electrical & Electronics Measurement & Instrumentation by A. K. Sawhney
5. Modern electronic instrumentation and Measurement Techniques by Helfrick & Cooper.

Semester III: Physics paper III:

PHY 303: Lab III

(Credits: 02): (60 L, 100M (40 Internal + 60 External))

(Note: Total 10 experiments should be performed. Minimum 05 experiments from both sections should be performed.)

Section A: General Physics-I

1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2. To determine the mechanical equivalent of heat (J) with the help of Joules calorimeter.
3. To determine the coefficient of thermal conductivity of a bad conductor by Lee's method and Charlton's disc method.
4. To determine the coefficient of thermal conductivity of copper by Searle's Apparatus.
5. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
6. To determine thermal conductivity of rubber by tubing method.
7. To determine thermal conductivity of metal by Forbe's method.
8. To Verify Clausius-Clapeyron equation.
9. Jolly's steam calorimeter.
10. To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
11. To study the variation of thermo e. m. f. across two junctions of a thermocouple with temperature.
12. Stefan's fourth power law using bulb.
13. To determine angle of prism and familiarization with Schuster`s focusing.
14. To determine the Refractive Index of the Material of a given Prism using Sodium Light.
15. To determine Dispersive Power of the Material of a given Prism using Mercury Light.
16. To determine Stefan's constant.

Section B: Electronics

1. Study of full wave rectifier with capacitor filter and to calculate its ripple factor.
2. Study of zener diode as a voltage regulator.
3. Study of CE transistor characteristics to find out 'β' of the transistor.
4. Study of logic gates (AND, OR and NOT) using diodes and transistors.
5. Verification of De Morgan's Theorems (using ICs).
6. To study the characteristics of Light Emitting Diode (LED).
7. Experimental verification of NAND gate as a universal building block.
8. Experimental verification of NOR gate as a universal building block.
9. To study I – V characteristic of (i) a resistor and (ii) a p–n junction diode and compare it.
10. Frequency response of CE single stage transistor amplifier and to calculate its bandwidth.
11. To determine fill factor and efficiency of solar cell.
12. Comparison of luminous intensities of two light sources by using photo voltaic cell.

OR Section B: Instrumentation

1. Use of C.R.O as a measurement tool for different electrical parameters (frequency, a.c. /d.c. voltage, pulse height, pulse width, rise time and fall time).
2. To obtain Lissajous figures using C.R.O.
3. To determine characteristics of Thermistor and to find an unknown temperature by using thermistor.
4. Use of thermocouple for measurement of temperature.
5. Measurement of errors.
6. Directional characteristics of a microphone.

7. Platinum resistance thermometer. (Determine the melting temperature of Wax)
8. Velocity of sound by phase shift method.
9. Measurement of Noise by Using Sound Pressure level Meter.

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Reference Books:

1. Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
4. A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal, 1985, Vani Publication.
5. A text Book of Experimental Physics – Dr. V.Y. Rajopadhye, V.L.Purohit and A. S. Deshpande (Continental Prakashan, Poona-30).
6. AN ADVANCED COURSE IN PRACTCIAL PHYSICS- D. Chattopadhyay and P.C. Rakshit.
7. Practical Physics by R. K. Shukla, Anchal Srivastava (New Age International).
8. B.Sc. Practical Physics by Harnam Singh and Dr. P.S. Hemne (S. Chand).
9. Advance Practical Physics by S.P.Singh (Pragati).
10. College Practical Physics: Khanna and Gulati (S. Chand and Co. Ltd , Delhi)
11. Practical Physics: Gupta and Kumar (Pragati Prakashan Meerat)
12. Advanced Level Practical Physics: J. M.Nelkon, J.M.Ogloom (EIBS)
13. A Text book of practical Physics: Shrinivasan and Balasubranian
14. A Text book of practical Physics: Indu Prakash and Ramkrishna.
15. B.Sc. Practical Physics by C.L. Arora (S. Chand and Co. Ltd , Delhi)
16. Practical Course in Electronics by Prof. J.R.Patil and other (Jaydeep Prakashan).

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Semester III: Physics paper IV

PHY 304: Skill Enhancement Course I (SEC-I)

Renewable energy and Energy Harvesting (Credits: 02) Theory: (30 L, 60M)

[The aim of this course is not just to impart theoretical knowledge to the students but to provide them with exposure and hands-on learning wherever possible]

Unit 1.Conventional and Non-conventional energy Sources: Fossil fuels and Nuclear Energy, their limitation, need of renewable energy, non-conventional energy sources. (**02L, 04M**)

Unit 2 . Solar Energy

Solar energy, its importance, storage of solar energy, solar pond, non convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems. Solar energy utilization by Solar roof panels. **(06 L,12 M)**

Unit 3. Ocean, geothermal, Hydro and Biomass energy resources.

a. **Ocean Energy**: Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices. **(03 L,06M)**
   Tidal energy,Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power. **(02 L,04M)**
b. **Geothermal Energy**: Geothermal Resources, Geothermal Technologies. **(02 L,04M)**
c. **Hydro Energy**: Hydropower resources, hydropower technologies, environmental impact of hydro power sources. **(02 L, 04M)**
d. **Biomass energy:** biomass, biochemical conversion, biogas generation, Ocean biomass **(02L,04M)**

Unit 4. Energy Harvesting:

a. **Wind Energy harvesting**: Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies **(03 L,06M)**
b. **Piezoelectric Energy harvesting**: Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, Piezoelectric parameters and modeling piezoelectric generators, Piezoelectric energy harvesting applications, Human power **(04 L,08M)**
c. **Electromagnetic Energy Harvesting**: Linear generators, physics mathematical models, recent applications, **(02 L,04M)**
d. Carbon captured technologies, cell, batteries, power consumption **(01 L,02M)**
e. Environmental issues and sustainability of renewable energy sources,. **(01 L,02M)**

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Demonstrations and Experiments

1. Demonstration of Training modules on Solar energy, wind energy, etc.
2. Conversion of mechanical energy (vibration) into voltage using piezoelectric materials
3. Conversion of thermal energy into voltage using thermoelectric modules.

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Reference Books:

1. Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
2. Solar energy - M P Agarwal - S Chand and Co. Ltd.
3. Solar energy - Suhas P Sukhatme Tata McGraw - Hill Publishing Company Ltd.
4. Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004, Oxford University Press, in association with The Open University.
5. Dr. P Jayakumar, Solar Energy: Resource Assesment Handbook, 2009
6. J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).
7. http://en.wikipedia.org/wiki/Renewable_energy

Semester IV: Physics paper V

PHY 401: Waves, Oscillations and Acoustics

(Credits: 02) : (30 Lectures 60 Marks)

Course description:

This course is aimed at introducing the fundamentals of Waves and Sound to Under Graduate students.

Course objectives:

1. To impart knowledge of basic concepts in Waves and Sound.
2. To provide the knowledge and methodology necessary for solving problems in Physics.
3. The course also involves the related experiments based on the theory.

Course outcome:

Learner will be able to ….

1. Apply the concept of use of knowledge of Waves and Sound to real life problems.
2. Understanding of the course will create scientific temperament.

Unit I: Composition of two S. H. M.'s

Composition of two S.H.M.s of equal frequencies along same line (co-linear) of vibration (analytical method only), Composition of two S.H.M.s of equal frequencies acting at right angles (analytical method with different cases), Composition of two S.H.M.'s right angles to each other (time period in the ratio 1:2), Lissajous figures- demonstration by mechanical, optical and electrical methods, applications of Lissajous figure (list only). **(06L, 16M)**

Unit II: Waves Motion

General: Transverse waves on a string. Travelling and standing waves on a string. Normal Modes of a string. Plane waves, Spherical waves, Wave intensity. **(05L, 8 M)**

Unit - III: Forced oscillations

Idea of forced oscillations, Resonance and its types- Mechanical resonance (Barton's pendulum), Acoustic resonance (resonance tube), Electrical resonance (LCR circuit) and Optical resonance (sodium vapour lamp), Differential equation of forced oscillations and its solution, Amplitude of forced oscillations, Amplitude resonance, Application to series L-C-R circuit. **(08L, 16M)**

Unit IV: Sound:

Parameters of Sound: Sound intensity, Loudness, Pitch, Quality and timber, Acoustic intensity level measurement, Acoustic pressure and its measurement. Reverberation and time of reverberation.

Ultrasonics: Classification of sound frequencies, Piezoelectric effect, Generation of ultrasonic waves by Piezoelectric oscillator (using transistor), Application of ultrasonic waves (list only).

Doppler effect: Doppler effect in sound, Expression for apparent frequency (no derivation), discussion of different cases when source, observer and medium are in relative motion, Asymmetric nature of Doppler effect in sound, Doppler effect in light, Symmetric nature of Doppler effect in light, Applications of Doppler effect in sound and light. **(11L, 20M)**

Reference Books:

1. Waves and oscillations- Brijlal and Subramaniyam (Vikas Publishing House)
2. Waves and Oscillations- R.N. Chaudhari, New Age International (Pvt.) Ltd.
3. Conceptual Physics- A. P. Taggarase, Jivan Sheshan (Himalaya Publishing).
4. The Physics of Waves and Oscillations- N. K. Bajaj (Tata McGraw Hill).
5. Oscillations and Waves- B. S. Agarwal (KedarNath, Ram Nath Publishers)
6. Sound- Mee and Heinmann, London Edition

Semester IV: Physics paper VI

PHY 402: Optics and LASERS

(Credits: 02) : (30 Lectures 60 Marks)

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Course description:

This course is aimed at introducing the fundamentals of Optics and LASERS to Under Graduate students.

Course objectives:

1. To impart knowledge of basic concepts in Optics and LASERS.
2. To provide the knowledge and methodology necessary for solving problems in Physics.
3. The course also involves the related experiments based on the theory.

Course outcome:

Learner will be able to ….

1. Apply the concept of use of knowledge of Optics and LASERS to real life problems.
2. Understanding of the course will create scientific temperament.

……..…….

Unit I: Geometrical Optics: Deviation produced by thin lenses, equivalent focal length of two thin lenses separated by a distance and when in contact. Power of lens, Spherical aberration in lens, reduction of spherical aberration (without derivation), Chromatic aberration, Achromatism; (two lenses in contact and separated by finite distance without derivation). **(04L, 10M)**

Unit II: Interference: Principle of superposition of two, Concept of interference, Intensity distribution in the interference pattern, Division of amplitude and division of wavefront. Young's Double Slit experiment, Expression for fringe width, Fresnel's Biprism and Lloyd's Mirror. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). fringe width in case of fringes of equal thickness. Newton's rings-experimental setup, theory and its application to determine wavelength of source and refractive index of liquids **(10L, 20M)**

Unit III : Diffraction: Definition of diffraction, Concept of diffraction, Types of diffraction, Fresnel Diffraction: Half-period zones, Zone plate, Fresnel Diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis, Fraunhofer diffraction: Single slit; Double Slit. Multiple slits and Diffraction grating. **(08L, 14M)**

Unit IV: Polarization: Polarization, Polarization by reflection, Brewster's law, Polarization by double refraction in uniaxial crystals, Maluss Law Double refracting crystals, Positive and negative crystals, Production and detection of circularly and elliptically polarized light, Nicol prism, Optical activity, Rotation of the plane of polarization, Specific rotation, Polarimeter or Sacherimeter, (Principle and working). **(04L, 10M)**

Unit V: Non-linear optics: Principle of LASER, Characteristics of LASER, Basic steps required to form a LASER: absorption, spontaneous emission, stimulated emission, Metastable state, population inversion, optical pumping, Types of LASER- He-Ne LASER, Applications of LASER (list only) **(04L, 06M)**

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Reference Books:

1. Fundamentals of Optics, F A Jenkins and H E White, 1976, McGraw-Hill
2. Principles of Optics, B.K. Mathur, 1995, Gopal Printing
3. Fundamentals of Optics, H.R. Gulati and D.R. Khanna, 1991, R. Chand Publication
4. University Physics. FW Sears, MW Zemansky and HD Young 13/e, 1986.Addison-Wesley
5. Lasers and nonlinear optics – B. B. Laud
6. An Introduction to Laser – Theory and applications – M. N. Avadhanale
7. A textbook of Optics: Dr. N. Subrahmanyam, Brijlal and Dr. M.N.Avadhanulu, S.Chand Publishing,Co.Ltd.
8. Optics: Singh and Agrwal, Pragati Prakashan, Meerut.
9. Optics and Thermodynamics- Sarkar and Sharma, Himalaya Publishing House

Semester IV: Physics paper VII:

PHY 403: Lab IV - General Physics II

(Credits: 02): (60 L, 100M (40 Internal + 60 External))

(Note: Total 10 experiments should be performed.)

1. To investigate the motion of coupled oscillators.
2. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment and to verify λ^2 – T Law.
3. To study Lissajous Figures and demonstration of Lissajous figures by using C.R.O.
4. Study of acoustic resonance by using bottle as a resonator.
5. Determination of velocity of sound by using Kundt's tube.
6. Study of resonance using Kater's pendulum.
7. Log decrement
8. Damping coefficient
9. Study of acoustic resonance by using resonance tube.
10. To determine the Resolving Power of a Prism.
11. To determine the value of Cauchy Constants of a material of a prism.
12. To determine wavelength of sodium light using Fresnel Biprism.
13. To determine wavelength of sodium light using Newton's Rings.
14. To determine the refractive index of a liquid by using Newton's rings apparatus.
15. Determination of specific rotation α of optically active substance using Polarimeter.
16. Measurement of beam size of a LASER beam.
17. Measurement of beam divergence of a LASER beam.
18. To determine the wavelength of light from LASER source using Diffraction grating.
19. To determine wavelength of (1) Sodium & (2) spectrum of Mercury light using plane diffraction Grating
20. To determine the Resolving Power of a Plane Diffraction Grating.
21. To measure the intensity using photosensor and laser in diffraction patterns of single and double slits.

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Reference Books:

1. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
4. B.Sc. Practical Physics: C. L. Arora, S. Chand Publishing Co. Ltd., New Delhi

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Semester IV: Physics paper VIII

PHY 404: Skill Enhancement Course II

Electrical Circuits and Network Skills

(Credits: 02) : (30 Lectures 60 Marks)

[The aim of this course is to enable the students to design and trouble shoots the electrical circuits, networks and appliances through hands-on mode]

Unit 1. Basic Electricity Principles: Voltage, Current, Resistance, and Power. Ohm's law. Series, parallel, and series-parallel combinations. AC Electricity and DC Electricity. Familiarization with multimeter, voltmeter and ammeter. **(03 L, 06 M)**

Unit 2. Understanding Electrical Circuits: Main electric circuit elements (R,L,C) and their combination. Rules to analyze DC sourced electrical circuits (KCL, KVL) Current and voltage drop across the DC circuit elements, Diode and rectifiers, . Response of inductors and capacitors with DC or AC sources Single-phase and three-phase alternating current sources. Rules to analyze AC sourced electrical circuits. Real, imaginary and complex power components AC source. Power factor. Saving energy and money. **(07 L, 14 M)**

Unit 3. Electrical Drawing and Symbols: Drawing symbols. Blueprints. Reading Schematics. Ladder diagrams. Electrical Schematics. Power circuits. Control circuits. Reading of circuit schematics. Tracking the connections of elements and identify current flow and voltage drop. **(04L, 08M)**

Unit 4.Generators and Transformers: Types of DC Power sources. Principle of DC/AC generators, construction of DC generator, Operation of transformers. **(03 L, 06 M)**

Unit 5.Electric Motors: Single-phase AC & DC motors (Basic design). Interfacing DC or AC sources to control heaters & motors. Speed & power of ac motor. **(04 L, 8 M)**

Unit 6.Electrical Protection: Relays. Fuses and disconnect switches. Circuit breakers. Overload devices. Ground-fault protection. Grounding and isolating. Phase reversal. Surge protection. Interfacing DC or AC sources to control elements (relay protection device) **(04L, 08 M)**

Unit 7.Electrical Wiring: Different types of conductors and cables. Basics of wiring-Star and delta connection. Voltage drop and losses across cables and conductors. Instruments to measure current, voltage, power in DC and AC circuits. Insulation. Solid and stranded cable. Conduit. Cable trays. Splices: wirenuts, crimps, terminal blocks, split bolts, and solder. Preparation of extension board. **(05 L, 10 M)**

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Reference Books:

1. A text book in Electrical Technology - B L Theraja - S Chand & Co.
2. A text book of Electrical Technology - A K Theraja
3. Performance and design of AC machines - M G Say ELBS Edn.
4. Electrical Technology by V.K.Meheta

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KAVAYITRI BAHINABAI CHAUDHARI NORTH MAHARASHTRA UNIVERSITY, JALGAON

Faculty of Science and Technology

SYLLABUS FOR CORE AND SKILL ENHANCEMENT COUESES IN BOTANY

As Per U. G. C. Guidelines

Based on

Choice Based Credit System (CBCS)

S. Y. B. Sc. BOTANY SEMESTER-WISE SYLLABUS

(Theory and Practicals)

Semester-III

Bot. 301: Plant Anatomy

Bot. 302: Plant Physiology

Bot. 303: Practical Based on Bot: 301 and Bot: 302

Bot. 304: Mushroom Culture Technology

Semester-IV

Bot. 401: Plant Embryology

Bot. 402: Plant Metabolism

Bot. 403: Practical Based on Bot: 401 and Bot: 402

Bot. 404: Nursery and Gardening

w. e. f. June, 2019

KAVAYITRI BAHINABAI CHAUDHARI NORTH MAHARASHTRA UNIVERSITY, JALGAON

Structure of S.Y. B.Sc. Botany Syllabus under CBCS Pattern

w.e.f. June, 2019

Year	Sem.	Paper	Code	Title of Course	Marks		Credits
					Int.(CA)	Ext.(UA)	
II	III	I	Bot. 301	Plant Anatomy	40	60	2
		II	Bot. 302	Plant Physiology	40	60	2
		III	Bot. 303	Practical (LAB – I)	40	60	2
		IV	Bot. 304	Mushroom Culture Technology (SEC)	40	60	2
	IV	I	Bot. 401	Plant Embryology	40	60	2
		II	Bot. 402	Plant Metabolism	40	60	2
		III	Bot. 403	Practical (LAB – I)	40	60	2
		IV	Bot. 404	Nursery and Gardening (SEC)	40	60	2

KAVAYITRI BAHINABAI CHAUDHARI NORTH MAHARASHTRA UNIVERSITY, JALGAON

Syllabus of S.Y.B.Sc. Botany w.e.f. June, 2019

CBCS Pattern

Semester: III

PAPER-I

BOT. - 301: PLANT ANATOMY

Lectures: 30

AIMS AND OBJECTIVES

1. To know scope and importance of plant anatomy
2. To study various tissue systems
3. To know primary structure of dicot and monocot plants
4. To study normal secondary growth in plants and their causes
5. To study protective tissue system

Unit-1: **Introduction** **02 L**

1.1 Definition, Scope and Importance

Unit- 2: **Plant Tissues** **08 L**

2.1 Definition

2.2 Meristematic tissues: Classification based on position and origin

2.3 Tissues and it's types:

(a) Simple tissues:

i) Parenchyma: Arenchyma, Chlorenchyma and Palisade

ii) Collenchyma

iii) Sclerenchyma: Fiber and Sclereids / Stone cells

(b) Complex tissues:

i) Xylem and its elements

ii) Phloem and its elements

Unit-3: Protective Tissue System **07 L**

3.1 Epidermal Tissue System: Definition and Function

3.2. Types of Epidermal Appendages

a) Unicellular, Multicellular (Uniseriate and Multiseriate) Trichomes

b) Glandular, Non-glandular Trichomes

c) Stellate, Dendroid Trichomes and Peltate scales

3.3 Types of Stomata

i. Ranunculaceous (Anomocytic)

ii. Cruciferous (Anisocytic)

iii. Rubiaceous (Paracytic)

iv. Caryophyllaceous (Diacytic)

v. Graminaceous

Unit-4: **Primary Structure** **08 L**

4.1 Dicotyledonous (Sunflower)

i. Root

ii. Stem

iii. Leaf

4.2 Monocotyledonous (Maize)

i. Root

ii. Stem

iii. Leaf

Unit- 5: Secondary Growth **05L**

5.1 Vascular cambium- Structure and function, seasonal activity

5.2 Secondary growth in root and stem of Sunflower

5.3 Wood- Heartwood and sapwood

REFERENCES:-

1) Carlquist, S. (1961) Comparative Plant anatomy. Hold, Rinehart and Winson, New York, USA.

2) Chandurkar, P.J, (1971) Plant Anatomy (3rd Ed.), Oxford and IBH Publishing Co. New Delhi and Bombay, India.

3) Choyal Rajaram (2012) Plant Anatomy and Physiology, Sonali Publications, New Delhi, India.

4) Cutter, E. G. (1971) Plant Anatomy: Experiment and Interpretation Part-II, Organ. Edward Arnold, London, UK.

5) Das Susheela, M. (2017) A Text Book of Plant Anatomy. Dominant Publishers and Distributers Pvt. Ltd., New Delhi, India.

6) Eames, A.J. and L.H. Mc Daniels (1947) An Introduction to Plant Anatomy, (2nd Ed.).McGraw Hill Co. New York, USA.

7) Esau, K. (1977) Anatomy of Seed Plants (2nd Ed.).John Wiley, New York, USA.

8) Fahn, A. (1982) Plant Anatomy (3rd Ed.) Pergman Press, Oxford and New York. USA.

9) Grewal, R.C. (2011) Plant Anatomy. Campus Books International, New Delhi, India.

10) Mauseth, J.D. (1988) Plant Anatomy. The Benjamin/Cummings Publisher, USA.

11) Menan , A.B. (2008) Introduction to Plant Anatomy. Rajat Publications, New Delhi, India.

12) Pandey, B.P. (1954) Plant Anatomy. S. Chand and Co. (P.) Ltd. New Delhi, India.

13) Pandey, S.N. and A. Chadha (2006) Plant Anatomy and Embryology. Vikas Publishing House Pvt., Ltd., New Delhi, India.

14) Sharda, Tarun P. (2012) An Introduction to Plant Anatomy. Alfa Publications, New Delhi, India.

15) Sharma Rajani (2009) An Introduction to Plant Anatomy. Campus Books International, New Delhi, India.

16) Singh Sanjay Kumar ((2005) Text Book of Plant Anatomy. Campus Books International, New Delhi, India.

17) Singh, S. K., and Seema Srivastava (2011) Anatomy of Angiosperm. Campus Books International, New Delhi, India.

18) Singh, V., P.C. Pande and D.K. Jain (1998) Anatomy of Seed Plants. Rastogi Publications, Meerut, India.

19) Singh, V., P. C. Pande and D.K. Jain (2013) A Text Book of Botany Angiosperm. Rastogi Publications, Meerut, India.

20) Tandan Neeraj (2014) An Introduction to Plant Anatomy. Anmol Publications, Pvt., Ltd., New Delhi, India.

21) Tayal, M.S. (1994) Plant Anatomy. Rastogi Publications, Meerut, India.

22) Vashista, P.C. (1986) Plant Anatomy. Pradeep Publications, Jalandhar, India.

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PAPER – II

BOT.302: PLANT PHYSIOLOGY

Lectures: 30

AIMS AND OBJECTIVES

1. To know importance and scope of plant physiology.
2. To study plant and plant cell in relation to water.
3. To study different process in relation with structure of organism and its environment.
4. To understand mechanism of absorption of water, gases and solutes.
5. To understand growth at various level.

Unit: 1.Introduction **01 L**

1.1 Definition, scope and importance of plant physiology.

Unit: 2. Plant cell and water relation **05 L**

2.1 Diffusion, Definition, mechanism of diffusion with suitable example, Diffusion Pressure, Graham's law of diffusion and significance of diffusion.

2.2 Osmosis: Introduction, definition, mechanism of osmosis with suitable Osmometer, osmotic pressure, turgor pressure and wall pressure, DPD and its relation with OP, TP, and WP. Types of solution- Hypotonic, Hypertonic and Isotonic. Type of Osmosis- Exosmosis and Endosmosis, significance of osmosis , Plasmolysis, de-plasmolysis.

2.3 Imbibition**:** Definition, mechanism, imbibition pressure, Importance of imbibition.

Unit: 3. Absorption of water **05 L**

3.1 Importance of water.

3.2 Mechanism of water absorption.

a. Active absorption- Osmotic theory and non-osmotic theory.

b. Passive absorption.

3.3 Factors affecting water absorption.

Unit: 4. Ascent of Sap **05 L**

4.1 Introduction and definition

4.2 Theories of ascent sap.

a. Vital theories

b. Root pressure theory.

c. Physical force theories

d. Transpiration pull theory.

Unit: 5. Transpiration **05 L**

5.1 Definition, Magnitude and types of transpiration, Structure of stomata, mechanism of opening and closing of stomata.

5.2 Theories of stomatal opening and closing.

a. Theory of Starch- Glucose interconversion and stomatal opening in Succulent plants(Steward's Theory)

b. K^+ pump theory.

5.3 Factors affecting rate of transpiration.

5.4 Significance of transpiration.

Unit: - 6. Mineral nutrition and absorption of mineral salt **05 L**

6.1 Introduction, essential and non essential elements, Macro and micro nutrient elements.

6.2 Specific functions and deficiency symptoms of- Nitrogen, Sulphur, Phosphorus, Potassium, Magnesium and Boron.

6.3 Mechanism of mineral salt absorption.

a) Passive absorption- Mass flow theory, Ion exchange and Donnan's equilibrium.

b) Active absorption- Carrier concept theory- Protein lecithin as carrier.

Unit: 7 .Plant growth and Phytohormones **04 L**

7.1 Introduction, Definition of growth, Development and Differentiation

7.2 Definition of Phytohormones and role of Auxins, Gibberellins, Cytokinins, Ethylene and Abscisic acid.

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REFERENCES:-

1. Amar Singh (1977) Practical Plant Physiology. Kalyani Publication, New Delhi, Ludhiana, India.

2. Jain. V.K. (1977) Fundamentals of plant physiology. S. Chand and Company Ltd. New Delhi, India.

3. Kochhar. P. L. (1962) A Text Book of Plant Physiology, Atmaran and Sons, New Delhi, India.

4. Kumar, A. and S.S. Purohit (1998) Plant Physiology, Fundamentals and Application. Agro Botanical, Bikaner, India.

5. Meyer. B.S and D.B. Anderson (1952) Plant Physiology Affiliated East-West Press Pvt. Ltd., New Delhi, India.

6.Mukharji and Ghosh A.K. (1996) Plant Physiology. Tata McGraw-Hill Publishing company Ltd. New Delhi, India.

7.Pandey and Sinha (1999) Plant Physiology. Vikas Publishing House Pvt. Ltd. New Delhi, India.

8. Sarabhai, B.P. (1995) Elements of Plant Physiology. Anmol Publication Pvt. Ltd, New Delhi, India.

9.Srivastava. H.C (1994) Plant Physiology, Rastogi Publication, Meerut, India.

10.Sundara Rajan (2000) College Botany (Plant Physiology and Molecular Biology Vol.IV, Himalaya Publishing House, New Delhi, India.

11.Varma, V. (1984) Introduction to Plant Physiology. Emkay Publication, New Delhi, India.

12.Varma V. (1995) A Text Book of Plant Physiology and Biochemistry. S. Chand and Company. New Delhi, India.

13.Taiz, L. Zeiger E. (2010) Plant Physiology. Sinauer Associates Inc.; U.S.A. 5th edition.

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PAPER- III

BOT. 303:Practical (Based on BOT. - 301 and BOT. - 302)

Practical No.1&2

i) Study of meristem (Permanent slides/ Photographs).

ii) Study of Simple Tissues:

Parenchyma, Collenchyma and Sclerenchyma (Permanent Slides/ Photographs)

iii) Macerated xylem and phloem elements (Permanent slides/ Photographs).

iv) Study of dicot leaf(Sunflower) and monocot leaf (Maize) (permanent slides.)

Practical No: 3 and 4: Study of primary structure of dicot stem (Sunflower) and monocot stem (Maize).

Practical No.5: Study of primary structure of dicot root (Sunflower) and monocot root(Maize) (Permanent slides).

Practical No.6 and 7: Study of secondary growth structure in dicot stem and root (Sunflower)

Practical No. 8:

Study of trichomes (any three types) and stomata (any three types) with the help of locally available plant materials.

Practical No. 9: To determine DPD by using potato tuber.

Practical No.10: Determination of osmotic potential of plant cell sap by plasmolytic method.

Practical No. 11: To study the effect of two environmental factors (light and wind) on transpiration by excised twig.

Practical No.12and 13: Qualitative assessment of minerals in plant ash (any two from Macro and Micro elements)

Practical No.14. Demonstration experiments.

1. Osmosis by Curling experiment.
2. Osmosis-Thistle funnel experiment.
3. Bolting (Specimen or photograph)

Practical No.15. Demonstration experiments.

1. Suction due to transpiration.
2. Relative Transpiration.
3. Imbibition Pressure.
4. Ringing experiment.

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PAPER – IV

SKILL ENHANCEMENT COURSE (SEC)

BOT. 304: MUSHROOM CULTURE TECHNOLOGY

Lectures: 30

AIMS AND OBJECTIVES

1. To learn the history, scope and importance of mushroom technology
2. To understand nutritional and medicinal values of edible mushrooms
3. To know about the storage, marketing and various food preparations of mushrooms.
4. To understand the economics of mushroom cultivation.

Unit l: Introduction **05 L**

1.1: Scope and importance.

1.2: Nutritional and medicinal value of edible mushrooms.

1.3: Edible and non-edible mushrooms.

1.4: Morphology and distinguishing characteristics of following mushrooms:

a. Button (*Agaricus bisporus*)

b. Oyster (*Lentinus sajor-caju*, Syn. *Pleurotus sajor-caju*)

c. Paddy straw *(Volvariella volvacea*)

Unit 2: Cultivation Technology **15 L**

2.1: Mushroom farm layout and requirements

2.2. Materials for compost preparation, Different formulations, Selection of composting materials, Commonly used formulations, Synthetic compost and its advantages,

2.3: Spore culture and preparation of spawn.

2.4: Casing and its Importance, Quality parameters of casing mixture and commonly used materials for casing.

2.5: Cultivation procedure of: a. *Agaricus bisporus b. Pleurotus sajor-caju*.

Unit 3: Storage **04 L**

3.1: Short-term storage (Refrigeration - upto 24 hours)

3.2: Long term storage (canning, pickling). Drying, storage in salt solutions.

3.3: Marketing

Unit 4: Food Preparation **06 L**

4.1: Types of foods prepared from mushroom: Soup, Cutlet, Omlette, Samosa, Pickles, Curry.

4.2 Training Centres: National and Regional level.

REFERENCES:-

l. Marimuthu, T. Krishnamoofthl, A.S. Sivaprakasam, K. and Jayarajan. R (1991) Oyster Mushrooms. Department of Plant Pathology. TamilNadu Agricultural University, Coimbatore.

2. Swarninathan, M. (1990) Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.

3. S.C.Tewari. Pankaj Kapoor, (1988). Mushroom Cultivation, Mittal Publications. Delhi.

4. Nita Bahl (1984-1988) Hand book of Mushrooms, II Edition. Vol.I and Vol. II.

5. Vijaya Khader (1993) Mushrooms for Livelihood. Kalyani Publishers. Pp170.

6. D. P. Tripathi (2005) Mushroom cultivation. Oxford IBH Publishing Co. Pvt. Ltd.Pp354.

7. S.C.Tiwari and Pankaj Kapoor. (1988) Mushroom Cultivation. Mittal Publications, Delhi. pp.-127

8. P.K. Khanna and S. Kappor (2007) Mannual of mushroom production. Dept. of Microbiology. College of Basic Sciences and Humanities, Punjab Agriculture University, Ludhiana. pp.86-90

9.Google.co.in

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Semester: IV

PAPER- I

BOT. - 401: PLANT EMBRYOLOGY

Lectures: 30

AIMS AND OBJECTIVES

1. To know the scope and Importance of Embryology
2. To study structure of micro and megasporangium.
3. To study pollination, fertilization, Endosperm and Embryogeny.
4. To give exposure of techniques in embryology

Unit 1: Introduction **01L**

1.1: Definition, Scope and importance of Embryology

Unit 2: Microsporangium (Anther) **04 L**

2.1: Structure of anther- Epidermis, endothecium, middle layer sporogenious tissue and Tapetum.

2.2: Tapetum types- a) Amoeboid or plasmodia b) Secretary or glandular

2.3: Functions of Tapetum

2.4: Microsporogenesis- karyokinesis and cytokinesis (simultaneous and successive)

2.5: Structure of pollen and Male gametophyte

2.6: Types of pollen tetrad – linear, isobilateral, tetrahedral, decussate, T- shaped.

Unit 3: Megasporangium (Ovule) **05 L**

3.1: Structure of Ovule.

3.2: Types of ovule: i) Orthotropous ii) Anatropous iii) Amphitropous iv) Hemianatropous v) Compylotropous vi) Circinotropous

3.3: Types of Embryo sac. i) Monosporic (*Polygonum*) ii) Bisporic (*Allium*) iii) Tetrasporic (*Peperomia*)

Unit 4: Pollination and Fertilization **05 L**

4.1: Definition and Types of Pollination: Anemophily, Entomophily, Hydrophily

4.2: Fertilization i) Definition ii) Entry of pollen tube into ovule - Porogamy,

chalizogamy and mesogamy

iii) Process of double fertilization and tripl fusion

iv) Significance of double fertilization mechanism.

Unit 5: Endosperm **03L**

5.1: Definition.

5.2: Structure and function of endosperm.

5.3: Types of Endosperm. i) Nuclear ii) Cellular iii) Helobial.

Unit 6: Embryo **03L**

6.1: Definition

6.2: Structure of Dicot Embryo e.g. *Capsella brussa pastories* (Development not expected)

6.3: Structure of monocot embryo e.g. *Sagittaria* (Development not expected)

Unit 7: Seed structure and dispersal **06L**

7.1: Definition, structure of seed.

7.2: Appendages and dispersal mechanism of seed- Aril, Coma, Caruncle

7.3 Dispersal Mechanism:

i. By Wind - (Anemochory):

a. Winged seed and fruits b. Parachute mechanism c. Hairs

ii. By Water (Hydrochory): a. Floating devices b. Protective covering

iii. By Animal (Zoochory): a. Hooked fruits and seeds b. Sticky Fruit c. Edible fruit

Unit 8: Apomixis and polyembryony. **03L**

8.1: Apomixis: Definition and types – Non- recurrent, recurrent , adventive embryony and veg. reproduction

8.2: Polyembryony: Definition

8.3 Types of polyembryony: i. Simple ii. Cleavage iii Rosette

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REFERENCES:

1. Bhojwani, S.S. and S.P. Bhatnagar, (2013 Reprint) The Embryology of Angiosperms,

Vikas Publishing House Pvt. Ltd. New Delhi, India.

2. Maheshwari, P. (1950) An introduction to the embryology of Angiosperms, McGraw Hill Book Co. New York, USA.
3. Singh,V., P.C.Pandey and D.K. Jain(1998) Embryology of Angiosperm , Rastogi Publications, Meerut, India
4. Singh,V., P.C.Pande and D.K. Jain(2004) Structure ,Development and Reproduction in Angiosperm (2nd Ed.) Rastogi Publications, Meerut.
5. Singh, Sanjay Kumar (2005) A Text Book of Plant Anatomy, Campus Books International, New Delhi, India
6. Singh, S. K. and Semma Srivastava (2011) Anatomy of Angiosperm, Campus Books International, New Delhi, India 20. Singh, Sanjay Kumar (2014) Embryology of Angiosperm, Campus Books International, New Delhi, India.

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PAPER- II

BOT.-: 402 PLANT METABOLISM

Lectures 30

AIMS AND OBJECTIVES

1. To know the scope and importance of plant metabolism.
2. To study the properties, mechanism and classification of enzymes.
3. To study the process of photosynthesis in higher plants, C3, C4 and CAM pathways.
4. To study respiration in higher plants.

Unit 1: Introduction **02 L**

1.1: Definition

1.2: Plant cell as organic Laboratory

1.3: Anabolism and catabolism

Unit 2: **Enzymes** **04 L**

2.1: Definition, Structure and properties.

2.2: Classification of enzymes

2.3: Mode of enzyme action: Lock and key Model, Induced fit model

Unit 3: **Photosynthesis** **11 L**

3.1: Definition, photosynthetic apparatus (Structure of Chloroplast)

3.2: Role of photosynthetic pigments: Chlorophyll (Chl- a, Chl- b), Carotenoids and Phycobillins

3.3: Photosystem I and II

3.4: Mechanism

a : Light Reaction: Cyclic and Non Cyclic Photophosphorylation.

b : Dark Reaction: C3, C4 and CAM pathways.

3.6: Photorespiration: Definition, Sites and Mechanism of photorespiration.

3.7: Factor affecting the process of photosynthesis.

Unit 4: Respiration **07 L**

4.1: Introduction, Definition and Types of respiration.

4.2: Mechanism of Aerobic respiration.

a) Glycolysis.

b) Kreb's cycle.

c) Electron Transfer System (ETS)

4.3 Mechanism of Anaerobic respiration: Alcoholic Fermentation

4.4 Factor affecting the process of respiration.

Unit 5: Nitrogen metabolism **06 L**

5.1: Introduction.

5.2: Types of Nitrogen fixation.

5.3: Biological nitrogen fixation.

5.4: Nitrate and ammonia assimilation.

5.5: Importance

REFRENCES:-

1. Kochhar P. L. (1962) Plant Physiology, Atmaram and Sons, Delhi, India
2. Salisbury, F.B and C.W. Ross (1999): Plant Physiology CBS Publishers and Printers, New Delhi
3. Harborne, J.B. (1973). Phytochemical Methods. John Wiley and Sons. New York
4. Mukherjee, S. A.K. Ghosh (1998) Plant Physiology ,Tata McGraw Hill Publishers(P) Ltd., New Delhi
5. Srivastava H. S., 2004. Plant Physiology and Biochemistry, Rastogi Publications.
6. Verma S. K. and Mohit Verma, 2006. A Text book of Plant Physiology, Biochemistry and Biotechnology, S. Chand and Co.
7. . Jain. V.K. (1977) Fundamentals of plant physiology. S. Chand and Company Ltd. New Delhi, India

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PAPER- III

BOT.403: Practical (Based on BOT. - 401 and BOT. - 402)

Practical No.1: Study of the following with the help of P.S. / photographs.

i) T.S. of microsporangium (Anther)

ii) Tapetum – a) Amoeboid b) Secretory

Practical No 2: Study of types of ovules with the help of P.S. / Photographs as per theory.

Practical No 3: Study of different kinds of embryo sac with the help of P.S / Photographs

i) Monosporic - *Polygonum*

ii) Bisporic - *Allium*

iii) Tetrasporic - *Peperomia*

Practical No 4: Mounting of embryos from suitable seeds (*Cucumis / Cymopsis / Citrus*).

Practical No 5: Study of structure of dicot and monocot seed

Practical No 6 and 7: Study of seed dispersal mechanism.

i: Winged – *Moringa, Hiptage*

ii: Parachute – Pappus (*Tridax*)

iii: Hair – *Calatropis*

iv: Floating – Coconut

v: Animal – *Xanthium, Achyranthes*

vi: Sticky – *Plumbago / Cleome / Boerrhaavia*

Practical No 8 and 9: Study the activity of catalase and study the effect of pH and enzyme concentration.

Practical No 10 and 11: To study the effect of light intensity and bicarbonate concentration on O_2 evolution in photosynthesis.

Practical No 12: Comparison of the rate of respiration in any two parts of a plant by using Ganong's potometer.

Practical No 13: Separation of amino acids by paper chromatography.

Practical No 14 and 15: Demonstration experiments

i. To demonstrate the presence of starch in chloroplast

ii. CO_2 essential for Photosynthesis

iii. R.Q. (Respiratory Quotient)

iv. Kuhne's Tube experiment

v . Isolation and Inoculation of *Rhizobium*

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PAPER – IV

SKILL ENHANCEMENT COURSE (SEC)

BOT.404: NURSERY AND GARDENING

Lectures: 30

AIMS AND OBJECTIVES

1. To know the concept of nursery and Gardening.
2. To improve the skills for growing fresh and safe vegetables.
3. To create awareness about home gardening.
4. To develop different skills regarding the gardening operations among the students

Unit 1. Nursery **04 L**

Definition, objectives and scope, building up of infrastructure for nursery, planning and seasonal activities. Planting :direct seedling and transplant.

Unit 2. Seed structures and types **04 L**

Seed dormancy, causes and methods of breaking dormancy, Seed storage: Seed banks, factors affecting seed viability and genetic erosions.

Unit 3. Vegetative propagation **05 L**

Cutting and Air-layering: selection, techniques of cutting, rooting medium, planting and hardening of plants in green house or glass house.

Harvesting, Packing, Storage and Marketing of Nursery stock.

Unit 4. Gardening **07 L**

Definition, objectives and scope,. Different types of gardening: Landscape, home gardening and park, and its Components, suitable plants, soil, manuring and watering.

Unit 5. Indoor Gardening **04 L**

Definition, characters of indoor plants, containers, selection of indoor plants, Potting media, watering tips.

Botanical name, cultivation practices, Ornamental value, maintenance and care of Cycads and Pothas (Two examples each)

Unit 6: Cultivation practices **06 L**

Introduction, study of cultivation of some vegetables: Brinjal and Tomato w.r.t.

i) Sowing ii) Transplanting of seedling

iii) Varieties iv) Mannuaring and irrigation

v) Pest, Diseases and control measures vi) Harvesting

vii) Storage and Marketing

REFERENCES:-

1.Bose T.K. and Mukherjee. D. (1972). Gardening in India, Oxford and IBH Publishing Vo., New Delhi.

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

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

4.Edmond Musser and Andres, Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.

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

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

Equivalence: Theory and Practicals
Class: S. Y. B. Sc.
Subject : Botany

PAPER	**Old Courses (W.E.F. June, 2016)**	**PAPER**	**New Courses (W.E. F. June, 2019)**
SEM-III			
BOT. 231	Bryophytes and Pteridophytes	Bot. 402	Plant Metabolism
BOT. 232	Morphology of Angiosperms	Bot. 401	Plant Embryology
BOT. 233	Based on BOT.231, BOT.- 232,	Bot. 403	Practical (LAB – I) Based on Bot. 401 and Bot. 402
SEM-IV			
BOT. 241	Plant Physiology	Bot. 302	Plant Physiology
BOT. 242	Taxonomy of Angiosperms	Bot. 301	Plant Anatomy
BOT. 243	Based On BOT.-241 and BOT.-242	Bot. 303	Practical (LAB – I) Based on Bot. 301 and Bot. 302

KAVAYITRI BAHINABAI CHAUDHARI NORTH MAHARASHTRA UNIVERSITY, JALGAON

STRUCTURE AND SYLLABUS OF

S.Y. B. Sc. (MATHEMATICS)

UNDER CHOICE BASED CREDIT SYSTEM (CBCS)

Effective from June 2019

KAVAYITRI BAHINABAI CHAUDHARI
NORTH MAHARASHTRA UNIVERSITY, JALGAON

Syllabus for S. Y. B. Sc. (Mathematics)
Under Choice Based Credit System (CBCS)
Effective from June 2019

The examination pattern is semester system for both the theory and practical papers. Each theory paper is of 100 marks (60 marks for external examination and 40 marks for internal examination) and practical paper is of 100 marks (60 marks for external examination and 40 marks for internal examination). The examination will be conducted at the end of each semester. Period of teaching for each theory paper is 30 clock hours and for practical paper is 60 clock hours.

COURSE STRUCTURE

Sem.	Course	Paper	Course Code with Title	Credits	No. Periods in Hour /week
III	MTHCC- C	Paper - 1	MTH 301: Calculus of Several Variables	2	2
		Paper - 2	MTH 302(A): Group Theory Or MTH -302(B): Theory of Groups and Codes	2	2
		Paper - 3	MTH 303: Practical paper based on MTH 301 and MTH 302	2	4
	SEC-1	SEC-1	MTH 304: Set Theory and Logic	2	2
IV	MTHCC- D	Paper - 1	MTH 401: Complex Variables	2	2
		Paper - 2	MTH 402(A): Differential Equations Or MTH-402 (B): Differential Equations and Numerical Methods	2	2
		Paper - 3	MTH 403: Practical paper based on MTH 401 and MTH 402	2	4
	SEC-2	SEC-2	MTH 404: Vector Calculus	2	2

Syllabus for S.Y. B.Sc. (Mathematics)

SEMESTER – III

MTH -301: Calculus of Several Variables (Period: 30 Clock hours)

Course Description:

This course provides an elementary level knowledge of functions of several variables, their limit continuity, Taylors expansion, differentiation and integration of functions of two or more variables.

Prerequisite Course(s): Preliminary knowledge of real analysis, functions of one variables and calculus.

General Objective:

This is the second course in the calculus series after a course of Calculus in F. Y. B. Sc. for science students. In this course we discuss functions of two and more variables along with their series expansions and extreme values. We also discuss integration techniques as well as applications of integrals.

Learning Outcomes:

Upon successful completion of this course the student will be able to understand:

a) limit and continuity of functions of several variables
b) fundamental concepts of multivariable Calculus.
c) series expansion of functions.
d) extreme points of function and their maximum, minimum values at those points.
e) meaning of definite integral as limit as sums.
f) how to solve double and triple integration and use them to find area by double integration and volume by triple integration.

Unit- 1: Functions of Two and Three Variables **Marks-15**

1.1 Explicit and Implicit Functions
1.2 Continuity
1.3 Partial Derivatives
1.4 Differentiability
1.5 Necessary and Sufficient Conditions for Differentiability
1.6 Partial Derivatives of Higher Order
1.7 Schwarz's Theorem
1.8 Young's Theorem.

Unit-2: Jacobian, Composite Functions and Mean Value Theorems **Marks-15**

2.1 Jacobian (Only for Two and Three Variable)
2.2 Composite Functions (Chain Rule)

2.3 Homogeneous Functions.
2.4 Euler's Theorem on Homogeneous Functions.
2.5 Mean Value Theorem for Function of Two Variables.

Unit -3: Taylor's Theorem and Extreme Values **Marks-15**

3.1 Taylor's Theorem for Function of Two Variables.
3.2 Maclaurin's Theorem for Function of Two Variables.
3.3 Absolute and Relative Maxima & Minima.
3.4 Necessary Condition for Extrema.
3.5 Critical Point, Saddle Point.
3.6 Sufficient Condition for Extrema.

Unit -4: Double and Triple Integrals **Marks-15**

4.1 Double Integrals by Using Cartesian and Polar Coordinates.
4.2 Change of Order of Integration.
4.3 Area by Double Integral.
4.4 Evaluation of Triple Integral as Repeated Integral.
4.5 Volume by Triple Integral.

Recommended Book:

Mathematical Analysis: S.C. Malik and Savita Arora. Wiley Eastern Ltd, New Delhi. 1992 (Chapter 15: Functions of several variables 1, 1.1, 1.2, 1.3, 1.4, 1.6,2, 3, 3.1, 3.2, 4, 4.1, 5, 5.2, 6, 7.2, 9, 9.1, 10, 10.1, 10.2)

Reference Books –

1. Calculus of Several Variables by Schaum's Outline Series.
2. Mathematical Analysis by T. M. Apostol, Narosa Publishing House, New Delhi, 1985

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MTH -302(A): Group Theory (Period: 30 Clock hours)

Course Description:

This course provides an elementary level knowledge of algebraic structure like groups and rings.

Prerequisite Course(s): Preliminary knowledge of sets, functions and binary operations and number systems like Set of integers, rationals, reals and complex.

General Objective:

A primary objective of this course is to understand algebraic structures and their properties. Doing this one can use these structures to solve problems arises in many branches of Mathematics such as theory of equations, theory of numbers, Geometry etc. This enable students to grow their mathematical skill and used them to apply in many

branches of science. So, the main objective is to develop and maintain problem-solving skills of the students.

Learning Outcomes:

Upon successful completion of this course the student will be able to:

a) understand group and their types which is one of the building blocks of pure and applied mathematics.
b) understand Lagarnge, Euler and Fermat theorem
c) understand concept of automorphism of groups
d) understand concepts of homomorphism and isomorphism
e) understand basic properties of rings and their types such as integral domain and field.

Unit-1: Groups **Marks-15**

1.1 Definition and Examples of a group.
1.2 Simple Properties of Group.
1.3 Abelian Group.
1.4 Finite and Infinite Groups.
1.5 Order of a Group.
1.6 Order of an Element and Its Properties.

Unit-2: Subgroups **Marks-15**

2.1 Definition and Examples of Subgroups.
2.2 Simple Properties of Subgroup.
2.3 Criteria for a Subset to be a Subgroup.
2.4 Cyclic Groups
2.5 Normal subgroups and Coset Decomposition.
2.6 Lagrange's Theorem for Finite Group.
2.7 Euler's Theorem and Fermat's Theorem.

Unit-3: Homomorphism and Isomorphism of Groups **Marks-15**

4.1 Definition and Examples of Group Homomorphism.
4.2 Properties of Group Homomorphism.
4.3 Kernel of a Group Homomorphism and it's Properties.
4.4 Definition and Examples of Isomorphism.
4.5 Definition and Examples of Automorphism of Groups.
4.6 Properties of Isomorphism of Groups.

Unit -4: Rings **Marks-15**

4.1 Definition and Simple Properties of a Ring.
4.2 Commutative Ring, Ring with unity, Boolean Ring.
4.3 Ring with zero divisors and without zero Divisors.
4.4 Integral Domain, Division Ring and Field. Simple Properties.

Recommended Book: -

1. University Algebra: N. S. Gopalakrishnan, New age international publishers, 2018. (Chapter 1: 1.3, 1.4, 1.5, 1.6,1.7, 1.8, 1.9)

Reference Books: -

1. Topics in Algebra: I. N. Herstein (John Wiley and Sons).
2. A first Course in Abstract Algebra: J. B. Fraleigh (Pearson).
3. A course in Abstract Algebra: Vijay K. Khanna and S. K. Bhambri, Vikas Publishing House Pvt. Ltd., Noida.

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MTH -302(B): Theory of Groups and Codes (Period: 30 Clock hours)

Course Description:

This course provides an elementary level knowledge of algebraic structure like groups and codes.

Prerequisite Course(s): Preliminary knowledge of Sets, functions and binary operations and number systems like Set of integers, rationals, reals and complex.

General Objective:

A primary need for the establishment of this course is to understand algebraic structures and their properties. Upon studying this one can use these sutures to solve problems arises in many branches of Mathematics and computer science such as theory of equations, theory of numbers, Geometry, theory of computations, cryptography etc. This enable students to grow their mathematical skill and used them to apply in many other branches of science and technology.

Learning Outcomes:

Upon successful completion of this course the student will be able to:

a) understand group structures which is useful to understanding ideas of modern mathematics.
b) understand solutions to polynomial equations
c) understand permutation groups
d) understand concepts of homomorphisms and isomorphisms
e) Students will understand basic concepts in codding theory.

Unit-1: Groups **Marks-15**

1.1 Definition and Examples of a group.
1.2 Simple Properties of Group.
1.3 Abelian Group.
1.4 Finite and Infinite Groups.
1.5 Order of a Group.
1.6 Order of an Element and Its Properties.

Unit-2: Subgroups **Marks-15**

2.1 Definition and Examples of Subgroups.
2.2 Simple Properties of Subgroup.
2.3 Criteria for a Subset to be a Subgroup.

2.4 Cyclic Groups
2.5 Normal subgroups and Coset Decomposition.
2.6 Lagrange's Theorem for Finite Group.
2.7 Euler's Theorem and Fermat's Theorem.

Unit-3: Homomorphism and Isomorphism of Groups **Marks-15**

3.1 Definition and Examples of Group Homomorphism.
3.2 Properties of Group Homomorphism.
3.3 Kernel of a Group Homomorphism and it's Properties.
3.4 Definition and Examples of Isomorphism.
3.5 Definition and Examples of Automorphism of Groups.
3.6 Properties of Isomorphism of Groups.

Unit -4: Group Codes **Marks 15**

4.1 Message, Word, (m, n)- Encoding Function, Code Words.
4.2 Detection of k or fewer errors, Weight, Parity Check Code
4.3 Hamming Distance, Properties of the Distance Function, Minimum Distance of an encoding function.
4.4 Group Codes.
4.5 (n, m)- Decoding function, Maximum Likelihood Decoding Function.
4.6 Decoding procedure for a Group Code given by a Parity Check Matrix.

Recommended Book: -

1. University Algebra: N. S. Gopalakrishnan, New age international publishers, 2018. (Chapter 1: 1.3, 1.4, 1.5, 1.6,1.7, 1.8, 1.9)
2. Discrete Mathematical Structures: Bernard Kolman, Robert C. Busby and Ross (Prentice Hall of India New Delhi, Eastern Economy Edition).

Reference Books: -

1. Topics in Algebra: I. N. Herstein (John Wiley and Sons).
2. A first Course in Abstract Algebra: J. B. Fraleigh (Pearson).

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MTH-303: Practical Course Based on MTH-301 and MTH-302

(Period: 60 Clock hours)

Practical No	Title of the Practical
1	Functions of two and three Variables
2	Jacobian, Composite Functions and Mean Value Theorems
3	Taylor's Theorem and Extreme Values
4	Double and Triple Integrals
5	Groups
6	Subgroups
7	Homomorphism and Isomorphism of Groups
8(A)	Rings
8(B)	Group Codes

List of Practical Problems

Practical 1: Functions of Two and Three Variables

1. Evaluate the limit, if it exists, for the following function
$$f(x,y)=\begin{cases}\dfrac{x^2y}{x^4+y^2} & ,if\ x^4+y^2\neq 0\\ 0 & ,if\ x=y=0.\end{cases}$$
2. Let $f(x,y)=x\sin\frac{1}{x}+\ y\sin\frac{1}{y}\ ,\ xy\neq 0$. Show that $\lim\limits_{(x,y)\to(0,0)} f(x,y)=0$.
3. Let $f(x,y)=\frac{x^2y^2}{x^4+y^4-x^2y^2}$, $(x,y)\neq(0,0)$. Verify that both the repeated limits exist and are equal, but simultaneous limit does not exist.
4. Show that the function
$$f(x,y)=\begin{cases}\dfrac{xy}{\sqrt{x^2+y^2}} & ,if\ (x,y)\neq(0,0)\\ 0 & ,if\ (x,y)=(0,0)\end{cases}$$
is continuous at the origin.
5. Let $f(x,y)=\begin{cases}\frac{xy}{x^2+y^2} & ,if\ (x,y)\neq(0,0)\\ 0 & ,\ if\ (x,y)=(0,0)\end{cases}$
Show that both the first order partial derivatives exist at (0, 0), but the function is not continuous thereat.
6. Discuss the continuity and differentiability at the origin of the function
$$f(x,y)=\begin{cases}\frac{xy}{x^2+y^2} & ,if\ (x,y)\neq(0,0)\\ 0 & ,if\ (x,y)=(0,0)\end{cases}$$
7. Let$f(x,y)=\begin{cases}x^2\tan^{-1}\left(\frac{y}{x}\right)-y^2\tan^{-1}\left(\frac{x}{y}\right) & ,if\ (x,y)\neq(0,0)\\ 0 & ,if\ (x,y)\neq(0,0)\end{cases}$
Show that $f_{xy}(0,0)\neq f_{yx}(0,0)$.
8. Show that for the function
$$f(x,y)=\begin{cases}\dfrac{xy}{x^2+y^2} & ,if\ (x,y)\neq(0,0)\\ 0, \quad , \quad if\ (x,y)=(0,0)\end{cases}$$
$f_{xy}(0,0)=f_{yx}(0,0)$, even though the conditions of Schwarz's theorem and Young's theorem are not satisfied.
9. Using differentials find approximate value of $\sqrt{(1.02)^2+(1.97)^3}$.
10. Using differentials find approximate value of $(3.9)^2(2.05)+(2.05)^3$.

Practical 2: Jacobian, Composite functions and Mean value theorem

1. If $u = \cos x\ , v = \sin x \cos y\ , w = \sin x \sin y \cos z,$ then show that
$$\frac{\partial(u,v,w)}{\partial(x,y,z)} = (-1)^3 sin^3x\ sin^2y \sin z$$
2. If $z = f(x,y) = \tan^{-1}\left(\frac{x}{y}\right), x = u + v\ , y = u - v$, then show that $\frac{\partial z}{\partial u} + \frac{\partial z}{\partial v} = \frac{u-v}{u^2+v^2}$.
3. If $u = f(e^{y-z}, e^{z-x}, e^{x-y})$, then prove that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$
4. If z is function of x and y and if $x = e^u + e^{-v}, y = e^{-u} - e^v$, then prove that $\frac{\partial z}{\partial u} - \frac{\partial z}{\partial v} = x\frac{\partial z}{\partial x} - y\frac{\partial z}{\partial y}$.
5. If $z = f(u,v)$, where $u = 2x - 3y$ and $v = x + 2y$, then prove that $\frac{\partial z}{\partial x} + \frac{\partial z}{\partial y} = 3\frac{\partial z}{\partial v} - \frac{\partial z}{\partial u}$.
6. If $u = \tan^{-1}\left(\frac{x^3+y^3}{x-y}\right)$, then show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \sin 2u$. Hence, deduce that $x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2} = (1 - 4sin^2u)sin2u$.
7. If $u = \sin^{-1}\left(\frac{x^2+2xy}{\sqrt{x-y}}\right)^{\frac{1}{5}}$, then find the value of $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$ and $x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2}$.
8. If $u = \tan^{-1}\left(\frac{\sqrt{x^2+y^2}}{x-y}\right)$, then find the value of $x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2}$.
9. Let$f(x,y) = x^2y + 2xy^2$. Find the quadratic equation in θ by applying the mean value theorem applied to the line segment joining the points (1,2) to (3,3).
10. Let$f(x,y) = x^3 - xy^2$. Show that θ used in the mean value theorem applied to the points (2,1) and (4,1) satisfies the quadratic equation $3\theta^2 + 6\theta - 4 = 0$.

Practical 3: Taylor's theorem and Extreme values

1. Use Taylor's theorem of suitable order to expand $\sin x \sin y$ in the form $xy - \frac{1}{6}\{(x^3 + 3xy^2)\cos\theta x \sin\theta y + (y^3 + 3x^2y)\sin\theta x \cos\theta y\}, 0 < \theta < 1$.
2. Show that the expansion of $\sin(xy)$ in powers of $(x-1)$ and $\left(y - \frac{\pi}{2}\right)$ upto and including second degree terms is
$$1 - \frac{1}{8}\pi^2(x-1)^2 - \frac{1}{2}\pi(x-1)\left(y - \frac{\pi}{2}\right) - \frac{1}{2}\left(y - \frac{\pi}{2}\right)^2.$$

3. Using Maclaurin's expansion, prove that $e^{ax}\cos by = 1 + ax + \frac{a^2x^2 - b^2y^2}{2!} + \frac{a^3x^3 - 3ab^2xy^2}{3!}$.
4. Expand $e^x tan^{-1}y$ about (1 ,1) up to the second degree in powers of $(x-1)$and $(y-1)$.
5. Find maxima and minima of the function $f(x,y) = x^3 + y^3 - 3x - 12y + 20$.
6. Discuss the extreme values of the function $f(x,y) = 2(x^2 - y^2) - x^4 + y^4$.
7. Investigate maximum and minimum values of $f(x,y) = (x + y - 1)(x^2 + y^2)$.
8. Find the extreme values of $f(x,y) = xy(a - x - y)$.
9. Find the least value of the function $f(x,y) = xy + \frac{50}{x} + \frac{50}{y}$.

Practical –4: Double and Triple Integrals

1. Using double integration, find the area between the parabola $y^2 = 4ax$ and $x^2 = 4ay$.
2. Find the area of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, using double integral.
3. Evaluate $\int_0^a \int_0^x \int_0^{x+y} e^{x+y+z}\, dxdydz$.
4. Using triple integration, find the volume of the sphere of radius a.
5. Evaluate $\int_0^1 \int_0^2 \int_0^3 (x + y + z)\, dxdydz$.
6. Change the order of integration in $\int_0^4 \int_0^{\sqrt{4x - x^2}} f(x,y)dxdy$.
7. Draw a sketch of the region of integration
   i) $\int_0^4 \int_0^{\sqrt{25 - x^2}} f(x,y)dxdy$.
   ii) $\int_{-1}^3 \int_{x^2}^{x+3} f(x,y)dxdy$.
8. Evaluate $\int\int ydxdy$ over the area bounded by $y = x^2$ and $x + y = 2$.

Practical - 5: Groups

1. Let $\mathbb{Q}^+$ denotes the set of all positive rational numbers and for any $a, b \in \mathbb{Q}^+$, define $a * b = \frac{ab}{3}$. Show that $(\mathbb{Q}^+, *)$ is an abelian group.
2. Let $G = \{(a, b): a, b \in \mathbb{R},\ a \neq 0\}$. Show that $(G, \odot)$ is a non-abelian group, where $(a, b) \odot (c, d) = (ac, ad + b)$.
3. Let G be a group and $a \in G$, $n \in \mathbb{N}$. Show that $a^n = e$ if and only if $o(a) | n$.
4. Show that a group G is abelian if and only if $(ab)^2 = a^2b^2\ \forall\ a, b \in G$.

5. In the group ($\mathbb{Z}_7, \times_7$), find (i) $(\bar{3})^2$ ii) $(\bar{4})^{-3}$ iii) $o(\bar{3})$ iv) $o(\bar{4})$
6. In the group ($\mathbb{Z}_{11}, \times_{11}$), find (i) $(\bar{4})^3$ ii) $(\bar{5})^2$ iii) $o(\bar{9})$ iv) $o(\bar{7})$
7. Show that $G = \mathbb{R} - \{1\}$ is an abelian group under the binary operation $a * b = a + b - ab, \forall\, a, b \in G$
8. Prove that $G = \{\begin{bmatrix} x & x \\ x & x \end{bmatrix} : x$ is a non-zero real number$\}$ is a group under matrix multiplication.
9. If G is a group such that $a^2 = e, \forall\, a, b \in G,$ then show that G is abelian.
10. If in a group G, $a^5 = e$ and $aba^{-1} = b^2, \forall\, a, b\, G$, then find order of an element b.

Practical - 6: Subgroups

1. If G is a group, then show that the center of $G, Z(G)$, is a subgroup of G, where $Z(G) = \{x \in G : xa = ax,\ \forall a \in G\}$.
2. Show that $(\mathbb{Z}_7, \times_7)$is a cyclic group. Find all its generators, all its proper subgroups and order of every element.
3. Let $G = \{1, -1, i, -i, j, -j, k, -k\}$ be a group under multiplication and $H = \{1, -1, i, -i\}$ be its subgroup. Find all the left and right cosets of H in G.
4. Let A and B be two subgroups of a finite group G whose orders are relatively prime. Show that $A \cap B = \{e\}$.
5. Show that every proper subgroup of a group of order 77 is cyclic.
6. Find the remainder obtained when 15^{27} is divided by 8.
7. Find the remainder obtained when 33^{19} is divided by 7.
8. Let G be a group of all non-zero complex numbers under multiplication. Show that $H = \{a + ib : a^2 + b^2 = 1\}$ is a subgroup of G.
9. If H is subgroup of a group G and if the normalizer of H, $N(H) = \{g \in G : gHg^{-1} = H\}$, then prove that (a) $N(H)$ is a subgroup of G and (b) H is a normal subgroup of $N(H)$.
10. If G is a group and H is a subgroup of index 2 in G, then prove that H is a normal subgroup of G.

Practical – 7: Homomorphism and Isomorphism of Groups

1. Let $G = \{A : A$ is $n \times n$ matrix over $\mathbb{R}$ and $|A| \neq 0\}$, the group of non-singular matrices of order n over $\mathbb{R}$ under matrix multiplication and let $\mathbb{R}^* = \mathbb{R} - \{0\}$, be the group of nonzero real numbers under multiplication. Define $f : G \to \mathbb{R}^*$ by $f(A) = |A|$, for all $A \in G$. Show that f is an onto group homomorphism and find its kernel.
2. If $G_1 = \{1, -1, i, -i\}$ is a group under multiplication and $G_2 = \{2, 4, 6, 8\}$ is a group under multiplication modulo 10, then show that G_1 and G_2 are isomorphic.
3. Let G be a group and $a \in G$. Show that $f_a : G \to G$ defined by $f_a(x) = axa^{-1}$, for all $x \in G$ is an automorphism.

4. Let G be a group and $f : G \to G$ be a map defined by $f(x) = x^{-1}$, for all $x \in G$. Prove that
   (a) If G is abelian, then f is an isomorphism.
   (b) If f is a group homomorphism, then G is abelian.
5. Let $G = \{a, a^2, a^3, \dots, a^{11}, a^{12} = e\}$ be a cyclic group of order 12 generated by a. Show that $f : G \to G$ defined by $f(x) = x^4, \forall x \in G$ is a group homomorphism. Find the kernel of f.
6. Let f and g be group homomorphisms from the group G into G. Show that $H = \{x \in G : f(x) = g(x)\}$ is a subgroup of G.
7. Prove that the mapping $f: C \to C_0$ such that $f(z) = e^z$ is a homomorphism of the additive group of complex numbers onto the multiplicative group of non-zero complex numbers. What is the kernel of f?
8. Let G be a group of all matrices of the type $\left\{\begin{bmatrix} a & b \\ -b & a \end{bmatrix} : a, b \in G \text{ and } a^2 + b^2 = 1\right\}$ under matrix multiplication and G' be a group of non-zero complex numbers under multiplication. Show that $f : G \to G'$ defined by $f\left(\begin{bmatrix} a & b \\ -b & a \end{bmatrix}\right) = a + ib$, is an isomorphism.

Practical – 8(A): Rings

1. (a) Show that $\mathbb{Z}_7 = \{\overline{0}, \overline{1}, \overline{2}, \overline{3}, \overline{4}, \overline{5}, \overline{6}\}$ forms a ring under addition and multiplication modulo 7.
   (b) In the ring $(\mathbb{Z}_{10}, +_{10}, \times_{10})$, find all divisors of zero.
2. Show that $\mathbb{Z}[i] = \{a + ib : a, b \in \mathbb{Z}\}$, the set of Gaussian integers, forms an integral domain under usual addition and multiplication of complex numbers.
3. Show that $R = \{a + b\sqrt{2} : a, b \in \mathbb{Z}\}$ is an integral domain under usual addition and multiplication.
4. In the ring $(\mathbb{Z}_7, +_7, \times_7)$, find (i) – $(\overline{4} \times_7 \overline{6})$; (ii) $\overline{3} \times_7 (\overline{-6})$; (iii) $(\overline{-5}) \times_7 (\overline{-5})$ (iv) Units in $\mathbb{Z}_7$; (v) additive inverse of $\overline{6}$; (vi) zero divisors. Is $\mathbb{Z}_7$ a field or an integral domain? Justify.
5. Let $\mathbb{R}$ be the set of all real numbers. Show that $\mathbb{R} \times \mathbb{R}$ forms a field under addition and multiplication defined by $(a, b) + (c, d) = (a + c, b + d)$ & $(a, b) . (c, d) = (ac - bd, ad + bc)$.
6. If p is a prime number, then show that $\mathbb{Z}_p$ is an integral domain.
7. Which of the following rings are integral domains? (i) $\mathbb{Z}_{187}$; (ii) $\mathbb{Z}_{61}$; (iii) $\mathbb{Z}_{2\times 2}$. (iv) $(\mathbb{Z}, +, \cdot)$.

Practical – 8(B): Group Codes

1. Consider the (3,8) encoding function $e : B^3 \to B^8$ defined by $e(000) = 00000000$, $e(001) = 10111000$, $e(010) = 00101101$, $e(011) = 10010101$, $e(100) = 10100100$, $e(101) = 10001001$, $e(110) = 00011100$, $e(111) = 00110001$.
   (a) Find the minimum distance of e.
   (b) How many errors will e detect?
2. Show that the (3,6) encoding function $e : B^3 \to B^6$ defined by $e(000) = 000000$, $e(001) = 001100$, $e(010) = 010011$, $e(011) = 011111$, $e(100) = 100101$, $e(101) = 101001$, $e(110) = 110110$, $e(111) = 111010$is a group code. Also find the minimum distance of e.
3. Compute: (a) $\begin{bmatrix}1&0&1\\1&1&0\\0&1&0\\0&1&1\end{bmatrix} \oplus \begin{bmatrix}1&1&1\\0&0&1\\1&1&0\\0&1&0\end{bmatrix}$ (b) $\begin{bmatrix}1&1&0\\1&0&1\\0&1&0\end{bmatrix} * \begin{bmatrix}1&1&1\\0&0&1\\1&1&0\end{bmatrix}$
4. Let $H = \begin{bmatrix}0&1&1\\0&1&1\\1&0&0\\0&1&0\\0&0&1\end{bmatrix}$ be a parity check matrix. Determine the $(2, 5)$ group code $eH : B^2 \to B^5$.
5. Consider the parity check matrix: $H = \begin{bmatrix}0&1&1\\1&0&1\\1&0&0\\0&1&0\\0&0&1\end{bmatrix}$. Decode the following words relative to a maximum likelihood decoding function associated with eH : $a) 10100 \quad b) 01101 \quad c) 11011$
6. Consider the parity check matrix: $H = \begin{bmatrix}1&1&0\\1&0&1\\0&1&1\\1&0&0\\0&1&0\\0&0&1\end{bmatrix}$. Determine the coset leaders for $N = eH(B^3)$. Also compute the Syndrome for each coset leader and decode the code 001110 relative to maximum likelihood decoding function.
7. Let the $(9, 3)$ decoding function $d : B^9 \to B^3$ be defined by $d(y) = Z1Z2Z3$, where $Z_i = 1$, if $\{yi, yi + 3, yi + 6\}$ has at least two 1's
   $= 0$, if $\{yi, yi + 3, yi + 6\}$ has less than two 1's, i = 1, 2, 3.
8. If $y \in B^9$, then determine $d(y)$, where $(i)\ y = 101111101$ $(ii)\ y = 100111100$.

Note: Practical problems based on each unit are not limited to the given ones, but any other related challenging and application-oriented problems may also be evaluated in the practical sessions.

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SEC -1

MTH 304: Set Theory and logic (Period: 30 Clock hours)

Course Description:

This course is an elementary skill development course for S. Y. B.Sc. students.

Prerequisite Course(s): Secondary school level knowledge of elementary mathematics.

General Objective: The general objectives are to acquire concepts of sets, relations, countable and uncountable sets; statements and truth values; concept of tautology, contradiction and quantifiers.

Learning Outcomes:

a) Uses of the language of set theory, designining issues in different subjects of mathematics
b) understand the issues associated with different types of finite and infinite sets via countable uncountable sets
c) knowledge of the concepts and methods of mathematical logic, set theory, relation calculus, and concepts concerning functions which are included in the fundamentals of various disciplines of mathematics
d) understanding the role of propositional and predicate calculus
e) able to provide the logical mathematical reasoning, formulate theorems and definitions

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Unit-1: Sets and Subsets **Marks-15**

1.1 Finite Set and Infinite set
1.2 Equality of two Sets,
1.3 Null Set, Subset, Proper subset, Symmetric difference of two sets
1.4 Universal set, Power set, Disjoint sets,
1.5 Operation on sets: Union and Intersection
1.6 Venn diagram
1.7 Equivalent sets
1.8 Countable and uncountable sets

Unit-2: Relations and Functions **Marks-15**

1.1 Product of sets

1.2 Relations, Types of relations, Reflexive, Symmetric, Transitive relations and Equivalence relations

1.3 Function, Types of functions, One-one, Onto, Even, Odd and Inverse function

1.4 Composite functions

Unit-3: Algebra of Propositions **Marks-15**

2.1 Statements, Conjunction, Disjunction.

2.2 Negation, Conditional and Bi-Conditional statements, Propositions.

2.3 Truth table, Tautology and Contradiction.

2.4 Logical equivalence, Logical equivalent statements.

Unit-4: Quantifiers **Marks-15**

3.1 Propositional functions and Truth sets.

3.2 Universal quantifier, Existential quantifier.

3.3 Negation of proposition which contain quantifiers, Counter examples.

Recommended book:

1. Set Theory and Related Topics by Schaum's outline Series (Chapter1, chapter 4, chapter 6: 6.2, 6.3, chapter 10)

Reference Books:

1. R.R.Halmons, Naïve Set Theory, Springer, 1974
2. E. Kamke, Theory of Sets, Dover Publishers,1950

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SEMESTER – IV

MTH -401: Complex Variables (Period: 30 Clock hours)

Course Description:

This course will improve basic and intermediate level knowledge of a special type of number system namely complex numbers and also discusses complex valued function with their integrations.

Prerequisite Course(s): Basic knowledge of Sets, functions, real valued functions, their limits and continuity and integrations.

General Objective:

A primary objective of this course is to make students aware of generalization of real number system and calculus. Analyticity and complex integrations are useful for applications. This course improves mathematical skill and ability to solve various integrations.

Learning Outcomes:

a) The course is aimed to introduce the theory for functions of complex variables
b) Students will understand the concept of analytic function
c) Students will understand the Cauchy Riemann Equations
d) Students will understand harmonic functions
e) Students will understand complex integrations
f) Students will understand calculus of residues.
g) Students will acquire the skill of contour integrations.

Unit-1: Complex numbers **Marks-15**

1.1 Complex numbers, modulus and amplitude, polar form
1.2 Triangle inequality and Argand's diagram
1.3 DeMoivre's theorem for rational indices and applications
1.4 n^{th} roots of a complex number
1.5 Elementary functions: Trigonometric functions, Hyperbolic functions of a complex variables (definitions only).

Unit-2: Functions of complex variables **Marks-15**

2.1 Limits, Continuity and Derivative.
2.2 Analytic functions, A Necessary and sufficient conditions for analytic functions.
2.3 Cauchy Riemann equations.
2.4 Laplace equations and Harmonic functions
2.5 Construction of analytic functions

Unit-3: Complex integrations **Marks-15**

3.1 Line integral and theorems on it.

3.2 Statement and verification of Cauchy-Gaursat's Theorem.
3.3 Cauchy's integral formulae for $f(a), f'(a)$ and $f^n(a)$
3.4 Taylor's and Laurent's series.

Unit-4: Calculus of Residues **Marks-15**

4.1 Zeros and poles of a function.
4.2 Residue of a function
4.3 Cauchy's residue theorem
4.4 Evaluation of integrals by using Cauchy's residue theorem
4.5 Contour integrations of the type $\int_0^{2\pi} f(cos\,\theta, sin\theta\,)d\theta$ *and* $\int_{-\infty}^{\infty} f(x)dx$

Recommended book:

1. Complex Variables and Applications; J. W. Brownand, R. V. Churchill. 7th Edition. (McGraw-Hill) (Capter1, chapter 2, chapter 3, chapter 4, chapter 6)

Reference Books:

1. Theory of Functions of Complex Variables: Shanti Narayan, S. Chand and Company New Delhi.
2. Complex variables: Schaum's Outline Series.

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MTH-402(A): Differential Equations (Period: 30 Clock hours)

Course Description:

This course is of primary nature and here we introduce the students how the Differential Equations are formed and how to solve them using various methods.

Prerequisite Course(s): Basic knowledge of Real and complex valued functions, differentiations and integrations.

General Objective:

The main objective of this program is to cultivate mathematical aptitude among the students and nurture their interest towards problem solving aptitude by introducing various methods of solution of differential equations.

Learning Outcomes:

a) Students will aware of formation of differential equations and their solutions
b) Students will understand the concept of Lipschitz condition
c) Students will understand method of variation of parameters for second order L.D.E.
d) Students will understand simultaneous linear differential equations and method of their solutions
e) Students will understand Pfaffian differential equations and method of their solutions
f) Students will understand difference equations and their solutions

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Unit-1: Theory of ordinary differential equations **Marks-15**

1.1 Lipschitz condition
1.2 Existence and uniqueness theorem
1.3 Linearly dependent and independent solutions
1.4 Wronskian definition
1.5 Linear combination of solutions
1.6 Theorems on i) Linear combination of solutions ii) Linearly independent solutions
iii) Wronskian is zero iv) Wronskian is non-zero
1.7 Method of variation of parameters for second order L.D.E.

Unit-2: Simultaneous Differential Equations **Marks-15**

2.1 Simultaneous linear differential equations of first order
2.2 Simultaneous D.E. of the form $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$.
2.3 Rule I: Method of combinations
2.4 Rule II: Method of multipliers
2.5 Rule III: Properties of ratios
2.6 Rule IV: Miscellaneous

Unit-3: Total Differential or Pfaffian Differential Equations **Marks-15**

3.1 Pfaffian differential equations
3.2 Necessary and sufficient conditions for the integrability
3.3 Conditions for exactness
3.4 Method of solution by inspection
3.5 Solution of homogenous equation

Unit-4: Difference Equations **Marks-15**

4.1 Introduction, Order of difference equation, degree of difference equations
4.2 Solution to difference equation and formation of difference equations
4.3 Linear difference equations, Linear homogeneous difference equations with constant coefficients
4.4 Non-homogenous linear difference equation with constant coefficients

Recommended books:

1. Ordinary and Partial Differential Equation by M. D. Rai Singhania, S. Chand & Co. 18th Edition. (Chapter 1 and Chapter 2)
2. Numerical Methods by V. N. Vedamurthy and N. Ch. S. N. Iyengar, Vikas Publishing House, New Delhi. (Chapter 10).

Reference Book:

1. Introductory course in Differential Equations by D. A. Murray, Longmans Green and co. London and Mumbai, 5th Edition 1997.

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MTH-402 (B): Differential Equations and Numerical Methods (Period: 30 Clock hours)

Unit-1 : Theory of ordinary differential equations **Marks-15**

1.1 Lipschitz condition
1.2 Existence and uniqueness theorem
1.3 Linearly dependent and independent solutions
1.4 Wronskian definition
1.5 Linear combination of solutions
1.6 Theorems on i) Linear combination of solutions ii) Linearly independent solutions
iii) Wronskian is zero iv) Wronskian is non-zero
1.7 Method of variation of parameters for second order L.D.E.

Unit-2 : Simultaneous Differential Equations **Marks-15**

2.1 Simultaneous linear differential equations of first order
2.2 Simultaneous D.E. of the form $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$.
2.3 Rule I: Method of combinations
2.4 Rule II: Method of multipliers
2.5 Rule III: Properties of ratios
2.6 Rule IV: Miscellaneous

Unit-3 : Total Differential or Pfaffian Differential Equations **Marks-15**

3.1 Pfaffian differential equations
3.2 Necessary and sufficient condition for integrability
3.3 Conditions for exactness
3.4 Method of solution by inspection
3.5 Solution of homogenous equation

Unit-4 : Numerical differentiation **Marks-15**

4.1 Numerical Differentiation
4.2 Derivatives using Newtons forward interpolation formula
4.3 Derivatives using Newtons backward interpolation formula
4.4 Derivatives using Stirling's interpolation formula
4.5 Maxima and minima

Recommended books: -

1. Ordinary and Partial Differential Equation by M. D. Rai Singhania, S. Chand & Co. 18th Edition. (Chapter 1 and Chapter 2)
2. Numerical Methods by Dr. V. N. Vedamurthy and Dr. N. Ch. S. N. Iyengar, Vikas Publishing (Chapter 9)

Reference Books:

1. Introductory methods of Numerical Analysis, S.S. Sastry, Prentice Hall India, 12 th edition, New Delhi.
2. Differential equations, G.F. Simmons, Tata Mcgrawhill, 1972.

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MT-403: Practical course based on MTH-401, MTH-402
(Period: 60 Clock hours)

Practical No	Title of the Practical
1	Complex Numbers
2	Function of Complex Variable
3	Complex Integration
4	Calculus of Residues
5	Theory of ordinary differential equations
6	Simultaneous Differential Equations
7	Total (Pfaffian) Differential Equations
8(A)	Difference Equations
8(B)	Numerical Differentiation

List of Practicals

Practical-1: Complex Numbers

1. Find the Modulus and principle value of the argument of $\frac{(1+i\sqrt{3})^{13}}{(\sqrt{3}-i)^{11}}$.
2. If z_1, z_2, z_3 represents the vertices of an equilateral triangle, then prove that $z_1^2 + z_2^2 + z_3^2 = z_1 z_2 + z_2 z_3 + z_3 z_1$.
3. If $cos\alpha + cos\beta + cos\gamma = 0$ and $sin\alpha + sin\beta + sin\gamma = 0$, then show that
   i. $cos3\alpha + cos3\beta + cos3\gamma = 3\cos(\alpha + \beta + \gamma)$ and
   $sin3\alpha + sin3\beta + sin3\gamma = 3\sin(\alpha + \beta + \gamma)$
   ii. $cos2\alpha + cos2\beta + cos2\gamma = 0$ and
   $sin2\alpha + sin2\beta + sin2\gamma = 0$
4. Find all the values of $(1 + i)^{\frac{1}{5}}$. Show that their continued product is $1 + i$.
5. Solve the equation $x^8 - x^4 + 1 = 0$.
6. Determine the region in the Z-plane represented by $|z - 3| + |z + 3| = 10$.
7. Using De Moivre's theorem express $\cos^6\theta$ in terms of cosines of multiple angles.
8. If $|z_1| = |z_2| = |z_3| = 5$ and $\bar{z_1} + \bar{z_2} + \bar{z_3} = 0$, then prove that $\frac{1}{Z_1} + \frac{1}{Z_2} + \frac{1}{Z_3} = 0$.

Practical-2: Functions of Complex Variable

1. Evaluate: $\lim_{z \to (1+i)} \frac{z^4+4}{z-1-i}$.
2. If $f(z) = \frac{3z^4-2z^3+8z^2-2z+5}{z-i}$, $z \neq i$ is continuous at $z = i$, then find the value of $f(i)$.
3. Find an analytic function $f(z) = u + iv$ and express it in terms of z, if $u = x^3 - 3xy^2 + 3x^2 - 3y^2 + 1$

4. Find an analytic function $f(z) = u + iv$ whose imaginary part is $v = e^x(xsiny + ycosy)$ using Milne Thomson Method.
5. Show that the real and imaginary parts of the function e^z satisfy C-R equations and they are harmonic.
6. Show that $u = \frac{1}{2}\log(x^2 + y^2)$ satisfies Laplace Equation. Find its harmonic conjugate.
7. If $f(z)$ is an analytic function with constant modulus, then show that $f(z)$ is a constant function.
8. Evaluate $\lim_{z \to e^{\frac{i\pi}{3}}} \frac{(z - e^{\frac{i\pi}{3}})z}{z^3+1}$.

Practical-3: Complex Integration

1. Evaluate $\int_C (y - x - 3x^2 i)dz$, where C is :
   i. The straight-line joining $z = 0$ to $z = 1 + i$
   ii. The straight-line joining $z = 0$ to $z = i$ first and then from $z = i$ to $z = 1 + i$.
2. Use the Cauchy Goursat theorem to obtain the value of $\int_C e^z \, dz$, where C is the circle $|z| = 1$ and hence deduce the following:
   i. $\int_0^{2\pi} e^{cos\theta} \sin(\theta + sin\theta)\, d\theta = 0$
   ii. $\int_0^{2\pi} e^{cos\theta} \cos(\theta + sin\theta)\, d\theta = 0$
3. Using Cauchy's Integral formula, evaluate $\int_C \frac{dz}{z^3(z+4)}$, where C is the circle $|z| = 2$.
4. Obtain the expansion of $f(z) = \frac{z^2-1}{(z+2)(z+3)}$, in the powers of z in the region
   (i) $|z| < 2$ (ii) $2 < |z| < 3$ (iii) $|z| > 3$.
5. Prove that $\frac{1}{4z-z^2} = \sum_{n=0}^{\infty} \frac{z^{n-1}}{4^{n+1}}$, where $0 < |z| < 4$.
6. Verify Cauchy's integral theorem for $f(z) = z^2$ around the circle $|z| = 1$.
7. Evaluate $\int_{|z|=2} \frac{e^{2z}}{(z-1)^4} dz$ using Cauchy's integral formula.
8. Find the expansion of $f(z) = \frac{1}{(z^2+1)(z^2+2)}$ in powers of z, when $|z| < 1$.

Practical-4: Calculus of Residues

1. Find the residue of $f(z) = \frac{z^2+2z}{(z+1)^2(z+4)}$ at its poles.
2. Evaluate $\int_{|z|=3} \frac{e^z}{z(z-1)^2} dz$ by Cauchy's residue theorem.

3. Evaluate $\int_C \frac{3z^2+2}{(z-1)(z^2+9)}dz$ by Cauchy's residue theorem, where C is
   (i) The circle $|z-2|=2$ (ii) The circle $|z|=4$
4. Use the Contour integration to evaluate $\int_0^{2\pi} \frac{d\theta}{5+3cos\theta}$.
5. Evaluate by Contour integration $\int_{-\infty}^{\infty} \frac{1}{x^4+13x^2+36}dx$.
6. Find the sum of residues of $f(z)=\frac{e^z}{z^2+a^2}$ at its poles.
7. Evaluate $\int_{|z|=2} \frac{dz}{z^3(z+4)}$ by Cauchy's residue theorem.
8. Evaluate $\int_0^{\infty} \frac{x^2dx}{(x^2+1)(x^2+4)}$ by contour integration.

Practical 5: Theory of ordinary differential equations

1. Show that $f(x,y)=xy^2$ satisfies the Lipschitz condition on the rectangle R: $|x|\leq 1$, $|y|\leq 1$, but does not satisfy the Lipschitz condition on the strip $S:\ |x|\leq 1$, $|y|\leq \infty$.
2. Prove that $\sin 2x$ and $\cos 2x$ are solutions of $y''+4y=0$ and these solutions are linearly independent.
3. Prove that $1, x, x^2$ are linearly independent. Hence, form the differential equation whose solutions are 1, x and x^2.
4. Examine whether the set of functions 1 , x^2, x^3 are linearly independent or not.
5. Solve by method of variation of parameters $y''+a^2y=cosec(ax)$
6. Solve by method of variation of parameters $y''+y-x=0$
7. Show that functions $1+x,\ x^2, 1+2x$ are linearly independent.
8. Examine whether e^{2x} and e^{3x} are linearly independent solution of differential equation $y''-5y'+6y=0$ or not?
9. Solve by method of variation of parameters, $y''+3y=sec3x$.

Practical 6 –Simultaneous Differential Equations

1. Solve : (i) $\frac{dx}{x^2z}=\frac{dy}{0}=\frac{dz}{-x^2}$ and (ii) $\frac{dx}{\tan x}=\frac{dy}{\tan y}=\frac{dz}{\tan z}$
2. Solve : (i) $\frac{dx}{xy}=\frac{dy}{y^2}=\frac{dz}{xyz-zx^2}$ and (ii) $\frac{dx}{y}=\frac{dy}{x}=\frac{dz}{xyz^2(x^2-y^2)}$
3. Solve : $\frac{dx}{y+z}=\frac{dy}{z+x}=\frac{dz}{x+y}$
4. Solve : $\frac{adx}{yz(b-c)}=\frac{bdy}{zx(c-a)}=\frac{cdz}{xy(a-b)}$
5. Solve : $\frac{dx}{x^2-y^2-z^2}=\frac{dy}{2xy}=\frac{dz}{2xz}$
6. Solve : $\frac{dx}{z(x+y)}=\frac{dy}{z(x-y)}=\frac{dz}{x^2+y^2}$

7. Solve : $\frac{dx}{\sin(x+y)} = \frac{dy}{\cos(x+y)} = \frac{dz}{z}$
8. Solve : $\frac{dx}{z^2} = \frac{ydy}{xz^2} = \frac{dz}{xy}$
9. Solve : $\frac{dx}{y^2(x-y)} = \frac{dy}{-x^2(x-y)} = \frac{dz}{z(x^2+y^2)}$.

Practical - 7 :Total (Pfaffian) Differential Equations

1. Show that the following differential equations are integrable. Hence solve them
   (i) $(y^2 + z^2 + x^2)dx - 2xydy - 2xzdz = 0$
   (ii) $2yzdx + zxdy - xy(1 + z)dz = 0$
2. Solve : $yz^2(x^2 - yz)dx + zx^2(y^2 - xz)dy + xy^2(z^2 - xy)dz = 0$
3. Solve : $\frac{yz}{x^2+y^2}dx - \frac{xz}{x^2+y^2}dy - tan^{-1}\frac{y}{x}dz = 0$
4. Solve : $zydx = zxdy + y^2dz = 0$
5. Solve : $(x^2 - yz)dx + (y^2 - xz)dy + (z^2 - xy)dz = 0$
6. Solve : $(2x^2 + 2xy + xz^2 + 1)dx + dy + 2zdz = 0$
7. Solve : $(y + z)dx + dy + dz = 0$
8. Show that the equation $yz^2(x^2 - yz)dx + zx^2(y^2 - xz)dy + xy^2(z^2 - xy)dz = 0$ is integrable. Is it exact? Verify.

Practical 8(A) : Difference Equations

1. Form the difference equation corresponding to the following general solution:
   (a) $y = c_1x^2 + c_2x + c_3$
   (b) $y = (c_1 + c_2n)(-2)^n$
2. Show that $y_x = c_1 + c_2.2^x - x$ is a solution of difference equation $y_{x+2} - 3y_{x+1} + 2y_x = 1$.
3. Formulate the Fibonnaci difference equation and solve it.
4. Solve the following difference equations:
   (a) $y_{x+1} - 3y_x = 1$
   (b) y_{x+1}-$3y_x = 0,\ y_0 = 2$
5. Solve the following non-homogeneous linear difference equations:
   (i) $y_{x+2} - 4y_x = 9x^2$
   (ii) $\Delta y_x + \Delta^2 y_x = sinx$
6. Solve: $y_{x+2} - 4y_{x+1} + 3y_x = 3^x + 1$.
7. Solve: $y_{x+2} - 4y_{x+1} + 4y_x = 3x + 2^x$.
8. Solve: $u_{x+2} - 5u_{x+1} + 6u_x = 36$.

Practical – 8 (B): Numerical differentiation

1. Find the first and second derivatives of the function tabulated below at $x = 1.9$

x	1.0	1.2	1.4	1.6	1.8	2.0
$f(x)$	0	0.128	.544	1.296	2.432	4.0

2. Find first and second derivatives at $x = 0$ from the following table:

x	0	1	2	3	4	5
$f(x)$	4	8	15	7	6	2

3. Find the value of $sec(310)$ from the following table:

x	31	32	33	34
$sec(x)$	0.6008	0.6249	0.6494	0.6745

4. Find first derivative using Stirling's formula at $x = 0.5$:

x	0.35	0.4	0.45	0.5	0.55	0.6	0.65
$f(x)$	1.521	1.506	1.488	1.467	1.444	1.418	1.389

5. Find the maximum value of $f(x)$ from the following table:

x	3	4	5	6	7	8
$f(x)$	0.205	0.240	0.259	0.262	0.250	0.224

6. Find the maximum value of y from the following table:

x	0	2	3	4	7	9
$f(x)$	4	26	58	112	466	922

7. Find the first derivative at $x = 4$ by using Stirling's formula:

x	1	2	3	4	5	6
$f(x)$	1	3	7	13	21	31

8. Find the maximum and minimum values of $f(x)$:

x	0	1	2	3	4	5
$f(x)$	0	0.25	0	2.25	16.0	56.25

Note: Practical problems based on each unit are not limited to the given ones, but any other related challenging and application-oriented problems may also be evaluated in the practical sessions.

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SEC- 2

MTH 404: Vector Calculus (Period: 30 Clock hours)

Course Description:

This is a skill development course of vector algebra and its calculus for S. Y. B.Sc. students

Prerequisite Course(s): Secondary school level knowledge of elementary physics and mathematics.

General Objective: The general objectives are to acquire skills of vectors algebra, vector valued functions, operators like del and curl and line and surface integrals.

Learning Outcomes:

a) understand scalar and vector products
b) understand vector valued functions and their limits and continuity and use them to estimate velocity and acceleration of partials.
c) Calculate the curl and divergence of a vector field.
d) Set up and evaluate line integrals of functions along curves.

Unit -1: Product of Vectors **Marks-15**

1.1 Scalar Product
1.2 Vector Product
1.3 Scalar Triple Product
1.4 Vector Product of Three Vectors
1.5 Reciprocal Vector

Unit-2: Vector functions **Marks-15**

1.1 Vector functions of a single variable.
1.2 Limits and continuity.
1.3 Differentiability, Algebra of differentiation.
1.4 Curves in space, Velocity and acceleration.
1.5 Vector function of two or three variables.
1.6 Limits, Continuity, Partial Differentiation

Unit-3: The Vector Operator Del **Marks-15**

2.1 The vector differentiation operator del.
2.2 Gradient.
2.3 Divergence and curl.
2.4 Formulae involving del. Invariance.

Unit-4: Vector Integration **Marks-15**

3.1 Ordinary integrals of vectors.
3.2 Line integrals.
3.3 Surface integrals.

Recommended Book:

1. Vector Analysis by Murray R Spiegel, Schaum's Series, McGraw Hill Book Company.

Reference Book:

1. Vector Calculus by Shanti Narayan and P.K. Mittal, S. Chand & Co., New Delhi

KAVAYITRI BAHINABAI CHAUDHARI
NORTH MAHARASHTRA UNIVERSITY, JALGAON

Equivalence courses for S. Y. B. Sc. (Mathematics)

Effective from 2019

Semester	Old course (June 2016)	New course (June 2019)
Sem-I	MTH 231 : Calculus of Several Variables	MTH 301 : Calculus of Several Variables
	MTH 232(A): Algebra	MTH 302(A) : Group Theory
	MTH 232(B): Theory of Groups	MTH -302(B): Theory of Groups and Codes
	MTH 233 : Practical Course based on MTH-232 & MTH-232	MTH 303 : Practical paper based on MTH 301 & MTH 302
Sem-II	MTH 241 : Complex Variables	MTH 401 : Complex Variables
	MTH 242(A): Differential Equations	MTH 402 : Differential Equations
	MTH 242(B): Differential and Difference Equations	MTH-402 (B): Differential Equations and Numerical Methods
	MTH 243 : Practical Course based on MTH-241 & MTH-242	MTH 403 : Practical paper based on MTH 401 & MTH 402

Kavayitri Bahinabai Chaudhari

NORTH MAHARASHTRA UNIVERSITY

JALGAON 425001, INDIA

SYLLABUS UNDER

FACULTY OF SCIENCE & TECHNOLOGY

UNDER CBCS

FOR COURSES RELATED TO SUBJECT

ZOOLOGY

S.Y.B.Sc. (Semester I and II)

WITH EFFECT FROM

ACADEMIC YEAR 2019-2020

KBC NORTH MAHARSHTRA UNIVERSITY, JALGAON

Syllabus for SYBSc ZOOLOGY under CBCS Pattern

(wef June 2019)

Examination Pattern 60:40

Semester	Core Course	Structure	Code & Title of the paper	Credit
III	DSC 1-C CC A-III	Theory	ZOO 301 Physiology	02
		Theory	ZOO 302 Biochemistry	02
		Practical	ZOO 303 Physiology & Biochemistry	02
	SE Course I	Section I	SEC I Apiculture	02
	AEC III	Section I	English/Marathi Communication (2 periods per week)	02
IV	DSC 1-D CC A-IV	Theory	ZOO 401 Genetics	02
		Theory	ZOO 402 Evolutionary Biology	02
		Practical	ZOO 403 Genetics & Evolutionary Biology	02
	SE Course II	Section II	SEC II Medical Diagnostics	02
	AEC IV	Section II	English/Marathi Communication (2 periods per week)	02
Total Credits Sem III & IV= 16+4=20				

DSC = Discipline selective course
SEC= Skill Enhancement Course
AEC = Ability Enhancement course
Credit 2= 2 hrs/ week = 30 periods per semester

CORE COURSE III

SYBSc Zoology Semester III

ZOO 301 PHYSIOLOGY

THEORY **(CREDITS 2)**

Unit 1: Nerve and muscle (5)
Structure of a neuron, Resting membrane potential, Graded potential, Origin of Action potential and its propagation in myelinated and non-myelinated nerve fibres, Ultra-structure of skeletal muscle, Molecular and chemical basis of muscle contraction

Unit 2: Digestion (3)
Physiology of digestion in the alimentary canal; Absorption of carbohydrates, proteins, lipids

Unit 3: Respiration (5)
Pulmonary ventilation, Respiratory volumes and capacities, Transport of Oxygen and carbon dioxide in blood

Unit 4: Excretion (4)
Structure of nephron, Mechanism of Urine formation, Counter-current Mechanism

Unit 5: Cardiovascular system (5)
Composition of blood, Hemostasis, Structure of Heart, Origin and conduction of the cardiac impulse, Cardiac cycle

Unit 6: Reproduction and Endocrine Glands (8)
Physiology of male reproduction: hormonal control of spermatogenesis; Physiology of female reproduction: hormonal control of menstrual cycle, Structure and function of pituitary, thyroid, Parathyroid, pancreas and adrenal

ZOO 302 BIOCHEMISTRY

THEORY **(CREDITS 2)**

Unit 1: Carbohydrate Metabolism (8)
Glycolysis, Krebs Cycle, Pentose phosphate pathway, Gluconeogenesis, Glycogen metabolism, Review of electron transport chain

Unit 2: Lipid Metabolism (6)
Biosynthesis and β oxidation of palmitic acid, Lipogenesis, Lipolysis

Unit 3: Protein metabolism (8)
Biosynthesis of amino acid, Transamination, Deamination, Decarboxylation and Urea Cycle

Unit 4: Enzymes (8)
Introduction, Classification of Enzymes, Mechanism of action, Enzyme Kinetics, Factors affecting rate of enzyme mediated reactions, Inhibition and Regulation

ZOO 303 PHYSIOLOGY AND BIOCHEMISTRY

PRACTICAL **(CREDITS 2)**

1. Preparation of hemin and hemochromogen crystals
2. Study of permanent histological sections of mammalian pituitary, thyroid, pancreas, adrenal gland
3. Study of permanent slides of spinal cord, duodenum, liver, lung, kidney, bone, cartilage
4. Qualitative tests to identify functional groups of carbohydrates in given solutions (Glucose, Fructose, Sucrose, Lactose)
5. Estimation of total protein in given solutions by Lowry's method.
6. Study of activity of salivary amylase under optimum conditions

SUGGESTED READINGS

- Tortora, G.J. and Derrickson, B.H. (2009). *Principles of Anatomy and Physiology*, XII Edition, John Wiley & Sons, Inc.
- Widmaier, E.P., Raff, H. and Strang, K.T. (2008) *Vander's Human Physiology*, XI Edition., McGraw Hill
- Guyton, A.C. and Hall, J.E. (2011). T*extbook of Medical Physiology*, XII Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company
- Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). *Biochemistry*. VI Edition. W.H Freeman and Co.
- Nelson, D. L., Cox, M. M. and Lehninger, A.L. (2009). *Principles of Biochemistry*. IV Edition. W.H. Freeman and Co.
- Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2009). *Harper's Illustrated Biochemistry*. XXVIII Edition. Lange Medical Books/Mc Graw3Hill.
- Prakash S.Lohar (2008)Endocrinology:Hormones and Human Health, MJP Publshers , A unit of Tamilnadu Book House, Triplicane, Chennai

Skill Enhancement Course I (Section I)

SEC I

Apiculture

Credit 2

Unit 1: Biology of Bees (4)

History, Classification and Biology of Honey Bees, Social Organization of Bee Colony

Unit 2: **Rearing of Bees** (12)

Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth Bee Pasturage Selection of Bee Species for Apiculture, Bee Keeping Equipment Methods of Extraction of Honey (Indigenous and Modern)

Unit 3: **Diseases and Enemies** (5)

Bee Diseases and Enemies Control and Preventive measures

Unit 4: **Bee Economy** (4)

Products of Apiculture Industry and its Uses (Honey, Bees Wax, Propolis, Pollen, etc)

Unit 5: **Entrepreneurship in Apiculture** (5)

Bee Keeping Industry – Recent Efforts, Modern Methods in employing artificial Beehives for cross pollination in horticultural gardens

SUGGESTED READINGS

- Prost, P. J. (1962). Apiculture. Oxford and IBH, New Delhi.
- Bisht D.S., Apiculture, ICAR Publication.
- Singh S., Beekeeping in India, Indian council of Agricultural Research, NewDelhi.

CORE COURSE IV
SYBSc Zoology Semester IV

ZOO 401 GENETICS

THEORY **(CREDITS 2)**

Unit 1: Introduction to Genetics (4)
Mendel's work on transmission of traits, Genetic Variation, Molecular basis of Genetic Information

Unit 2: Mendelian Genetics and its Extension (10)
Principles of Inheritance, Chromosome theory of inheritance, Incomplete dominance and co dominance, Polygenic inheritance, Multiple alleles, Lethal genes, Epistasis, Pleiotropy, sex linked inheritance, extra-chromosomal inheritance

Unit 3: Linkage, Crossing Over and Chromosomal Mapping (6)
Linkage and crossing over, Recombination frequency as a measure of linkage intensity, two factor and three factor crosses, definition of gene mapping.

Unit 4: Mutations (6)
Chromosomal Mutations: Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy; Gene mutations: Induced versus Spontaneous mutations

Unit 5: Sex Determination (4)
Chromosomal mechanisms and methods

ZOO 402 EVOLUTIONARY BIOLOGY

THEORY **(CREDITS 2)**

Unit 1: History of Life (2)
Major Events in History of Life

Unit 2: Introduction to Evolutionary Theories (4)
Lamarckism, Darwinism, Neo-Darwinism

Unit 3: Direct Evidences of Evolution (4)
Types of fossils, Incompleteness of fossil record, Dating of fossils, Phylogeny of horse

Unit 4: Processes of Evolutionary Change (8)
Organic variations; Isolating Mechanisms; Natural selection (Example: Industrial melanism); Types of natural selection (Directional, Stabilizing, Disruptive), Artificial selection

Unit 5: Species Concept (4)
Biological species concept (Advantages and Limitations); Modes of speciation (Allopatric, Sympatric)

Unit 6: Macro-evolution (4)
Macro-evolutionary Principles (example: Darwin's Finches)

Unit 7: Extinction (4)
Mass extinction (Causes, Names of five major extinctions, K-T extinction in detail), Role of extinction in evolution

ZOO 403 GENETICS AND EVOLUTIONARY BIOLOGY

PRACTICAL **(CREDITS 2)**

1. Study of Mendelian Inheritance and gene interactions (Non Mendelian Inheritance) using suitable examples. Verify the results using Chi-square test.
2. Study of Linkage, recombination, gene mapping using the data.
3. Study of Human Karyotypes (normal and abnormal).
4. Study of fossil evidences from plaster cast models and pictures
5. Study of homology and analogy from suitable specimens/ pictures
6. Study of Picture/Charts with reference to:
   a) Phylogeny of horse with diagrams/ cut outs of limbs and teeth of horse ancestors
   b) Darwin's Finches with diagrams/ cut outs of beaks of different species
7. Visit to Natural History Museum and submission of report

SUGGESTED READINGS

- Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). *Principles of Genetics*. VIII Edition. Wiley India.
- Snustad, D.P., Simmons, M.J. (2009). *Principles of Genetics*. V Edition. John Wiley and Sons Inc.
- Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). *Concepts of Genetics*. X Edition. Benjamin Cummings.
- Russell, P. J. (2009). *Genetics- A Molecular Approach.* III Edition. Benjamin Cummings.
- Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. *Introduction to Genetic Analysis*. IX Edition. W. H. Freeman and Co.
- Ridley, M. (2004). *Evolution*. III Edition. Blackwell Publishing
- Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007). *Evolution*. Cold Spring, Harbour Laboratory Press.
- Hall, B. K. and Hallgrimsson, B. (2008). *Evolution*. IV Edition. Jones and Bartlett Publishers
- Campbell, N. A. and Reece J. B. (2011). *Biology*. IX Edition, Pearson, Benjamin, Cummings.
- Douglas, J. Futuyma (1997). *Evolutionary Biology*. Sinauer Associates

Skill Enhancement Course II (Section II)

SEC II

Medical Diagnostics

THEORY **Credit 2**

Unit 1: **Introduction to Medical Diagnostics and its Importance** (2)

Unit 2: **Diagnostics Methods Used for Analysis of Blood** (10)

Blood composition, Preparation of blood smear and Differential Leucocyte Count (D.L.C) using Leishman's stain, Platelet count using haemocytometer, Erythrocyte Sedimentary Rate (E.S.R), Packed Cell Volume (P.C.V.)

Unit 3: **Diagnostic Methods Used for Urine Analysis** (6)

Urine Analysis: Physical characteristics, normal and abnormal constituents

Unit 4:**Non-infectious Diseases** (6)

Causes, types, symptoms, complications, diagnosis and prevention of Diabetes (Type I and Type II), Hypertension (Primary and secondary), Testing of blood glucose using Glucometer/ diagnostic kit

Unit 5: **Infectious Diseases** (3)

Causes, types, symptoms, diagnosis and prevention of Tuberculosis and Hepatitis

Unit 6: **Tumours** **(**3)

Types (Benign/Malignant), Detection and metastasis; Medical imaging: X-Ray of Bone fracture, PET, MRI and CT Scan (using photographs).

SUGGESTED READINGS

- Park, K. (2007), Preventive and Social Medicine, B.B. Publishers
- Godkar P.B. and Godkar D.P. Textbook of Medical Laboratory Technology
- Edition, Bhalani Publishing House Cheesbrough M., A Laboratory Manual for Rural Tropical Hospitals, A Basis for Training Courses
- Guyton A.C. and Hall J.E. Textbook of Medical Physiology, Saunders
- Robbins and Cortan, Pathologic Basis of Disease, VIIIEdition, Saunders
- Prakash, G. (2012), Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand and Co. Ltd.

FACULTY OF SCIENCE & TECHNOLOGY

KAVAYITRI BAHINABAI CHAUDHARI NORTH MAHARASHTRA UNIVERSITY, JALGAON

'A' Grade
NAAC Re-Accredited
(3rd Cycle)

SYLLABUS
FOR
F. Y. B. Sc. (PHYSICS)

(AS PER CHOICE BASED CREDIT SYSTEM PATTERN OF UGC)

(With effect from June - 2022)

Preamble

The University Grants Commission (UGC) has initiated several measures to bring equity, efficiency and excellence in the Higher Education System of country. The important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process and examination and evaluation systems.

In that context in the last decade, North Maharashtra University, Jalgaon has taken several initiatives to upgrade and enhance the academic excellence, examination reforms and developing the skilled minds and skilled hands. As per the directions of UGC, from last year our KBC North Maharashtra University, Jalgaon has implemented the Choice Based Credit (CBCS) pattern to undergraduate programs run by various colleges affiliated to NMU, Jalgaon. As per the directions given by the Honorable Vice Chancellor, Pro-Vice Chancellor and Dean of the Faculty of Science and Technology of our university, one day workshop was organized for syllabus framing. The teachers of the affiliated colleges and university department were participated in the workshop of re-structuring the syllabi of F. Y. B.Sc. (Physics) as per the CBCS pattern and it has been finalized during the workshop and the same will be effectively implemented from the academic year 2022-23.

The main objective of the re-structuring the syllabus of F. Y. B. Sc. (Physics) is to create skilled minds and therefore expectation is to equip the students with the knowledge and understanding of concepts of physics rather than the ability to remember facts so that they may have a reasonable comprehensive and complete grasp of principles of physics. It is expected that the students should study physics with keen interest, develop their experimental skill and problem solving ability. The students should communicate their knowledge of Physics to the Society, to make them to understand physics around us. The students should use their knowledge of Physics for betterment of our Society, our nation and the World.

Board of Studies (Physics),
North Maharashtra University, Jalgaon

OBJECTIVES

1. To provide education in physics of the highest quality at the undergraduate level and generate graduates of the caliber sought by industries and public service as well as academic teachers and researchers of the future.
2. To acquire deep knowledge in fundamental aspects of Physics and basic knowledge in the specialized thrust areas like Mechanics, Dynamics and Properties of Matter , Electricity, Electrostatics, Dielectrics, Magnetism, Electromagnetism and Mathematical physics.
3. To develop ability among the students to identify, remember and grasp the meaning of basic facts, concepts and principles of Physics.
4. To develop observational skills, confidence in using scientific equipment and relate the knowledge of scientific concepts to quantitative and physical measurement.
5. Acquire knowledge, skills, working methods and ways of expression which will reflect on all round development of the students' attitudes towards scientific thinking and its applications.
6. To develop attitudes such as concern for accuracy and precision, objectivity, and Enquiry.
7. The overall aim is to provide comprehensive knowledge and understanding in the relevant fields and enable students to pursue the physics subject at an advanced level later and to attract outstanding students from all back grounds.

BOS (PHYSICS)-Faculty of Science & Technology

Kavayitri Bahinabai Chaudhari
North Maharashtra University, Jalgaon

Class: **F. Y. B. Sc.** Subject: **Physics**

Choice Base Credit System (With effect from June 2022)

The Board of Studies in Physics has unanimously accepted the revised syllabus prepared by different committees, discussed and finalized in the **Workshop on Syllabus restructuring at F. Y. B. Sc. Physics (CBCS Pattern)** held on 11th April 2022.

The titles of the papers for F.Y.B.Sc. (Physics) are as given below:

Semester	Credits	Course code	Course Title	No. of Credits	Hours/ semester	Marks	
						Internal	External
I	Theory-04 Practicals-02	PHY 101	Basic Mechanics	02	30	40	60
		PHY 102	Dynamics and Properties of Matter	02	30	40	60
		PHY 103	LAB -I	02	60	40	60
II	Theory-04 Practicals-02	PHY 201	Electricity and Electrostatics	02	30	40	60
		PHY 202	Dielectrics, Magnetism and Electromagnetism	02	30	40	60
		PHY 203	LAB -II	02	60	40	60

Note: The industrial/study tour is compulsory for students of F. Y. B. Sc. (Physics).

Semester I
PHY 101: Basic Mechanics
(Credits: 02): (30 Lectures 60 Marks)

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Course description:

This course is aimed at introducing the concepts of Basic Mechanics to Under Graduate students.

Course objectives:

1. To impart knowledge of basic concepts in Basic Mechanics.
2. To provide the knowledge and methodology necessary for solving problems in Physics.
3. The course also involves the related experiments based on the theory.

Course outcome:

Learner will be able to ….

1. Apply the concept and knowledge of Basic Mechanics to understand and solve real life problems.
2. Understanding of the course will create scientific temperament.

……

Unit 1. Vectors

Vector algebra, Scalar and vector products (Dot, Cross, Scalar Triple Product, Vector Triple Product, Derivatives of a vector with respect to a parameter. **(04 Lectures, 12 Marks)**

Unit 2. Ordinary Differential Equations

Types of differential equations, degree and order of differential equation (definitions only), linear and non-linear differential equations (definitions only), homogeneous and non-homogeneous differential equations (definitions only), 1^{st} order homogeneous differential equations, 2^{nd} order homogeneous differential equations with constant coefficients (definitions with examples). **(08 Lectures, 16 Marks)**

Unit 3. Laws of Motion

Frames of reference, Newton's Laws of motion, Dynamics of a system of particles, Centre of Mass, Centre of mass of two particle system, Centre of mass of n-particle system, Centre of mass of a rigid body, Centre of mass of a circular ring. **(10 Lectures, 16 Marks)**

Unit 4. Momentum and Energy

Conservation of momentum, Work and energy, Conservation of energy, Motion of rockets.

(04 Lectures, 08 Marks)

Unit 5. Rotational Motion

Angular velocity and angular momentum, Torque, Conservation of angular momentum.

(04 Lectures, 08 Marks)

Reference Books:

1. University Physics. FW Sears, MW Zemansky and HD Young13/e, 1986. Addison-Wesley
2. Mechanics Berkeley Physics course, V-1: Charles Kittel, et. al. 2007, Tata McGraw-Hill.
3. Physics: Resnick, Halliday & Walker 9/e, 2010, Wiley
4. Engineering Mechanics, Basudeb Bhattacharya, 2nd edn., 2015, Oxford UniversityPress
5. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
6. New Simplified Physics : S. L. Arora, Dhanpat Rai and CO. (A reference book for class XI, Volume I)
7. Concept of Physics, H. C. Verma, Volume I.

Semester I
PHY 102: Dynamics and Properties of Matter
(Credits: 02): (30 Lectures 60 Marks)

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Course description:

This course is aimed at introducing the concepts of Dynamics and Properties of Matter to Under Graduate students.

Course objectives:

1. To impart knowledge of basic concepts in Dynamics and Properties of Matter.
2. To provide the knowledge and methodology necessary for solving problems in Physics.
3. The course also involves the related experiments based on the theory.

Course outcome:

Learner will be able to ….

1. Apply the concept and knowledge of Dynamics and Properties of Matter to understand and solve real life problems.
2. Understanding of the course will create scientific temperament.

……

Unit 1. Gravitation

Newton's Law of Gravitation, Central force, Motion of a particle in the central force field Kepler's Laws (Statement only), Conservation of angular momentum, Areal velocity is constant, Satellite in circular orbit, Geosynchronous orbit, Applications of satellites, Weightlessness, Basic idea of global positioning system(GPS). **(08 Lectures, 16 Marks)**

Unit 2. Surface Tension

Concept of surface tension, Examples of surface tension, surface tension, surface energy, Angle of contact, Wettability, Relation between surface tension, Excess pressure and Curvature, Factors affecting surface tension, surface tension of water by Jaeger's method, Applications of surface tension. **(07 Lectures, 14 Marks)**

Unit 3. Elasticity

Hooke's law, Stress-strain diagram, Elastic moduli, Relation between elastic constants (Y, k and η), Poisson's Ratio, Expression for Poisson's ratio in terms of elastic constants, Work done in stretching and work done in twisting a wire, Torsional pendulum, To determine Y, k,η and σ by Searle's method. **(07 Lectures, 14 Marks)**

Unit 4. Fluid Dynamics and Viscosity:

Introduction, General concept of fluid flow, Streamline and turbulent flow, Critical velocity, Different forms of energy possessed by liquids, Bernoulli's theorem, Applications of Bernoulli's theorem- Venturimeter and Pitot tube to find the rate of flow. Concept of viscosity, Definition,

Newton's law of viscosity, Velocity gradient, Rate of flow of liquid in a capillary tube-determination of coefficient of viscosity of a liquid by Poiseuille's formula, Viscosity of water by Poiseuille's method, Dependence of viscosity of a liquid on temperature.

(08 Lectures, 16 Marks)

Reference Books:

1. University Physics. FW Sears, MW Zemansky and HD Young13/e, 1986. Addison-Wesley
2. Mechanics Berkeley Physics course, V-1: Charles Kittel, et. al. 2007, Tata McGraw-Hill.
3. Physics: Resnick, Halliday & Walker 9/e, 2010, Wiley
4. Engineering Mechanics, Basudeb Bhattacharya, 2nd edn., 2015, Oxford UniversityPress
5. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
6. Elements of properties of matter- D. S. Mathur, Shamlal Charitable Trust, New Delhi
7. General Properties of Matter- J. C. Upadhyaya, Ramprasad and Sons, Agra
8. Mechanics- J. C. Upadhyaya, Ramprasad and Sons, Agra.
9. New Simplified Physics: S. L. Arora, Dhanpat Rai and CO. (A reference book for class XI, Volume II)
10. Concept of Physics, H. C. Verma, Volume I.

Semester I
PHY 103: LAB II
(Credits: 02): (60 Lectures 60 Marks)

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

1. To demonstrate their practical skills.
2. To understand and practice the skills while doing Physics practical.
3. To understand the use of apparatus and their use without fear.
4. To correlate Physics theory concepts through practical.
5. Understand the concepts of errors and their estimation.

……

(Students should perform at least ten experiments from the following list)

1. Calculation of errors from given data.
2. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.
3. Determine the acceleration due to gravity 'g' of an object falling freely using Kinematic equation
4. To determine 'g' by Bar Pendulum.
5. To determine 'g' by Kater's Pendulum.
6. To determine 'g' and velocity for a freely falling body using Digital Timing Technique
7. To determine the restoring force per unit extension of a spiral spring by statistical and dynamical methods and also determines the mass of the spring.
8. To study the Motion of a Spring and calculate (a) Spring Constant (b)Value of 'g'
9. To determine the Moment of Inertia of a Disc.
10. To determine Y by using flat spiral spring.
11. To determine Y of a rectangular beam by bending.
12. To determine η by using flat spiral spring.
13. To determine η by torsional oscillations.
14. To find the torsional rigidity (C) and torsion constant ($\alpha = C/$) of the given string using torsional pendulum.
15. To determine 'Y' by vibrational cantilever.

16. To determine the Young's Modulus of a Wire by Optical Lever Method.
17. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
18. To determine the Elastic Constants of a Wire by Searle's method.
19. To determine Poisson's Ratio of rubber by using rubber cord/tube.
20. To determine the Moment of Inertia of a Flywheel.
21. Determination of coefficient of viscosity of water by Poiseuille's method.
22. Verification of Bernoulli's theorem.
23. To determine surface tension by Jaeger's method.
24. To determine the angle of prism (A) using spectrometer.

Reference Books:

1. Advanced Practical Physics for students, B.L. Flint and H.T.Worsnop,1971,Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. Engineering Practical Physics, S. Panigrahi & B. Mallick,2015,Cengage Learning India Pvt. Ltd.
4. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011,KitabMahal, New Delhi.
5. A text Book of Experimental Physics-Dr. V.Y. Rajopadhye, V. L. Purohit and A .S. Deshpande (Continental Prakashan, Poona-30)
6. Practical Physics by R. K. Shukla, Anchal Srivastava (NewAge International).
7. Advance Practical Physics by S. P. Singh (Pragati).
8. Practical Physics: Gupta and Kumar (Pragati Prakashan Meerut)
9. University Practical Physics by D. C. Tayal, Himalaya Publishing House.

Semester II
PHY 201: Electricity and Electrostatics
(Credits: 02): (30 Lectures 60 Marks)

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Course description:

This course is aimed at introducing the concepts of Electricity and Electrostatics to Under Graduate students.

Course objectives:

1. To impart knowledge of basic concepts in Electricity and Electrostatics.
2. To provide the knowledge and methodology necessary for solving problems in Physics.
3. The course also involves the related experiments based on the theory.

Course outcome:

Learner will be able to ….

1. Apply the concept and knowledge of Electricity and Electrostatics to understand and solve real life problems.
2. Understanding of the course will create scientific temperament.

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Unit 1. Network theorems in current electricity

Kirchhoff's laws and loop analysis by Kirchhoff's laws, Network theorems: Thevenin's theorem and Norton's theorem with illustrations, Maximum power transfer theorem (D. C. Source only), Electric power, Electricity bill calculation, Joule's law. **(10 Lectures, 20 Marks)**

Unit 2. Vector Analysis

Gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume, integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors (statement only). Six vector identities without proof:

(a) $\nabla \times \nabla\phi = 0$ (b) $\nabla \cdot (\nabla \times \mathbf{A}) = 0$ (c) $\nabla \cdot (\phi \mathbf{A}) = \phi (\nabla \cdot \mathbf{A}) + \mathbf{A} \cdot (\nabla \phi)$

(d) $\nabla \times (\phi \mathbf{A}) = \phi (\nabla \times \mathbf{A}) + (\nabla \phi) \times \mathbf{A}$ (e) $\nabla \cdot (\mathbf{A} \times \mathbf{B}) = \mathbf{B} \cdot (\nabla \times \mathbf{A}) - \mathbf{A} \cdot (\nabla \times \mathbf{B})$

(f) $\nabla \times (\nabla \times \mathbf{A}) = \nabla (\nabla \cdot \mathbf{A}) - \nabla^2 A$ **(05 Lectures, 10 Marks)**

Unit 3. Basics of Electrostatics

Coulomb's Law**,** Coulomb's Law in vector form, Principal of superposition: Force calculation for three charges and n-charges, Distribution of charges: discrete and continuous charge distribution, Concept of charge density: Linear, surface and volume, Coulomb's Law for continuous charge distribution. Electrostatic Field, electric flux, Electric field due to system of point charges (use of principal of superposition for three charge system and n-charge system), Electric potential, Electric potential as line integral of electric field, potential due to a point charge. **(08 Lectures, 16 Marks)**

Unit 4. Gauss's theorem and electric dipole

Gauss's theorem of electrostatics, Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential. **(07 Lectures, 14 Marks)**

Reference Books

1. Mathematical Physics: B.S. Rajput, Pragati Prakashan (19th Edition, 2007).
2. Principles of electronics: V. K. Mehta
3. Basic Electronics: B. L. Thereja
4. Fundamentals of Physics: Robert, Resnick, David Halliday & Jearl Walker, [8th ed]
5. Electricity and Magnetism: D. C. Tayal, 1988, Himalaya Publishing House.
6. Engineering Physics: R.K Gaur and S.L.Gupta,
7. Basic Electrical engineering , B. H. Deshmukh, Nirali Prakashan, Dhanpat Rai and Sons, New Delhi.
8. Electromagnetics: B. B. Laud, New York ; Toronto : Wiley
9. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.
10. Electricity and Magnetism, J.H. Fewkes& J. Yarwood. Vol. I, 1991, Oxford Univ.Press.
11. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.11
12. Introduction to Electrodynamics, 3rd Edn,D.J. Griffiths, 1998, Benjamin Cummings.
13. Electrodynamics- D. J. Griffiths.
14. New Simplified Physics : S. L. Arora, Dhanpat Rai and CO. (A reference book for class XII, Volume I)
15. Concept of Physics, H. C. Verma, Volume 2.

Semester II
PHY 202: Dielectrics, Magnetism and Electromagnetism
(Credits: 02): (30 Lectures 60 Marks)

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Course description:

This course is aimed at introducing the concepts of Dielectrics, Magnetism and Electromagnetism to Under Graduate students.

Course objectives:

1. To impart knowledge of basic concepts in Dielectrics, Magnetism and Electromagnetism.
2. To provide the knowledge and methodology necessary for solving problems in Physics.
3. The course also involves the related experiments based on the theory.

Course outcome:

Learner will be able to ….

1. Apply the concept and knowledge of Dielectrics, Magnetism and Electromagnetism to understand and solve real life problems.
2. Understanding of the course will create scientific temperament.

……

Unit 1. Capacitance and dielectrics

Introduction, Calculation of effective/equivalent capacitance for series and parallel combination, Parallel plate capacitor with and without dielectric, Cylindrical capacitor and Spherical capacitor, Energy per unit volume in electrostatic field, Dielectric constant, Electric polarization, Gauss's law in dielectrics, Three electric vectors $\overline{E}, \overline{D}, \overline{P}$ and the relation between them, Introduction to super capacitors and its applications. **(10 Lectures, 20 Marks)**

Unit 2. Magnetism

Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility, Brief introduction of diamagnetic, paramagnetic and ferromagnetic materials. Hard and Soft magnetic materials, Introduction to Magnetostatics: Biot-Savart's law and its applications-straight conductor, circular coil, solenoid carrying current, Divergence and curl of magnetic field, Magnetic vector potential, Ampere's circuital law (statement only).

(08 Lectures, 16 Marks)

Unit 3. Electromagnetic induction:

Faraday's laws of electromagnetic induction, Lenz's law, self inductance and mutual inductance, L of single coil, M of two coils, Reciprocity theorem of mutual induction, Energy stored in a magnetic field. **(05 Lectures, 10 Marks)**

Unit 4. Maxwell`s equations and Electromagnetic wave propagation

Equation of continuity of current, Displacement current, Maxwell's equations, Poynting vector for plane wave, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves, polarization. **(07 Lectures, 14 Marks)**

Reference Books:

1. Electromagnetics, 2nd Edition, B.B. Laud, Wiley Eastern Limited
2. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.
3. Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ.Press.
4. Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
5. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.11
6. Introduction to Electrodynamics, 3rd Edn,D.J. Griffiths, 1998, Benjamin Cummings.
7. Electrodynamics- D. J. Griffiths.
8. Electrodynamics, Kumar, Gupta and Singh
9. New simplified Physics, S. L. Arora, Dhanpat Rai and Co., (A reference book for class XII, Volume I)
10. Concept of Physics, H. C. Verma, Volume 2.

Semester II
PHY 203: LAB II
(Credits: 02): (60 Lectures 60 Marks)

……

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

6. To demonstrate their practical skills.
7. To understand and practice the skills while doing Physics practical.
8. To understand the use of apparatus and their use without fear.
9. To correlate Physics theory concepts through practical.
10. Understand the concepts of errors and their estimation.

……

(Students should perform at least ten experiments from the following list)

1. Study of Analog /Digital Voltmeter, Ammeter (AC, DC, ranges and least count)
2. To use a Multimeter for measuring:
    i) Resistances,
    ii) A.C. and D .C. Voltages,
    iii) D.C. Current (in a simple circuit)
    iv) Checking electrical fuses.
3. Verification of Kirchhoff's laws.
4. To verify Thevenin's theorem
5. To verify Norton's theorem
6. To verify Maximum Power Transfer Theorem. (Note : Use personal computer/laptop for graph plotting is necessary.)
7. To verify Joule's law.
8. To find electrical energy consumed in a circuit using Joule's law.
9. To determine time constant of R-C circuit using charging and discharging of condenser through resistor.
10. To compare capacitances using De'Sauty's bridge.
11. Determination of time constant of L-R circuit.
12. Ballistic Galvanometer:
    i) Measurement of charge and current sensitivity

ii) Measurement of CDR

13. Determine a high resistance by Leakage Method.
14. To determine Self-Inductance of a Coil by Rayleigh's Method.
15. Measurement of field strength Band its variation in a Solenoid (Determine dB/dx).
16. To study the Characteristics of a Series RC Circuit.
17. Verification of laws of capacitances.
18. To determine a Low Resistance by Carey Foster's Bridge.
19. Electric billing with energy meter.
20. Frequency of a. c. using vibrating wire and magnet.
21. Study of transformer.
22. To determine efficiency and turns ratio of transformer.
23. To determine unknown wavelength using spectrometer.

Reference Books

1. Advanced Practical Physics for students, B. L. Flint & H.T.Worsnop,1971, Asia Publishing House.
2. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
3. Engineering Practical Physics, S. Panigrahi and B. Mallick, 2015,Cengage Learning India Pvt. Ltd.
4. Advanced level Physics Practicals, Michael Nelson and Jon M.O gborn,4 th Edition, reprinted 1985, Heinemann Educational Publishers.
5. Practical Course in Electronics by Prof. J. R. Patil and other (Jaydeep Prakashan).
6. Advance Practical Physics by S. P. Singh (Pragati).
7. Practical Physics: Gupta and Kumar (Pragati Prakashan Meerut).
8. University Practical Physics by D. C. Tayal (Himalaya Publishing House).

CAREER OPPORTUNITIES FOR B. Sc. PHYSICS STUDENTS

B.Sc. Physics students can find jobs in public as well as in private sectors. There are many opportunities available for B. Sc Physics students in technical as well as scientific fields. They can work as Science and Mathematics Teachers, Quality Control Manager, Laboratory assistant, Laboratory Technician, School Science Technician in any government or private organization.

Private Sector:

There are many opportunities available in IT field for B. Sc (Physics) graduates. Many IT companies such as Infosys, Wipro and TCS are recruiting B. Sc. Physics graduates for software jobs. They can also get jobs in Energy Plants. Another jobs available for these graduates is Technician in Electronic Industry. They can apply for jobs in many companies in automobile industry. Some of those companies are Maruti Udyog, TATA Motors and Tech Mahindra. The B. Sc. (Physics) graduates can apply and secure their job in Solar devices production industries, electrical or electronic industries with their skills developed while studying. B.Sc. Physics graduates can get opportunities in Fibers Optics industries, Glass or Lens making industries etc.

Government Sector:

There are vast opportunities available for B. Sc graduates in Government sector. They can apply for jobs in Scientific Research and Development Organizations such as The Defense Research and Development Organization (DRDO), CSIR, Physical Research Laboratory (PRL) Ahmedabad, Saha Institute of Nuclear Physics Kolkata and Nuclear Science Centre New Delhi. They can also apply for various jobs in popular government organizations such as Bhabha Atomic Research Centre (BARC), Atomic Energy Regulatory Board (AERB), Oil and Natural Gas Corporation (ONGC), Bharat Heavy Electricals Limited (BHEL), National Thermal Power Corporation (NTPC).

They can also apply for the various competitive exams conducted by Union Public Service Commission such as IFS, IPS and IAS. Several other government exams conducted for recruiting B. Sc Physics graduates are Tax Assistant Exam, Statistical Investigator Exam, Combined Graduate Level Exam.

Another option available for B. Sc Physics graduate is to apply for jobs in public sector banking. Several banks are conducting exam every year for recruiting graduates to the post of Probationary Officers. They can also find many jobs in Railway sector. They should qualify the exams conducted by Railway Recruitment Board to get a job in Railway sector. These graduates can also apply for Combined Defense Services Exams conducted for recruiting candidates to various posts in Defense Department.

Equivalence Courses

Semester	Course code	Course Title	No. of Credits	Hours/ semester	Marks		OLD Syllabus code
					Internal	External	
I	PHY 101	Basic Mechanics	02	30	40	60	PHY 101
	PHY 102	Dynamics and Properties of Matter	02	30	40	60	PHY 102
	PHY 103	LAB -I	02	30	40	60	PHY 103
II	PHY 201	Electricity and Electrostatics	02	30	40	60	PHY 201
	PHY 202	Dielectrics Magnetism and Electromagnetism	02	30	40	60	PHY 202
	PHY 203	LAB -II	02	30	40	60	PHY 203

Faculty of Science and Technology

KBC North Maharashtra University, Jalgaon

'A' Grade
NAAC Re-Accredited
(3rd Cycle)

Syllabus

For

F. Y. B.Sc. (Electronics)

(*As per Choice Based Credit System*)

(With effect from July - 2022)

Preamble

The University Grants Commission (UGC) has initiated several measures to bring distinction, quality and uniformity in the Higher Education System of the country. The important measures taken to enhance academic standards include enhancements in curriculum, teaching-learning process and examination and evaluation systems. In view of this, KBC North Maharashtra University, Jalgaon has taken several initiatives to upgrade and improve the academic excellence, examination reforms for overall development of the students. As per the expectations of UGC, KBC North Maharashtra University, Jalgaon is going to implement the Choice Based Credit (CBCS) pattern to undergraduate program. As per the initiatives led by the Honorable Vice Chancellor, Pro-Vice Chancellor and Dean of the Faculty of Science and Technology and academic bodies of our university, one day workshop was organized for syllabus framing. Participants in the workshop cooperated with their constructive minds of re-structuring the syllabi of F.Y.B.Sc. (Electronics) as per the CBCS pattern and it has been finalized during the workshop and the same will be effectively implemented from the academic year 2022-23. The main objective of reforming the syllabi of F.Y.B.Sc. (Electronics) is to create man power that can cater the present needs of the society with perfect understanding of Electronics and complete skill to serve the industry and country. It is expected that the students studying Electronics will apply their practical minds to solve real life problems of the society and the world in future by becoming entrepreneur to serve the mankind.

Board of Studies (Electronics and Instrumentation),
KBC North Maharashtra University, Jalgaon

Objectives:

1. To prepare students as a successful person in a life which cater needs of the society and serve country.
2. To prepare the students for successful career in industry and motivate them for higher education.
3. To provide strong platform for analyzing electrical and electronics problems.
4. To provide knowledge on basic electronics to Digital electronics and Integrated circuit chips and their applications for the society.
5. To provide necessary foundation on computational platforms and software simulation tools.
6. To develop observational skills, confidence in using electronics equipment and relate the knowledge of practical concepts for the development of the society.
7. To provide comprehensive knowledge and understanding in the relevant fields and enable students to pursue the Electronics subject at an advanced level later and to attract outstanding students from all backgrounds.

KBC North Maharashtra University, Jalgaon

Class: **F. Y. B. Sc.**

Subject: **Electronics**

Choice Base Credit System (With effect from July 2022)

The Board of Studies in Electronics in its meeting has unanimously accepted the revised syllabus (as per CBCS pattern) prepared by different committees, discussed and finalized in workshop for F.Y.B.Sc. Syllabi revision. The titles of the papers for F.Y.B.Sc. (Electronics) are as given below:

Semester	Course as per UGC Guidelines	Core Course		No. of Credits	Clock Hour/ Semester	Marks	
		Course Code	Course Title			Int.	Ext.
I	**Electronics-DSC 1A:** Network Analysis and Basics of Digital Electronics (Credits: Theory-04, Practicals-02) ELECTRONICS LAB	ELE-101	Circuit Components and Network Analysis	2	30	40	60
		ELE-102	Basics of Digital Electronics	2	30	40	60
		ELE-103	ELECTRONICS LAB -I	2	60	40	60
II	**Electronics-DSC 1B:** Analog Electronics and Digital Circuits (Credits: Theory-04, Practicals-02) ELECTRONICS LAB	Course Code	Course Title	No. of Credits	Clock Hour/ Semester	Marks	
						Int.	Int.
		ELE-201	Analog Electronics	2	30	40	60
		ELE-202	Digital Circuits	2	30	40	60
		ELE-203	ELECTRONICS LAB -II	2	60	40	60

KBC North Maharashtra University, Jalgaon

Syllabus of F. Y. B. Sc. Electronics

(Choice Based Credit System)

Semester I

ELECTRONICS-DSC 1 A: Network Analysis and Basics of Digital Electronics

Theory: 60 clock hours

(Credits: Theory-04, Practicals-02)

Course description:

This course is aimed at introducing the fundamentals of Electronics, Network Theorems Electronic Devices to Under Graduate students and provide them practical exposure.

Course objectives:

1. To impart knowledge of basic concepts in Electronics.
2. To provide the knowledge and methodology necessary for building electronics circuits.
3. To provide exposure of linear and digital electronics circuits.
4. To have practical exposure of electronic circuits.
5. To predict the behaviour and characteristics of electronics devices and circuits using simulation tools.

Course outcome:

Learner will be able to ….

1. Apply knowledge to develop circuits using electronic devices.
2. Apply the concept and knowledge of electronics devices to real life problems.
3. Simulate complex circuits and understand the behaviour of the systems.
4. Understand and analyse, linear and digital electronic circuits.
5. Review, prepare and present technological developments.

F.Y.B.Sc. (Electronics) Sem-I Paper-I (Credit:02)

ELE-101: Circuit Components and Network Analysis (30 clock hour)

Course Content

Unit 1: Basic Circuit Components

Resistors: Introduction of resistor, Resistive circuits: Series circuit, characteristics of series circuit, series voltage divider, open and short in series circuit, Parallel circuit, laws of parallel circuit, open and short in parallel circuit, series-parallel circuits

Inductors: Self and mutual inductance, Inductance in series and parallel

Capacitors: Principles of capacitance, capacitors in series and parallel

Transformers –Step-up and Step-down Transformers, Turn-Ratio, Voltage and Current Ratio. Types of Transformer (introduction only)

Relays and Switches- Electromagnetic Relay, Relay as Switch, Concept of Pole and Throw, Types of Switches – SPST, SPDT, DPST and DPDT. **(8 hour, 16 Marks)**

Unit 2: Circuit Analysis

Concept of Voltage and Current Sources. Kirchhoff's Current Law, Kirchhoff's Voltage Law. Mesh Analysis. Node Analysis. Star and Delta networks, Star-Delta Conversion. Problems based on KCL, KVL and Problem on Star-Delta conversion. **(7 hour, 14 Marks)**

Unit 3: Network Theorems

Principal of Duality. Superposition Theorem. Thevenin's Theorem. Norton's Theorem. Reciprocity Theorem. Maximum Power Transfer Theorem. Problems based on these theorems. **(7 Hour 14 Marks)**

Unit 4: AC Fundamentals

Types of Alternating Waveforms, Basic AC Generator, Definitions of Cycle, Time Period, Frequency and Amplitude, Characteristics of a Sine Wave, Audio and Radio Frequencies, Different Values of Sinusoidal Voltage and Current, Phase of an AC ,Phase Difference, Vector Representation of an Alternating Quantity, AC through pure resistance , inductance and capacitance. Concept of Reactance and Impedance, RL, RC and RLC circuits, Passive RC filters (Low pass, high pass and band pass filters). Series and parallel resonance **(8 hour, 16 Marks)**

Reference Books:

- Electric Circuits, S. A. Nasar, Schaum's outline series, Tata McGraw Hill (2004)
- Electrical Circuits, M. Nahvi and J. Edminister, Schaum's Outline Series, Tata McGraw-Hill (2005)
- Electrical Circuits, K.A. Smith and R.E. Alley (2014) Cambridge University Press
- Network, Lines and Fields, J.D.Ryder, Prentice Hall of India.
- Electrical Circuit Analysis, Mahadevan and Chitra, PHI Learning.
- Alternating Current Fundamentals, Stephen Herman et.al.

F.Y.B.Sc.(Electronics) Sem-I Paper-II (Credit:02)

ELE-102: Basics of Digital Electronics (30 clock hour)

Course Content

Unit 1: Number System and Codes: Introduction, Concept of Radix, Number Systems: Decimal Number System, Binary Number System, Octal Number System, Hexadecimal Number System, Base conversion
Codes: BCD Code, Excess-3 Code, ASCII code. **(8 hour, 16 Marks)**

Unit 2: Logic Gates: Concept of Positive and Negative Logic, Basic Gates (Symbol and Truth table): OR Gate, AND Gate, NOT Gate, Derived Gates: NAND gate, NOR Gates, EX-OR Gate, EX-NOR Gate, NAND and NOR as Universal Logic Gates
Applications of XOR gate: Controlled inverter, Parity Tester **(6 hour, 12 Marks)**

Unit 3: Binary Arithmetic and Boolean algebra
Binary Arithmetic: Addition and Subtraction, 1's Complement, 2's Complement of binary number, Binary Subtraction**:** Using 1's Compliment & 2's Complement, Half adder and Full Adder, Basic Laws of Boolean Algebra, De Morgan's Theorems, Simplifications of Boolean expression (Numerical) **(8 hour, 16 Marks)**

Unit 4: Combinational logic Circuits: Introduction, Standard representation of Canonical forms: Sum of Product (SOP), Product of Sum (POS), Minterms and Maxterms, Conversion between SOP and POS
Karnaugh Map (K Map) Simplification: K map structure, Plotting K map, Representation of Boolean expression using K map (Grouping-Pair, Quad and Octet, overlapping and rolling), Don't care condition, Minimization of SOP expression (Up to 4 variables)
Numerical based on above topics **(8 hour, 16 Marks)**

Reference Books:

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- Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, 7th Ed., (2011)
- Tata McGraw Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, (2009) PHI Learning Pvt. Ltd.
- Digital Circuits and systems, Venugopal, (2011) Tata McGraw Hill.
- Digital Fundamentals, Thomas L. Flyod, , Pearson Education Asia (1994)
- Digital Principles, R. L. Tokheim, Schaum's Outline Series, Tata McGraw- Hill (1994)

ELECTRONICS LAB: DSC 1A LAB: Network Analysis and Basics of Digital Electronics Lab (60 clock hour)

ELE-103: ELECTRONICS LAB-I

(**Section A experiments are compulsory,** and students should perform at least **04** experiments from each **Section B & C** means total **10** experiments.)

Course Objectives:

Students are expected to:

1. Familiarize with basic electronics components, testing and measuring instruments.
2. Understand the practical use of various networks theorems
3. Study the electronics circuits analysis and verification of the circuits
4. Have the knowledge of passive filters and skill to build and test the circuits
5. Familiarize with logic gate ICs and have the knowledge of truth tables of logic gates.
6. Study various digital combinational circuits.

Section A: Circuit Components and Network Analysis	
1.	To familiarize with basic electronic components (Switch, fuse, Batteries, R, C, L, transformer, Relays, diodes, LED, transistors etc.), digital Multimeter, Function Generator and Oscilloscope.
2.	Measurement of AC (Amplitude, Frequency and Phase Difference) and DC (Voltage) signal parameters using Oscilloscope
Section B: Network Analysis and Semiconductor diode	
1.	Verification of Thevenin's theorem.
2.	Verification of Norton's theorem
3.	Verification of Superposition Theorem
4.	Verification of Reciprocity Theorem.
5.	Verification of the Maximum Power Transfer Theorem
6.	To study the properties of delta-star connection
7.	To study the characteristics of sine wave
8.	To study of passive low pass filter
9.	To study of passive high pass filter
10.	To study of passive band pass filter
11.	To study the series resonance circuit
12.	To study the series RL Circuit
13.	To study the series RLC Circuit
14.	To study the Parallel RLC Circuit

Section C: Basics of Digital Electronics	
1.	Verification of truth table of logic gates OR, AND, NOT, NOR, NAND, XOR using ICS
2.	(a) Verification of Universal gates (NAND) (b) Verification of Universal gates (NOR)
3.	Verification of D-Morgan's Theorem
4.	(a) To design a combinational logic system for a specified Truth Table. (b) To convert Boolean expression into logic circuit and design it using logic gate ICs. (c) To minimize a given logic circuit
5.	Study of Half Adder and Full Adder
6.	Study of Full Subtractor

Reference Books:

- Electrical Circuits, M. Nahvi and J. Edminister, Schaum's Outline Series, Tata McGraw-Hill (2005)
- Networks, Lines and Fields, J.D.Ryder, Prentice Hall of India.
- J. Millman and C. C. Halkias, Integrated Electronics, Tata McGraw Hill (2001)
- Allen Mottershead, Electronic Devices and Circuits, Goodyear Publishing Corporation.
- Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, 7th Ed., (2011) Tata McGraw
- R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill (1994)
- Digital Electronics, S.K. Mandal (2010) 1st edition, McGraw Hill

Course Outcomes (COts):

	Course Outcomes	Cognitive level
	Handle various electronics devices	L2
	Build and test electronic circuits	L2
	Verify various network theorems	L2, L3
	Handle digital ICs and circuits	L2

Semester II

ELECTRONICS-DSC 1 B: Analog Electronics and Digital Circuits

Theory: 60 clock hours

(Credits: Theory-04, Practicals-02)

Course description:

This course is aimed at introducing the concepts of integrated circuits including linear and digital chips to Under Graduate students and provide hands on training of handling integrated circuit chips.

Course objectives:

1. To impart knowledge of electronics devices and digital integrated circuits.
2. To provide the knowledge and methodology necessary for using digital integrated circuit chips.
3. To have practical exposure of handling Electronics devices and IC chips.

Course outcome:

Learner will be able to ….

1. Apply the concept and knowledge of digital integrated circuit chips to develop new systems.
2. Apply practical knowledge to solve real life problems of the society.
3. Understand of the course and create scientific temperament and give exposure to the students for independent use of digital integrated circuit chips for innovative applications.
4. Model complex circuits and simulate them.
5. Handle simulation software to analyse analog and digital electronics circuits.

F.Y.B.Sc.(Electronics) Sem-II Paper-I (Credit:02)

ELE-201: Analog Electronics (30 clock hour)

Course Content

Unit 1: Junction Diode

PN junction diode –formation/construction, Formation of Depletion Layer, forward and reverse biasing, Diode Equation and I-V characteristics. Idea of static and dynamic resistance, Zener diode- I-V characteristics, Zener and avalanche breakdown, Reverse saturation current. **(8 hour, 15 Marks)**

Unit 2: Applications of Junction Diodes

Rectifiers- Half wave rectifier, Full wave rectifiers (center tapped and bridge), circuit diagrams, working and waveforms, PIV, ripple factor and efficiency (Derivation not expected). Comparison of rectifiers, Filter-Shunt capacitor filter, its role in power supply, output waveform, and working. Zener diode as a voltage regulator, Problems on Zener regulator **(8 hour, 15 Marks)**

Unit III: Bipolar Junction Transistor

Construction and operation of BJT (NPN and PNP), CB, CE and CC configuration, characteristics of transistor in CE and CB configurations, h parameter definitions for CE, Regions of operation (active, cut off and saturation), Current gains α and β, Relations between α and β, Need of dc biasing, Biasing methods, dc load line and Q point.

(8 hour, 15 Marks)

Unit 4: Unipolar Devices

JFET. Construction, working and I-V characteristics (output and transfer), Pinch off voltage. JFET as an amplifier, Concept of MOSFET, UJT, basic construction, working, equivalent circuit and I-V characteristics. UJT as a relaxation oscillator. **(6 hour, 15 Marks)**

Reference Books:

- Electronic Devices and Circuits, David A. Bell, 5th Edition (2015), Oxford University Press.
- Electronic Circuits: Discrete and Integrated, D.L. Schilling et. al. , Tata McGraw Hill
- Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, (2014), 6th Edn., Oxford University Press.
- J. Millman and C. C. Halkias, Integrated Electronics, Tata McGraw Hill (2001)
- J. J. Cathey, 2000 Solved Problems in Electronics, Schaum's outline Series, Tata McGraw Hill (1991)
- Basic Electronics, Bernod Grob, McGra-Hill, India.

- Applied Electronics, R. S. Sedha; S. Chand and Company, New Delhi.

F.Y.B.Sc.(Electronics) Sem-II Paper-II (Credit:02)

ELE-202: Digital Circuits (30 clock hour)

Course Content

Unit 1: Data Processing circuits

Idea of Multiplexing and DeMultiplexing, Multiplexer: 2 to 1, 4 to 1, DeMultiplexer: 1 of 2, 1 of 4, IC's of Multiplexer and Demultiplexer, Decoder: BCD to decimal decoder, Encoder: Decimal to BCD encoder using OR-gates. **(6 hour, 12 Marks)**

Unit 2: Flip-Flops

Introduction to sequential logic circuit, Comparison of Combinational and Sequential logic circuits, 1-bit memory cell, RS-FF using NAND and NOR gates, Clocked RS - FF, D- FF, JK - FF, Level and Edge triggered FF, PRESET and CLR, Race around condition, Master Slave J-K FF, T-FF, Difference between latch and flip flop **(8 Hours, 16 marks)**

Unit 3: Shift Register

Introduction to Shift Register, Classification of Register and Types of Registers: Serial in Serial out (SISO), Serial in Parallel out (SIPO), Parallel in Serial out (PISO), Parallel in Parallel out (PIPO), Universal shift register, Applications of Shift Register, Ring counter.

(6 Hours, 12 marks)

Unit 4: Counters

Concept of counter, Asynchronous counter (3-bit), Decade counter, Synchronous counter (3-bit), Comparison between Synchronous and Asynchronous counter, Down counter, Up-Down counter. **(5 Hours, 10 marks)**

Unit-5: Data Converters

Introduction, Need of ADC and DAC, Types of converters, Digital to analog converters (DAC): weighted resistor type and R-2R ladder type converter. Drawbacks of weighted resistor type DAC, Binary or R-2R type D to A convertor, Analog to Digital Converter: Simultaneous or Parallel ADC, Successive approximation type ADC. **(5 Hours, 10 marks)**

Reference Books:

- Digital principles and applications - A. P. Malvino & D. P. Leach
- Modem digital electronics - R. P. Jain
- Digital Electronics - William Gothman
- Digital fundamentals (3rd Edition)- Thomas Floyd

- Digital Systems: Principles and Applications, R.J.Tocci, N.S.Widmer, (2001) PHI Learning.

F.Y.B.Sc.(Electronics) Sem-II Paper-III (Credit:02)

ELECTRONICS LAB- DSC 1B LAB: Analog Electronics and Digital Circuits Lab

ELE-203: ELECTRONICS LAB-2 (60 clock hour)

(Students should perform at least any **05** experiments from each **Section A and B** means total **10** experiments.)

Course Objectives: **Students are expected to:** 1. Familiarize with various Semiconductor devices. 2. To understand the behavior of semiconductor devices. 3. Understand the practical use of various semiconductor devices. 4. Familiarize with combinational and sequential circuit ICs. 5. Design of various combinational and sequential circuits. **6.** Study various data processing circuits.	
Section A: Analog Electronics	
1.	Study of the I-V Characteristics of (a) p-n junction Diode, and (b) Zener diode.
2.	Study of (a) Half wave rectifier (b) Centre-taped Full wave rectifier and (c) Bridge Full wave rectifier.
3.	To study Zener diode as a voltage regulator on the output of FWR.
4.	Study of the I-V Characteristics of BJT in CE configuration.
5.	Study of the I-V Characteristics of UJT.
6.	To design and Study of the UJT relaxation oscillator
7.	Study of the output characteristics of common source JFET.
8.	To study Transistor as a switch (LED ON/OFF)
Section B: Digital Circuits	
1.	Study of clocked R-S / D-type flip flop using logic gates.
2.	Study of JK / T- flip flop using logic gates/ICs.
3.	Study of 4:1 line multiplexer and 1:4 line demultiplexer.

4.	Study of decade counter using IC7490.
5.	Study of Up-down- counter using IC74191.
6.	Study of shift register using IC 7495.
7.	Study of DAC using R-2R ladder.
8.	To study BCD to Seven Segment Decoder using IC-7447/7448

Reference Books:

- Electronic Devices and Circuits, David A. Bell, 5th Edition (2015), Oxford University Press.
- Basic Electronics, Bernod Grob, McGra-Hill, India.
- Applied Electronics, R. S. Sedha, S. Chand and Company, New Delhi.
- Electrical Circuits, M. Nahvi and J. Edminister, Schaum's Outline Series, Tata McGraw-Hill (2005).
- Solid State Electronic Devices, Ben G Streetman and S. Banerjee, Pearson Education
- Integrated Electronics, J. Millman and C. C. Halkias, Tata McGraw Hill (2001).
- Electronic Devices and Circuits, Allen Mottershead, Goodyear Publishing Corporation.
- Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, 7th Ed., (2011) Tata McGraw
- Digital Principles, R. L. Tokheim, Schaum's Outline Series, Tata McGraw- Hill (1994)
- Digital Electronics, S.K. Mandal (2010) 1st edition, McGraw Hill
- Digital System Design, M. Morris Mano, Pearson Education Asia,(Fourth Edition)

Course Outcomes (COts):

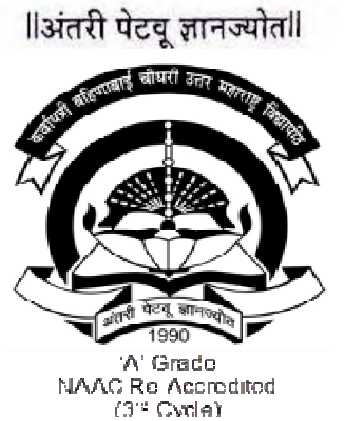
	Course Outcomes	Cognitive level
	Handle various semiconductor devices	L2
	Test basic electronic circuits	L2
	Understand the behavior and applications of semiconductor devices	L2, L3
	Handle digital ICs and circuits	L2

Equivalent Courses with Credits

Semester	Core Course		No of Credits	Clock Hours/ Semester	Marks		Old Syllabus Code
	Course Code	Course Title			Int.	Ext.	
I	ELE-101	Circuit Components and Network Analysis	2	30	40	60	ELE 101: Network Analysis and Semiconductor Diodes
	ELE-102	Basics of Digital Electronics	2	30	40	60	ELE 102: Digital Integrated Circuits
	ELE-103	ELECTRONICS LAB -I	2	60	40	60	ELE-103: Electronics Lab I
II	Course Code	Course Title	No of Credits	Clock Hours/ Semester	Marks		Old Syllabus Code
					Int.	Int.	
	ELE-201	Analog Electronics	2	30	40	60	ELE 201: Analog Electronics
	ELE-202	Digital Circuits	2	30	40	60	ELE – 202 – Linear Integrated Circuits
	ELE-203	ELECTRONICS LAB -II	2	60	40	60	ELE-103: Electronics Lab II

KAVAYITRI BAHINABAI CHAUDHARI

NORTH MAHARASHTRA UNIVERSITY JALGAON



SYLLABUS of

F.Y. B. Sc. (MATHEMATICS)

(Semester System 60+40 Pattern)

UNDER CHOICE BASED CREDIT SYSTEM (CBCS)

Effective from June 2022

Scheme for B. Sc. (Mathematics) under Choice Based Credit System pattern with

F.Y. B. Sc. Syllabus

Effective from June 2022

Sem.	Course	Paper	Course Code with Title	Credit	No. Periods in Hour /week	No. Periods of 45 min.
I	MTHCC- A	Paper - 1	MTH 101: Matrix Algebra	2	2	3
		Paper - 2	MTH 102: Calculus of Single Variable	2	2	3
		Paper - 3	MTH 103 (A): Co-ordinate Geometry **or** MTH 103 (B): Discrete Mathematics	2	2	3
II	MTHCC- B	Paper-1	MTH 201: Ordinary Differential Equations	2	2	3
		Paper- 2	MTH 202: Theory of Equations	2	2	3
		Paper - 3	MTH 203 (A): Laplace Transforms **or** MTH 203 (B): Numerical Methods	2	2	3

SEMESTER - I

MTHCC- A
MTH 101: Matrix Algebra

Course Description:

This course provides an elementary level knowledge of Rank and adjoint of matrix, Applications of matrices to system of linear equations, Eigen values and Eigen vectors of matrices and also the transformation of matrices.

Prerequisite Course(s): 11 and 12 standard Mathematics.

General Objective:

A primary need for the establishment of this course is to understand the basic knowledge and applications of matrices in various fields. So, the main objective is to teach mathematical approaches and models to grow mathematical skill, to improve mathematical thinking and to improve choice making power of the students.

Learning Outcomes:

Upon successful completion of this course the student will be able to:

a) understand concepts on matrix operations and rank of the matrix.
b) understand use of matrix for solving the system of linear equations.
c) understand basic knowledge of the eigen values and eigen vectors.
d) apply Cayley-Hamilton theorem to find the inverse of the matrix.
e) know the matrix transformation and its applications in rotation, reflection, translation.

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Unit 1: Adjoint and Inverse of a Matrix. (Marks 15, 08 hours)

Elementary operations on matrices, Adjoint of a matrix, Inverse of matrix, Existence, uniqueness and properties of inverse of a matrix.

Unit 2: Rank of a Matrix. (Marks 15, 08 hours)

Elementary matrix, Rank and Normal form of a matrix. Reduction of matrix to its normal form. Rank of product of two matrices.

Unit 3: System of Linear Equations and Eigen Values. (Marks 15, 07 hours)

A homogeneous and non-homogeneous system of linear equations. Consistency of system of linear equations. Application of matrices to solve the system of linear equations. Eigen values, Eigen vectors, Characteristic equation of a matrix, Cayley Hamilton theorem, (Statement only) and its use to find the inverse of a matrix.

Unit IV: Orthogonal Matrices and Quadratic Forms. (Marks 15, 07 hours)

Orthogonal matrices. Properties of orthogonal matrices. Quadratic forms: matrix representation. Elementary congruent transformations. Diagonal form of a quadratic form. Canonical forms.

REFERENCE BOOKS:

1. Matrix and Linear Algebra, by K. B. Datta, Prentice Hall of India Pvt. Ltd. New Delhi,2000.
2. A Text Book of Matrices, by Shanti Narayan, S. Chand Limited, 2010.
3. Schaum's Outline of Theory and Problems of MATRICES, by Richord Bronson, McGraw-Hill, New York, 1989.

MTH 102 –Calculus of Single Variable

Course Description: This course provides fundamental knowledge of limits and continuity, Differentiations, Mean value theorem, Rolle's theorem, Cauchy's Mean value theorem and Geometrical interpretations.

Prerequisite Course(s): 11 and 12 standard Mathematics.

General Objective: Use the fact that the derivative is the slope of the tangent line to the curve at a given point to help determine the derivatives of simple linear functions. The basic need of this course is to understand the concepts Limits, Derivative and applications of calculus. Use the Intermediate Value Theorem to identify an interval where a continuous function has a root. Use the fact that the derivative is the slope of the tangent line to the curve at a given point to help determine the derivatives of simple linear functions. Also, this course will improve problem solving and logical thinking abilities of the students. By learn this course students can use the concepts of calculus to develop different mathematical models.

Learning Outcomes: Upon successful completion of this course the student will be able to:

a) understand basic concepts on limits and continuity.
b) understand use of differentiations in various theorems.
c) know the Mean value theorems and its applications.
d) make the applications of Taylor's, Maclaurin's theorem.
e) know the applications of calculus.
f) Determine the derivative of a function using the limit definition.
g) Interpret the derivative as the slope of a tangent line to a graph, the slope of a graph at a point, and the rate of change of a dependent variable with respect to an independent variable
h) Use the first and second derivatives to analyze and sketch the graph of a function, intervals on which the graph is increasing, decreasing.

Unit-1 Limit and Continuity (Marks 15, 08hours)

Epsilon-delta definition of limit of a function, Basic properties of limit, Indeterminate form, L-Hospitals rule, Examples of limit, Continuous function.

Properties of continuous function on closed and bounded interval.

i. Boundedness.
ii. Attains its bounds
iii. Indeterminate mean value theorem.
iv. Uniform continuity.

Unit-2 Mean Value Theorems (Marks 15, 08 hours)

Differentiability, Definition of derivative ,Theorem on continuity and examples, Roll's theorem, Langrage's Mean value theorem, Cauchy's mean value theorem, Examples on Roll's theorem, Langrage's Mean value theorem & Cauchy's mean value theorem, Geometrical interpretation and application, Increasing and Decreasing function.

Unit-3. Successive Differentiation (Marks 15, 07 hours)

The nth derivative of some standard functions:

$e^{ax+b}, x^m, (ax+b)^m, \frac{1}{ax+b}, \log(ax+b), \sin(ax+b), \cos(ax+b),$

$e^{ax}\sin(ax+b), e^{ax}\cos(ax+b)$

Leibnitz's Theorem and examples on it.

Unit-4. Application of differential Calculus. (Marks 15, 07 hours)

Taylor's theorem with Lagrange's form of remainder and related examples.

Maclaurin' theorem with Lagrange's form of remainder and related examples.

Reduction formulae

i. $\int_0^{\pi/2}(\sin x)^n\,dx$

ii. $\int_0^{\pi/2}(\cos x)^n\,dx$

iii. $\int_0^{\pi/2}(\sin x)^m(\cos x)^n dx$

iv. $\int(\frac{\sin nx}{\sin x})\,dx$ and examples on it.

REFERENCE BOOKS:

1. Theory and Problems of Advanced Calculus, by Robert Wrede and Murray R. Spiegel, McGraw-Hill Company, New York, Second Edition, 2002.
2. Text Book on Differential calculus, by Gorakh Prasad, Pothishala Private Ltd., Allahabad, 1959.
3. Integral calculus, by Gorakh Prasad, Pothishala Private Ltd., Allahabad
4. Problems in Calculus of One Variable, by I. A. Maron CBS Publishers & Distributors

MTH 103(A): Coordinate Geometry

Course Description: This course provides an elementary level knowledge of two- and three dimensional geometries especially sphere, cone and cylinders.

Prerequisite Course(s): 11 and 12 standard Mathematics.

General Objective: General objectives are to study two-dimensional geometry, translation and rotation of axes and its use to convert in standard 2-d forms. Also, to study three-dimensional geometry, Sphere, Cone and Cylinder along with their properties and interpretations.

Learning Outcomes:

Students can visualize geometrical concepts and draw two dimensional figures and can find their standard forms by shifting and rotation of axes. Students also can draw three dimensional figures and their equations particularly Sphere, Cone and Cylinder.

Unit-I Analytical Geometry **(Marks 15, 08 hours)**

Change of axes, Translation and Rotation,Invariant, Conic section, General equation of second degree in two variables and its reduction to standard form.

Unit-II Sphere **(Marks 15 , 08 hours)**

Equation of sphere in different forms, Plane section of sphere, Tangent line and Tangent plane to sphere,

Condition of tangency and point of contact, Interpretation of $S + \lambda S' = 0$, and $S + \lambda U = 0$ with usual notations.

Unit-III Cone **(Marks 15, 07 hours)**

Equation of cone with vertex at origin, Equation of cone with vertex at (α, β, γ), Right circular cone, Enveloping cone of sphere.

Unit-IV Cylinder **(Marks 15, 07 hours)**

Definition of cylinder, Equation of cylinder, Right circular cylinder, Enveloping cylinder.

REFERENCE BOOKS:

1. The Elements of Coordinate Geometry, By S. L. Loney, Mc-Millan and Company, London, 1895.
2. Text Book of Coordinate Geometry, By Gorakh Prasad and H. C. Gupta, Pothishala Pvt. Ltd. Allahabad,2000.
3. Analytical Solid Geometry, By Shanti Narayan, S. Chand and Co., 1959.

MTH 103(B): Discrete Mathematics

Course Description: This course provides fundamental knowledge of discrete mathematics.

Prerequisite Course(s): 11 and 12 standard Mathematics.

General Objective: To study

- Partition and Relations
- Coding Theory
- Mathematical logic
- Boolean Circuit and Algebra

Learning Outcomes:

Students are able to understand the concepts of relations, coding and decoding, mathematical logic, Boolean algebra.

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Unit-1. Relation **(Marks 15, 08 hours)**

1.1 Partition of sets

1.2 Cartesian product of two sets

1.3 Relation: Domain and range of relation

1.4 Inverse relation

1.5 Reflexive, Symmetric, Anti-Symmetric, Transitive relations, equivalences relation

1.6 Equivalence Classes

Unit-2. Coding Theory **(Marks 15, 08 hours)**

2.1 Weight of word, Hamming Distance, Message

2.2 Encoding Function, Detection of k or Fewer Errors, Parity Check Code

2.3 Minimum Distance of Encoding Function

2.4 Parity Check Matrix

2.5 Decoding Function, Maximum Likelyhood Decoding Function (Only Theory)

Unit-3. Mathematical Logic **(Marks 15, 07 hours)**

3.1 Statement

3.2 Logical Connectives: Conditional, Bi-conditional, Converse, Inverse, Contrapositive

3.3 Tautology, Contradiction, Satisfiable

3.4 Duality Law

3.5 Algebra of Proposition

3.6 Exclusive OR, NAND, NOR

Unit-4. Boolean Algebra **(Marks 15, 07 hours)**

4.1 Gates: NOT, AND, OR, NOR, NAND, XOR, XNOR

4.2 Combinatorial Circuit

4.3 Boolean Expression

4.4 Equivalence Combinatorial Circuits

4.5 Boolean Algebra

REFERENCE BOOKS:

1. Fundamental Approach to Discrete Mathematics by D. P. Achariya Sreekumar, New Age International Publishers, New Delhi.
2. Discrete Mathematical Structures by Bernard Kolman, Robert C Busby and Ross, Prentice Hall of India New Delhi, Eastern Economy Edition.

SEMESTER - II

MTH 201: Ordinary Differential Equations

Course Description: This course provides fundamental knowledge of Ordinary Differential Equations and their applications.

Prerequisite Course(s): 11 and 12 standard Mathematics.

General Objective: The basic need of this course is to understand the different methods of solving differential equations and their applications to solve problems arrives in engineering and technology.

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

a) understand basic concepts in differential equations.

b) understand method of solving differential equations

c) understand use of differential equations in various fields.

Unit-I Differential Equations of First Order and First Degree (Marks 15, 08 hours)

a) Partial derivatives of first order.

b) Exact differential equations. Condition for exactness.

c) Integrating factor.

d) Rules for finding integrating factors.

e) Linear differential equations.

f) Bernoulli's Equation. Equation reducible to linear form.

Unit-II Differential Equations of First Order and Higher Degree (Marks 15, 07 hours)

a) Differential equations of first order and higher degree.

b) Equation solvable for p.

c) Equation solvable for y.

d) Equation solvable for x.

e) Clairaut's form.

Unit-III Linear Differential Equations with Constant Coefficients (Marks 15, 08 hours)

a) Linear differential equations with constant coefficients.

b) Complementary functions.

c) Particular integrals of $f(D)y = X$, where $X = e^{ax}$, $cos(ax)$, $sin(ax)$, x^n, $e^{ax}V$ & xV with usual notations.

Unit-IV Homogeneous Linear Differential Equations (Marks15, 07hours)

a) Homogeneous linear differential equations (Cauchy's differential equations).

b) Example of Homogeneous linear differential equations.

c) Equations reducible to homogeneous linear differential equations (Legendre's equations)

d) Example of Equations reducible to homogeneous linear differential equations

REFERENCE BOOKS:

1. Introductory Course in Differential Equations, by D. A. Murray, Orient Congman (India) 1967.
2. Differential Equations, by G. F. Simmons, Tata McGraw Hill, 1972.

MTH 202: Theory of Equations

Course Description: This course provides fundamental knowledge of Theory equations.

Prerequisite Course(s): 11 and 12 standard Mathematics.

General Objective: To study

- Divisibility of numbers and Roots of polynomial equations.
- Relations between roots and coefficients of polynomials.
- Roots of cubic equations by using Cardon's method, biquadratic equations by Descarte's method and roots of polynomial equation s by Newton's method.

Learning Outcomes:

Students can find out roots of any equation of degree less than or equal to five. Theory of equations is highly useful in various subjects like algebra, linear algebra, calculus, ordinary and partial differential equations etc.

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Unit-1. Divisibility of Integers (Marks15, 08 hours)

Number Systems. Well ordering principle (statement only). Principle of Mathematical Induction. Divisibility of integers and theorems. Division algorithm. GCD and LCM. Euclidean algorithm. Unique factorization

Unit-2. Polynomials (Marks15, 08 hours)

Revision of Polynomials, Horner's method of synthetic division, Existence and uniqueness of GCD of two polynomials, Polynomial equations, Factor theorem and generalized factor theorem for polynomials, Fundamental theorem of algebra (Statement only), Methods to find common roots of polynomial equation, Descarte's rule of signs, Newton's method of divisors for the integral roots.

Unit-3. Theory of Equations-I (Marks15, 07 hours)

Relation between roots and coefficient of general polynomial equation in one variable. Relation between roots and coefficient of quadratic, cubic and biquadratic equations. Symmetric functions of roots.

Unit-4. Theory of Equations–II (Marks15, 07 hours)

Transformation of equations. Cardon's method of solving cubic equations. Biquadratic equations. Descarte's method of solving biquadratic equations.

REFERENCE BOOKS:

1. Elementary Number Theory, by David M. Burton, W. C. Brown publishers, Dubuquolowa, 1989.
2. Higher Algebra, by H. S. Hall and S. R. Knight, H. M. Publications, 1994.
3. Matrix and Linear Algebra, by K. B. Datta, Prentice Hall of India Pvt. Ltd. New Delhi, 2000.
4. Theory of Equations, by D. R. Sharma, Sharma Publications, Jalandar, 2003.

MTH 203(A): Laplace Transforms

Course Description: This course offers an introduction to the concepts of Laplace transforms, Inverse Laplace transforms along with some important properties, and solution of an ordinary differential equations using Laplace transform.

Prerequisite Course: 11 and 12 standard Mathematics.

General Objective: The basic need of this course is to understand the concepts and applications of Laplace transforms. The concepts and methods are useful for solving Differential Equations.

Course Outcomes:

Upon successful completion of this course the student will be able to:

- Know about piecewise continuous functions, Dirac delta function, Laplace transform and its properties.
- Know about Unit step, Periodic, Error, Gamma and Null functions.
- Understand Laplace and Inverse Laplace transforms.
- Know the basic properties of Laplace and inverse Laplace transforms.
- Calculate the Laplace transform of basic functions using the definition.
- Find the Laplace transform of derivatives of functions.
- Compute inverse Laplace transforms.
- Solve ordinary differential equations using Laplace transforms.

UNIT-I: Laplace Transform and Their Basic Properties (Marks15, 08 hours)

1. Basic concept & Definition of Integral Transform.
2. Definition of the Laplace transform, Kernel of Laplace Transform
3. Definition of Sectional or piecewise continuity& Functions of exponential order
4. Sufficient conditions for existence of Laplace transform.
5. Laplace transforms of elementary functions
6. Some important properties of Laplace transforms: Linearity property, First translation or shifting property, Second translation or shifting property, Change of scale property, Laplace transform of derivatives, Laplace transform of integrals, Multiplication by t^n, Division by t.

UNIT-II: Laplace Transform of Some special functions (Marks15, 08 hours)

1. Periodic functions.
2. The Gamma function.
3. The Error &Complementary Error function.
4. Unit step function.
5. Unit impulse or Dirac delta function.
6. Null functions.
7. Evaluation of integrals by Laplace transform.

UNIT-III: Inverse Laplace Transform (Marks15, 07 hours)

1. Definition of inverse Laplace transform, Uniqueness of inverse Laplace transform.
2. Inverse Laplace transform of some functions.
3. Some important properties of inverse Laplace transforms: Linearity property, First translation or shifting property, Second translation or shifting property, Change of scale property, Inverse Laplace transform of derivatives, Inverse Laplace transform of integrals, Multiplication by s^n, Division by s.
4. Convolution Theorem(Without Proof)
5. Partial fraction Method.

UNIT-IV: Applications to Differential Equations (Marks15, 07 hours)

1. Ordinary differential equations with constant coefficients.
2. Ordinary differential equations with variable coefficients.
3. Simultaneous ordinary differential equations of first order.

REFERENCE BOOKS:

1. Murray R. Spiegel, Schaum's Outline Series,Theory and Problems of Laplace Transforms, Mc Graw Hill Ltd, New York, 1965.
2. Lokenath Debnath and Dambaru Bhatta,Integral Transforms and Their Applications, Second Edition, C. R. C. Press, London, 2007.

3. Phil Dyke, An Introduction to Laplace Transforms and Fourier Series, Second Edition, Springer-Verlag London, 2014.

MTH-203(B) Numerical Methods

Course Description: This course provides fundamental knowledge of different methods of solution of equations, basics of interpolation and curve fitting for set of dada Also it provides methods for solving differential equations.

Prerequisite Course(s):11th and 12thstandard Mathematics.

General Objective: The students will be able to understand the basic numerical analysis which is applicable to problems like finding of zeroes of algebraic equations, interpolation, curve fitting and solution of first order differential equations. Students will also understand that when exact solutions are difficult to obtain, then approximate solutions can be obtained by using numerical methods.

Learning Outcomes: Students will be able to

- Understand basic concepts of methods of solutions of equations viz. bisection, iteration, Newton-Raphson methods and method of false position.
- Understand methods of curve fitting viz. Gauss's forward and backward difference formulae and Lagrange's interpolation formula.
- Use of curve fitting such as least square, polynomials and exponential fittings for set of given dada.
- Use Taylor's series, Euler's method, Modified Euler's methods, RangeKutta methods for solving ordinary differential equations.

Unit-1: Solutions of Algebraic and Transcendental Equations (15 marks, 08 hours)

1.1: Errors and their computation: Algebraic equations, transcendental equations, root of equations, Exact and Approximate numbers, significant digits or significant figures, rounding off Numbers, Type of errors: Inherent errors, Truncation errors.

1.2: Absolute error, Relative error and percentage error, Absolute accuracy, Relative accuracy.

1.3: The bisection method.

1.4: The iteration method.

1.5: The method of false position.

1.6: Newton-Rapson method.

Unit-2: Interpolation (15 marks, 08 hours)

2.1: Finite Differences: forward differences, backward differences,central differences.

2.2: Symbolic relations and separation of symbols: Forward difference operator, Backward difference operator, Central difference operator, Averaging (Mean) operator, Shift operator.

2.3: Gauss's forward central difference formula.(without proof)

2.4:Gauss's backward central difference formula.(without proof)

2.5: Interpolation with unevenly spaced point, Lagrange's interpolation formula.

Unit-3: Curve fitting **(15 marks, 07 hours)**

3.1: Least squares curve fitting procedures.

3.2: Fitting of straight line $y = a + bx$.

3.3: Nonlinear curve fitting: Power function $y = ax + c$

3.4: Fitting of polynomial of degree two $y = a + bx + cx^2$

3.5: Fitting of exponential function $y = ae^{bx}$

Unit-4: Numerical solutions of ordinary differential equations: **(15 marks, 07 hours)**

Solution by

4.1: Taylor's series

4.2: Euler's method

4.3: Modified Euler's method

4.4: RungeKutta second order formula

4.5: RungeKutta fourth order formula.

REFERENCE BOOKS:

1. Numerical Methods by V.N.Vedamurty and N.Ch.S.N.Iyehgar, Vikas Publishing House, India.
2. Introductory Methods of Numerical Analysis by S. S. Sastry, Prentice Hall India Learning Private Limited, Fifth edition, 2012.

Equivalences for F. Y. B. Sc. (Mathematics)

Effective from June 2022

New Paper				Old Paper	
Sem.	**Course**	**Paper**	**Course Code with Title**	**Paper**	**Course Code with Title**
I	MTHCC- A	Paper - 1	MTH 101: Matrix Algebra	Paper - 1	MTH 101: Matrix Algebra
		Paper – 2	MTH 102: Calculus of Single Variable	Paper – 2	MTH 102: Calculus
		Paper – 3	MTH 103 (A): Co-ordinate Geometry	Paper – 3	MTH 103 (A): Co-ordinate Geometry
			MTH 103 (B): Graph Theory	Paper – 3	MTH 103 (B): Discrete Mathematics
II	MTHCC- B	Paper-1	MTH 201: Ordinary Differential Equations	Paper-1	MTH 201: Ordinary Differential Equations
		Paper- 2	MTH 202: Theory of Equations	Paper- 2	MTH 202: Theory of Equations
		Paper – 3	MTH 203 (A): Laplace Transforms	Paper – 3	MTH 203 (A): Laplace Transform
			MTH 203 (B): Numerical Methods		MTH 203 (B): Numerical Analysis

KAVAYITRI BAHINABAI CHAUDHARI NORTH MAHARASHTRA UNIVERSITY, JALGAON

Faculty of Science and Technology

F. Y. B. Sc. BOTANY

Theory and Practical Syllabus

(CBCS Pattern)

As Per U. G. C. Guidelines

Semester – I

To Be Implemented From

Academic – Year 2022 - 2023

BOT. – 101: Diversity of Lower Cryptogams

BOT. – 102: Morphology of Angiosperms

BOT. – 103: Practical Based on BOT.-101 and BOT.-102

F.Y. B.Sc. Semester: I

Paper: I BOT. 101: Diversity of Lower Cryptogams		Lecture 30

Aims and Objectives:

1. To study the diversity among microbes.
2. To study systematic, morphology and structure of Bacteria, Viruses, Algae and Fungi.
3. To study the life cycle pattern of Bacteria, Viruses, Algae and Fungi.
4. To study the useful and harmful activities of Bacteria, Viruses, Algae and Fungi.

Course outcomes:

1. Provide identification technique of microbes, Viruses, Bacteria, Algae and Fungi.
2. Understand the systems of classification of Microbes, Viruses, Bacteria, Algae and Fungi, and its interdisciplinary approaches.
3. Provide lab-based training in writing short species descriptions and illustration.
4. Recognise members of the major microbes, Viruses, Bacteria, Algae, Fungi and their medicinal, economic importance for human welfare.

Unit 1	**Microbes:** 1.1: Introduction and main groups of microbes: Prions, Viroids, Viruses, Rickettsias, Mycoplasmas, Bacteria, Cyanobacteria. 1.2: Classification of microorganisms – R.H. Whittaker's (1969) five kingdom concept.	**02 L**
Unit 2	**Viruses:** 2.1: Introduction, discovery and characteristics of Viruses. 2.2: General morphology of viruses: Helical, Polyhedral, Enveloped and Complex viruses. 2.3: Nature of viruses (living and non-living) 2.4: Ultra structure of viruses 2.5: DNA Virus (T-Phase) and RNA, Virus (TMV) 2.6: Reproduction of Bacteriophage: Lytic and Lysogenic cycle. 2.7: Economic importance 2.8: Plant diseases caused by viruses w.r.t. causal organism, symptoms and control measures of. i. Yellow vein mosaic disease of Lady's finger. ii. Bunchy top of Banana.	**06 L**
Unit 3	**Bacteria:** 3.1: Introduction, discovery and general characters. 3.2: Classification of Bacteria on the basis of morphology. 3.3: Ultrastructure of Bacterial Cell 3.4: Gram positive and Gram negative Bacteria	**06 L**

	3.5: Reproduction - Asexual and Sexual (Conjugation) 3.6: Economic importance of Bacteria - useful and harmful activities 3.7: Study of Bacterial diseases w.r.t. causal organism, symptoms and control measures of i) Citrus canker ii) Black arm of Cotton.	
Unit 4	**Algae:** 4.1: Introduction, definition and general characters of algae 4.2: Habitats of algae: aquatic, terrestrial and algae unusual habitats 4.3: Thallus structure in algae. 4.4: Reproduction: vegetative, asexual and sexual 4.5: Classification of algae according to G. M. Smith (1955) up to classes with reasons giving at least two examples from each class. 4.6: Economic importance of algae in; i) Agriculture ii) Food iii) Industries iv) Medicine 4.7: A] Study of life cycle of ***Nostoc*** w.r.t. Systematic position Occurrence, structure of colony and filament, ultrastructure of ***Nostoc*** cell and reproduction B] Study of life cycle of ***Sargassum*** w.r.t. Systematic position, occurrence, external and internal structure of thallus, reproduction and alternation of generation.	**07 L**
Unit 5	**Fungi:** 5.1: Introduction, definition and general characters 5.2: Thallus structure, reproduction and mode of nutrition 5.3: Classification of Fungi, according to G.M. Smith up to classes with reasons giving at least two example of each class. 5.4: Economic importance of Fungi i) Agriculture ii) Food iii) Industries iv) Medicine 5.5: A] Study of life cycle ***Agaricus*** w. r. t. Systematic position, structure of mycelium, internal structure, (T.S. of gills) and reproduction. B] Study of life cycle ***Aspergillus.*** w. r. t. Systematic position, structure of mycelium and reproduction.	**07 L**
Unit 6	**Lichens and Mycorrhiza:** 6.1 Lichens: definition, characters, types - Crustose, Foliose, Fruticose and economics importance. 6.2 Definition, general account, significance of Mycorrhiza, 6.3 Types: Ectomycorrhiza and Endomycorrhiza.	**02 L**
Suggested readings:		

1. Agrawal, S. B. and Srivastav (1985)Modern Text Book of Botany Vol. I Algae, Fungi, Bacteria Viruses and Lichen, Universal Publication, Agra.
2. Biswas, S. B. and Amita Biswas (1986 Ed.)An Introduction to Viruses, Vikas Publishing House (P) Ltd. New Delhi.
3. Vashista, B.R. (2010) S. A Text Book of Algae S. Chand and Company (P.)Ltd New Delhi.
4. Vashista, B.R. (2010) S. A Text Book of Fungi S. Chand and Company (P.)Ltd New Delhi.
5. Sarabhai, B. P. &Arora C.K. (1995). A Text Book of Algae Anmol Publication, New Delhi.
6. Salle, A.J. (1974) Fundamental Principles of Bacteriology (TMH Ed.) New Delhi.
7. Gangulee, H.C. and Kar, A.K. (1998) College Botany Vol. II New Central Book Agency, Kolkota.
8. Pandey B. P. (2014) College Botany Volume 1S. Chand publications, New Delhi.
9. Pandey, S. N. and Trivedi (1997) A Text Book of Botany Vol. I Vikas Publishing House, New Delhi.
10. Sharma, P D. (1998) A Text Book of Fungi Rastogi Publication, Meerut.
11. Sharma, P D. (2009) A Text Book of Algae Tata McGraw Hill Publication, New Delhi

F.Y. B.Sc. Semester I

Paper II **BOT 102: Morphology of Angiosperms**		**Lecture 30**
Aims and objectives: **1.** To inculcate the students with angiosperm plant body. **2.** To study vegetative characteristics of angiosperm plants. **3.** To study reproductive characteristics of angiosperm plants. **4.** To study modifications and functions of plant organs. **Course outcomes:** **1.** Students will able to understand ground plan of angiospermic plant. **2.** Students will aware about vegetative and reproductive characteristics of angiospermic plant. **3.** Students will able to understand the modifications and functions of plant parts.		
Unit 1	**Introduction:** 1.1 Definition and scope of Morphology 1.2 Plant body – Root system, Shoot system	**02 L**
Unit 2	**Root:** 2.1 Definition 2.2 Characteristics of root 2.3 Functions of root 2.4 Types of root 2.5 Modifications of root for: a) Food storage:- Fusiform, Conical, Napiform, Tuberous root. b) Support:-roots, Stilt roots, Climbing roots c) Breathing:- Pneumatophores d) Special functions:- Epiphytic roots, Sucking roots	**04 L**
Unit 3	**Stem:** 3.1 Definition 3.2 Characteristics of stem 3.3 Functions of stem 3.4 Forms of stem: a) Strong form :- Herb, Shrub, Tree b) Weak form:- Creepers, Trailers and Climbers 3.5 Modifications of stem: a) Underground:- Rhizome, Stem tuber, Bulb and Corm b) Sub-aerial:- Runner, Stolon, Offset and Sucker c) Aerial:- Phylloclade, Cladode, Thorn, Stem tendril and Bulbil	**04 L**
Unit 4	**Leaf:** 4.1 Definition 4.2 Parts of leaf	**04L**

	4.3 Types of stipules 4.4 Types of leaf 4.5 Functions of leaf 4.6 Phyllotaxy:- definition and types: Alternate, Opposite (Decussate and Superposed) and Whorled. 4.7 Venation:- Definition and types: Reticulate and Parallel venation 4.8 Modifications of leaf:- leaf spines, leaf tendrils, fleshy leaves, phyllode, pitcher and bladder.	
Unit 5	**Inflorescence :** 5.1 Definition, Significance and parts of inflorescence 5.2 Types of inflorescence a) Racemose:- Raceme, Spike, Spikelet, Catkin, Spadix, Corymb, Umbel, Capitate and Head or Capitulum b) Cymose:- Solitary, Uniparous, Biparous and Multiparous c) Special type of inflorescence:-Cyathium, Verticillaster and Hypanthodium	**05L**
Unit 6	**Flower:** 6.1 Definition 6.2 Parts of typical flower 6.3 Types of flower:- Hypogynous, Epigynous and Perigynous 6.4 Symmetry of flower :- Actinomorphic and Zygomorphic 6.5 **Calyx:**- Polysepalous calyx, Gamosepalous calyx, Caducous calyx, Deciduous calyx, Persistent calyx and Petaloid calyx 6.6 **Corolla:** a) Forms of polypetalous corolla: Cruciform, Caryophyllaceous, Rosaceous and Paplionaceous b) Forms of gamopetalous corolla:- Campanulate, Infundibuliform, Tubular, Rotate, Hypocrateriform, Ligulate, Bilabiate and Personate 6.7 Perianth:-Polyphyllous and Gamophyllous 6.8 Aestivation:-i) Definition ii) Types of Aestivation. 6.9 **Androecium:** a) Attachment of anther to filament:- Basifixed, Dorsifixed and Versatile b) Cohesion and Adhesion of stamens. 6.10 **Gynoecium:** a) Apocarpous, Syncarpous, Monocarpellary, Bicarpellary and Polycarpellary b) Placentation: Definition and types of Placentation.	**06 L**
Unit 7	**Fruits:** **7**.1 Definition 7.2 Parts of typical fruit : nature of Pericarp 7.3 Types of fruits:- a) Simple fruits:- **i) Dry fruits:**	**05 L**

	a) Dehiscent:- Legume and Loculicidal Capsule b) Schizocarpic:-Lomentum and Regma c) Indehiscent:- Caryopsis, Cypsela **ii) Fleshy fruits:-** a) Drupe and Hesperidium b) Aggregate fruits:- Etaerio of berries and Etaerio of follicle c) Composite fruits:- Sorosis and Syconus.	

Suggested readings:

1. Gangulee H.C. Das K.S., Dutta C. (2014) College Botany Volume I, New Central Book Agency (P) Ltd. Kolkata.
2. Dutta A.C. (2013) Botany for Degree Students, Sixth edition, Oxford University Press, New Delhi.
3. Sachdeva S.K. (1990) Angiosperms – Morphology, Anatomy, Taxonomy, Evolution, Kalyani Publication, Ludhiana.
4. Pandey S.N. Mishra S.P. (2009) Taxonomy of Angiosperms, Ane Books Pvt. Ltd., New Delhi.
5. Singh M.P. Sharma A.K. (2002) Textbook of .Botany, Anmol Publication, Pvt. Ltd., New Delhi.
6. Sundararajan S. (2003) Practical Manual of Plant Morphology, Anmol Publication, Pvt. Ltd., New Delhi.
7. Bendre A. Kumar A. (1999) A Textbook of Practical Botany II, Rastogi Publication, Meerut

F.Y. B.Sc. Semester I

Paper III
Bot-103: Practical (Based on Bot.101 and Bot.102)

Practical – 1 : Study of Equipment, Chemicals and Stains used in Botany laboratory:

A) Equipment: Dissecting microscope, Compound Microscope

B) Chemicals:

i) Preservatives: FAA

ii) Stains: Safranin, Light green, Fast green, Cotton blue, Crystal violet,

iii) Mounting media; Glycerine, Lactophenol.

Practical - 2:.A) Study of viruses and bacteria using electron photomicrographs (TMV, Bacteriophage, Cocci, Bacillus, Spirillum Bacteria).

B) Technique of Gram staining of bacteria.

Practical – 3 & 4 : A) Study of Plant diseases w.r.t. causal organism, symptoms and control measures of the following:

a. Virus.

i. Yellow vein mosaic disease of Lady's finger

ii. Bunchy top of Banana

b. Bacteria

i. Citrus canker

ii. Black arm of cotton

c. Fungi

i. Green mould of citrus fruits

ii. White rust disease (Specimen/P.S.)/Tikka disease on groundnut [P.S.] (Any one)

B) Study of growth forms of lichens (Crustose, Foliose and Fruticose) specimens / P.S./ Photographs

C) Study of Mycorrhiza: (Ectomycorrhiza and Endomycorrhiza) by Photographs.

Practical -5& 6: Study of systematic position, vegetative and reproductive structures of the following:

A. ***Nostoc***

i) Vegetative structure -Filament and cell

ii) Reproductive structure (P.S.)

B. ***Sargassum***

i) Vegetative structure

ii) T. S. of main axis

iii) Reproductive structure male and female conceptacles (P.S.)

C. *Aspergillus*

i) Structure of thallus: mycelium,

ii) Reproductive structures asexual (Conidiophore and Conidia)

D. *Agaricus*

i) Structure of basidiocarp

ii) Reproductive structures: basidia and basidospores (V. S. of Gill)

Practical -7: Study of morphology of root and stem modifications as per theory.

Practical – 8 : Study of

a) Parts of leaf
b) Types of stipules
c) Types of leaf
d) Types of phyllotaxy
e) Types of venation
f) Modifications of leaf as per theory

Practical – 9 : Study of types of inflorescence as per theory.

Practical – 10 : Study of

a) Calyx – types of calyx as per theory
b) Corolla – forms of corolla as per theory
c) Types of aestivation

Practical -11: Study of

a) Androecium – Cohesion and Adhesion
b) Gynoecium– types of placentation.

Practical -12: Study of types of fruits as per theory.

Submission: 1. Excursion tour report

Note: Short or long excursion tour and visit to any botanical garden are compulsory.

KAVAYITRI BAHINABAI CHAUDHARI NORTH MAHARASHTRA UNIVERSITY, JALGAON

Faculty of Science and Technology

F. Y. B. Sc. BOTANY

Theory and Practical Syllabus

(CBCS Pattern)

As Per U. G. C. Guidelines

Semester – II

To Be Implemented From

Academic Year 2022 - 2023

BOT. – 201: Diversity of Higher Cryptogams

BOT. – 202: Taxonomy of Angiosperms

BOT. – 203: Practical Based on BOT.-201 and BOT.-202

F.Y. B.Sc. Semester II

Paper I Bot-201: Diversity of Higher Cryptogams		Lecture 30
Aims and objectives: 1. To study salient features of higher Cryptogams. 2. To know the morphology and systematics of higher cryptogams. 3. To study the life cycles of selected genera. 4. To study economic importance of higher cryptogams. To make the students aware about conservation and sustainable use of plants. **Course outcomes:** 1. Student will be able to understand the basic knowledge of the subject. 2. To understand the basic structure and study the comparative characteristic of Bryophytes and Pteridophytes. 3. Also, to understand the structural similarities and differences among both the groups. 4. Student will be able to aware developmental stages of life cycle of higher cryptogamic plants. To facilitate students for taking up and shaping a successful career in botany.		
Unit 1	**Introduction:** 1.1: Introduction, definition and diversity of higher cryptogams. 1.2: Bryophytes - a) Introduction. b) Habit and habitat. c) General characteristics of Bryophytes. d) Alternation of generations. 1.3: Classification of Bryophytes according to G. M. Smith (1955) up to classes with reasons, giving at least two examples from each class. 1.4: Economic and ecological importance of Bryophytes.	**05 L**
Unit 2	**Study of life cycle of *Riccia*:** 2.1: Systematic position with reasons. 2.2: Habit and habitat. 2.3: External and internal structure of gametophyte. 2.4: Vegetative reproduction. 2.5: Sexual reproduction (Development of sex organs not expected) 2.6: Fertilization. 2.7: Structure of mature sporophyte. 2.8: Structure and germination of spores. 2.9: Alternation of generation**.**	**05 L**
Unit 3	**Study of life cycle of *Funaria*:** 3:1. Systematic position with reasons. 3.2: Habit and habitat. 3.3: External and internal structure of gametophyte. 3.4: Vegetative reproduction.	**05 L**

	3.5: Sexual reproduction (Development of sex organs not expected) 3.6: Fertilization. 3.7: Structure of mature sporophyte. 3.8: Alternation of generation**.**	
Unit 4	**Pteridophytes:** 4.1: Introduction, definition and general characteristics of Pteridophytes. 4.2: Habit and Habitat. 4.3: Classification of Pteridophytes according to G. M. Smith (1955) up to classes with reasons, giving at least two examples from each class. 4.4: Economic importance of Pteridophytes.	**04 L**
Unit 5	**Study of life cycle of *Selaginella*:** 5.1: Systematic position with reasons. 5.2: Habit and habitat. 5.3: External and internal structure of sporophyte. 5.4: Asexual reproduction: position and structure of strobilus. 5.5: Sporangia (megasporangium and microsporangium). 5.6: Structure and germination of spores. 5.7: Structure of male and female gametophyte. 5.8: Position and structure of sex organs. (Development of sex organs not expected) 5.9: Fertilization. 5.10: Structure of mature embryo. 5.11: Alternation of generations. 5.12: Heterospory and its significance	**06L**
Unit 6	**Study of life cycle of *Adiantum* :** 6.1: Systematic position with reasons. 6.2: Habit and habitat. 6.3: External and internal structure of sporophyte. 6.4: Asexual reproduction: position and structure of sorus. 6.5: Structure of sporangium. 6.6: Structure and germination of spore. 6.7: Structure of mature gametophyte. 6.8: Position and structure of sex organs. (Development of sex organs not expected). 6.9: Fertilization. 6.10: Alternation of generation.	**05 L**

Suggested readings:

1. Gangulee, H.C. and Kar, A.K. (2001). College Botany Vol. II. Books and Allied Press Ltd. Kolkata.
2. Pandey, S.N. and Trivedi, P.S. (1997). A Text Book of Botany Vol. II, Vikas Publishing House (P.) Ltd. New Delhi.
3. Parihar, N.S. (1977). Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.

4. Parihar, N.S. (1984). An Introduction to Embryophyta Vol. I Bryophyta. Central Book Depot, Allahabad
5. Rashid, A. (1996). An Introduction to Bryophyta. Vikas Publishing House Ltd. New Delhi.
6. Rashid, A. (1996). An Introduction to Pteridophyta. Vikas Publishing House Ltd
7. Saxena, A.K. and Sarbhai, R.M. (1992). A Text Book of Botany Vol. II Embryophyta.
8. Ratan Prakashan Mandir, Agra.
9. Smith, G.M. (1995). Cryptogamic Botany. Vol. II (Bryophytes and Pteridophytes).
10. Mc Graw-Hill Book Company, New york and London.
11. Sporne, K.R. (1995). The Morphology of Pteridophyta. The Hutchinson University Library, London, U.K.
12. Vashistha, B.R. (1997). Botany For Degree Students-Bryophyta. S. Chand and company (P.) Ltd. New Delhi.
13. Vashistha, P.C. (1984). Pteridophytes. S. Chand and company (P.) Ltd. New Delhi

F.Y. B.Sc. Semester II

Paper II Bot-202: Taxonomy of Angiosperms		Lecture 30
Aims and objectives: **1.** To study the diversity of angiosperms. **2.** To study of comparative account among the families of angiosperm. **3**. To study the economic importance of the angiospermic plants. **4.** To study the distinguishing features, medicinal and economic importance of angiosperm families. **5.** To study botanical garden and herbarium techniques. **Course outcomes:** 5. Understanding of angiospermic plants Causes of phenomenal succession and alternation of generation. 6. Understand the systems of classification of angiosperms, nomenclature and interdisciplinary approaches. 7. Provide lab-based training in writing short species descriptions and illustration. 8. Recognise members of the major angiosperm families by identifying their diagnostic features, economic and medicinal importance. 9. Understand botanical gardens and herbarium technique		
Unit 1	**Introduction** 1:1 Definition, scope and importance of taxonomy. 1:2 General characters of Angiosperms. 1:3 Causes of phenomenon succession of Angiosperms. 1:4 Alternation of generations. 1:5 Taxonomy and systematics: synonyms.	**06 L**
Unit 2	**Taxonomic hierarchy** 2:1 Functions of Taxonomy: identification, classification and nomenclature. 2:2 Ranks of classification; major categories. 2:3 Binomial nomenclature. 2:4 Author citation and rejection of name. 2:5 Numerical Taxonomy; definition and applications.	**06 L**
Unit 3	**Classification** 3:1 Types of classification a) Artificial b) Natural c) Phylogenetic 3:2 Outline of Bentham and Hooker's system of classification up to series. 3:3 Merits and demerits.	**06L**

Unit 4	**Study of plants families w.r.t. systematic position, general characters, distinguishing characters and economic importance.** a) Malvaceae b) Papilionaceae (Fabaceae). c) Rubiaceae d) Solanaceae e) Euphorbiaceae f) Cannaceae	**06 L**
Unit 5	**Botanical Gardens and Herbarium.** 5:1) Botanical garden. a) Definition and Functions b) Special feature of following Botanical Garden. i) Indian Botanical Garden, Kolkata ii) Royal Botanical Garden, Kew England. 5:2) Herbarium. a) Definition, techniques and functions. b) Importance of herbaria.	**06L**

Suggested readings:

1. Gangully , H.C & K.S Das (1986) College Botany Vol. – 1 (6th Edition) , New Central book Agency, Calcutta , India.
2. Gangully H.C., K. S.Das and C.T Datta (1968) college Botany Vol.1 , New Central Book Agency , Calcutta , India.
3. Kumar, N.C (1992) An Introduction to Taxonomy of Angiosperm, Himalaya Publishing House, Bombay India.
4. Lawrence G.H.M (1951) Taxonomy of Vascular plants. Macmilan , New York , USA.
5. Naik , V. N (1984) Taxonomy of Angiosperms . Tata McGraw – Hil publishing Company Ltd , New Delhi , India
6. Pandey B.P. (1997) Taxonomy of Angiosperms . S. Chand & Company Ltd., New Delhi, India.
7. Sharma , O.P. (1997) Plants Taxonomy . Tata McGraw – Hill Publishing Co.Ltd . New Delhi, India
8. Shivarajan , V.V . (1984) Introduction to Principles of Principles of Plants Taxonomy . Oxford & IBHP publishing Co.New Delhi , India
9. Singh V. And Jain , D.K (1992) Taxonomy of Angiosperms. Rastogi publication , Meerut, India.
10. Subramanyam , N.S. (1997) Modern plants Taxonomy . Vikas Publishing house, New Delhi ,India.
11. MukerjeeSusilkumar (1984) College Botany Vol.3 Published by J.N.SenB.S.I.New central Book Agency Calcutta.
12. Vashistha , P.C. (1992) Taxonomy of Taxonomy of Angiosperms. R.Chand& Co. Publishers , New Delhi , India.

F.Y. B.Sc. Semester II

Paper III
Bot-203: Practical (Based on Bot.201 and Bot.202)

Practical - 1: Study of diversity of Bryophytes w.r.t systematic position and morphology of:
a) *Marchantia b*) *Anthoceros* c) *Sphagnum*

Practical - 2: Study of *Riccia:*
2.1: Systematic Position with reasons
2.2: External morphology
2.3: Mounting of scales and rhizoids
2.4: V. S. of Thallus
2.5: V. S. of thallus showing antheridia [P. S.]
2.6: V.S. of thallus showing archegonia [P.S.]
2.7: V.S. of sporophyte [P.S.]

Practical - 3: Study of *Funaria:*
3.1: Systematic Position with reasons
3.2: External morphology
3.3: T. S. of axis
3.4: V.S. of antheridial head [P.S.]
3.5: V.S. of archegonial head [P.S.]
3.6: V.S. of Capsule [P.S.]
3.7: Mounting of spores and peristomial teeth

Practical - 4: Study of diversity of Pteridophytes w.r.t systematic position and morphology of:
a) *Psilotum* b) *Lycopodium* *c*) *Equisetum*

Practical - 5: Study of *Selaginella*:
5.1: Systematic Position with reasons
5.2: External morphology
5.3: T. S. of Stem
5.4: Mounting of micro and megaspores
5.5: T. S. of Leaf [P.S.]
5.6: V. S of Strobilus [P.S.]

Practical - 6: Study of *Adiantum*:
6.1: Systematic Position with reasons
6.2: External morphology
6.3: T. S. of Rachis
6.4: T. S. of Sorus [P. S.]
6.5: Mounting of spores

Practical -7: How to describe Angiospermic plant.

Practical -8, 9&10: Study of plant families according to syllabus w.r.t Systematic position, morphological characters, floral formula and floral diagram.
i) Malvaceae iii) Rubiaceae v) Euphorbiaceae
ii) Papilionaceae/ Fabaceae iv) Solanaceae vi) Cannaceae

Practical -11: Preparation of artificial key based on vegetative & reproductive characters.

Practical -12: Herbarium and its techniques.

Submission: 1. Any five photographs of higher cryptogamic plants
2. Any five wild plant (Weeds) herbarium/photograph.
3. Excursion tour report

Note: Short or long excursion tour and visit to any botanical garden are compulsory.

Equivalence

	Old Syllabus w.e.f. June, 2018		New Syllabus, w.e.f. June 2022	
Sr. No.	Paper	Title	Paper	Title
SEMESTER-I				
1	BOT.101	Microbial Diversity of Algae and Fungi	BOT.101	Diversity of Lower Cryptogams
2	BOT.-102	Plant Taxonomy	BOT.-102	Morphology of Angiosperms
3	BOT.-103	Practical Course based on BOT-101 and BOT.-102	BOT.-103	Practical Course based on BOT-101 and BOT.-102
SEMESTER-II				
4	BOT.201	Diversity of Archegoniate	BOT.201	Diversity of Higher Cryptogams
5	BOT.-202	Plant Ecology	BOT.-202	Morphology of Angiosperms
6	BOT.-203	Practical Course based on BOT-201 and BOT.-202	BOT.-203	Practical Course based on BOT-201 and BOT.-202

KBC NORTH MAHARASHTRA UNIVERSITY, JALGAON

Syllabus for F.Y.B.Sc. ZOOLOGY under CBCS Pattern

With Effect from June 2022

Semester	Core Course (CC)	Structure	Code & Title of the paper	Credit
I	CC A-I	Theory	ZOO 101 Invertebrate Zoology	02
		Theory	ZOO 102 Grasshopper- The Nonchordate	02
		Practical	ZOO 103 Corresponding to Zoo 101 and Zoo 102	02
II	CC A-II	Theory	ZOO 201 Vertebrate Zoology	02
		Theory	ZOO 202 Frog-The Chordate	02
		Practical	ZOO 203 Corresponding to Zoo 201 and Zoo 202	02
Total Credits Sem I & II = 12				

Credit 2 = Lectures 45 = 60 Marks

F.Y.B. Sc. Zoology Semester I

Core Course A-I Theory			
Zoo: 101: Invertebrate Zoology			
	Course objective: • To familiarize the student with the basic concept of Invertebrate Zoology. • To understanding of the ecological relationships of the local species. • To identify common and unknown species. • To understand the invertebrate taxonomy and diversity.		
	Learning outcomes: After successful completion of this course, students are expected to: • Know the basic concept of Invertebrate Zoology. • Acquire the ecological relationships of the local species. • Know common and unknown invertebrate species. • Understand of the – Invertebrate phyla, anatomy, natural history, collection, preservation, behavior and evolution.		
Unit	**Name of Topic**	**Lectures 45**	**Marks: 60**
Unit-1	Introduction to the animal kingdom. **A) Porifera:** General characteristics and classification up to class. **B) Cnideria:** General characteristics and classification up class. **C) Ctnophora**: General characteristics and classification up to class.	**08**	**12**
Unit-2	**A) Platyhelminthes**: General characteristics and classification up to class. **B) Aschelminthes:** General characteristics and classification up to class. **C) Annelida:** General characteristics and classification up to class.	**10**	**12**
Unit-3	**A) Arthropoda**: General characteristics and classification up to class with two examples. **B) Mollusca:** General characteristics and classification up to class with two examples.	**10**	**12**
Unit- 4	**A) Echinodermata**:- General characteristics and classification up to class with two examples. **B) Hemichordata:-** General characteristics and classification up to class with two examples.	**07**	**10**
Unit- 5	**General Topics** • Canal system in Porifera. • Polymorphism in Coelenterates.	**10**	**14**

	• Parasitic adaptation in Flat worm. • Metamerism in Annelida. • Metamorphosis in insect. • Economic importance in Mollusca. • Water vascular system in Echinodermata.		

Suggested Readings

- Kershaw, D. R. :Animal Diversity, Redwood Burn Ltd, Trowbridge
- Parker J. and Haswell, W.: Text-Book of Zoology, ELBS Edition
- Vidyarthi: Text-Book of Zoology - Agrasia Publishers, Agra.
- Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII Edition. Holt Saunders International Edition.
- Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates: A New Synthesis*, III Edition, Blackwell Science
- Kotpal R L (2009): Modern textbook of Zoology Invertebrates, Rastogi Publication.
- Hall B.K. and Hallgrimsson B. (2008). *Strickberger's Evolution*. IV Edition. Jones and Bartlett Publishers Inc.
- Kotpal R.L.: Protozoa to Echinodermata series.
- Prasad S.N.: Life of Invertebrates, Vikas Publishing house, New Delhi.
- Jorden,E.L.: The Invertebrates, S.C. Chand, New Delhi.
- Prof P S Lohar *et al*: FYBSz Zoo 101 & 102: Atahrva Publication, Jalgaon

F.Y.B. Sc. Zoology Semester I

Core Course A-I Theory			
Zoo: 102: Grasshopper-The Nonchordate			
	Course objective: • To provide thorough knowledge about external morphological features of grasshopper • To develop an understanding about internal structural and functional details of grasshopper including its reproductive system and life cycle.		
	Learning outcomes: After successful completion of this course, students are expected to: • Acquire knowledge about external morphological features of grasshopper • Understand internal structural and functional details of grasshopper • Develop deeper knowledge about reproduction and life cycle of grasshopper		
Unit	**Study of Grasshopper (*Poekilocerus pictus*) with respect to following points**	**Lectures 45**	**Marks: 60**
Unit-1	**1.1 External Characters and sexual dimorphism** a) Shape, size and Colour b) Division of the body c) Sexual dimorphism **1.2 Digestive system:** a) Mouth parts b) Alimentary canal, Digestive glands, c) Food, feeding and Digestion	**08**	**12**
Unit-2	**2. Respiratory system:** a) Tracheal system b) Types of spiracles c) Mechanism of respiration	**09**	**12**
Unit-3	**3. Circulatory system**: a) Type of circulatory system b) Heart, sinuses c) Haemolymph - Composition and functions	**10**	**12**
Unit- 4	4.1 **Nervous system** : Brain, nerve cord and sense organs 4.2 **Excretion** in grasshopper	**06**	**10**
Unit- 5	5.1 Male & Female **Reproductive system** 5.2 **Life cycle** of grasshopper 5.3 Economic importance of grasshopper	**12**	**14**
Suggested Readings			

- Parker J. and Haswell, W.: Text-Book of Zoology, ELBS Edition
- Vidyarthi: Text-Book of Zoology - Agrasia Publishers, Agra.
- Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII Edition. Holt Saunders International Edition.
- Kotpal R L (2009): Modern textbook of Zoology Invertebrates, Rastogi Publication.
- Kotpal R.L.: Arthropods
- Prasad S.N.: Life of Invertebrates, Vikas Publishing house, New Delhi.
- Jorden,E.L.: The Invertebrates, S.C. Chand, New Delhi.
- Prof P S Lohar *et al*: FYBSz Zoo 101 & 102: Atahrva Publication, Jalgaon

F.Y.B. Sc. Zoology Semester I

Core Course A-I Practical Zoo 103 (Corresponding to Zoo 101 & Zoo 102)			
Zoo: 101: Invertebrate Zoology and Zoo 102: Grasshopper-The Nonchordate			
	Course objective: • To understand habit, habitat and taxonomic status of invertebrate animals • To explain the basic aspects of structural and functional details of grasshopper		
	Learning outcomes: After successful completion of this course, students are expected to: • Know the basic concept of Invertebrate Zoology. • Understand common and unknown invertebrate species. • Acquire practical knowledge about structural and functional aspects of grasshopper		
Part	**Title of Practical**	**Lectures 45**	**Marks: 60**
A	**Study of the following Invertebrate specimens :** *Amoeba*, *Euglena, Plasmodium, Paramecium, Sycon*, *Hyalonema,* and *Euplectella,Obelia, Physalia, Aurelia, Tubipora, Metridium, Taenia solium,* Male and female *Ascaris lumbricoides, Aphrodite, Nereis, Pheretima, Hirudinaria, Palaemon, Cancer*, *Limulus*, *Palamnaeus, Scolopendra*, *Julus*, *Periplaneta, Apis, Chiton, Dentalium, Pila, Unio,Loligo, Sepia, Octopus, Pentaceros, Ophiura, Echinus, Cucumaria* and *Antedon.*	**15**	**20**
B	**Study of phylum specific characteristic features:** • Canal system in Porifera. • Polymorphism in Coelenterates. • Parasitic adaptation in Flat worm. • Metamerism in Annelida. • Metamorphosis in insect. • Economic importance in Mollusca. • Water vascular system in Echinodermata	**10**	**10**
C	**Study of Grasshopper with respect to following** • External characters and sexual dimorphism • Mounting of mouth parts, wings, legs, trachea and spiracles, gizzard, malpighian tubules ootheca • Digestive system • Circulatory system • Nervous system • Male and female reproductive system • Life cycle of grasshopper	**20**	**30**

Suggested Readings

- Parker J. and Haswell, W.: Text-Book of Zoology, ELBS Edition
- Vidyarthi: Text-Book of Zoology - Agrasia Publishers, Agra.
- Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII Edition. Holt Saunders International Edition.
- Kotpal R L (2009): Modern textbook of Zoology Invertebrates, Rastogi Publication.
- Kotpal R.L.: Arthropods
- Prasad S.N.: Life of Invertebrates, Vikas Publishing house, New Delhi.
- Jorden,E.L.: The Invertebrates, S.C. Chand, New Delhi.
- Prof P S Lohar *et al*: Practical Handbook for FYBSz Zoo 103: Atahrva Publication, Jalgaon

F.Y.B.Sc. Zoology Semester II

Core Course A-II Theory			
Zoo: 201: Vertebrate Zoology			
	Course objective: ➢ To understand General Characters, habit, habitat and distribution of vertebrate animals. ➢ To understand the classification of vertebrate animals. ➢ To learn about general topics like • Accessory Respiratory Organs • Migration in Fishes • Metamorphosis in frog and Parental care in Amphibians • Poisonous and non-poisonous snakes, Importance of snake venom • Flight adaptations in birds, Migration in birds • Origin and Evolution of mammals		
	Learning outcomes: After successful completion of this course, students are expected to: • Gain the knowledge of the systematic position, habit and habitat of vertebrate animals • Acquire the knowledge about classification of vertebrates • Understand the general topics related to vertebrate animals.		
Unit	**Name of Topic**	**Lectures 45**	**Marks: 60**
Unit-1 A **Unit-1 B** **Unit-1 C**	**Introduction**, General characters of Chordates **Protochorda** 1.1 General characters, habit, habitat and distribution of Hemichordates, Urochordates and Cephalochordates **Agnatha** 1.2 General characters, habit, habitat and distribution of Agnatha 1.3 Classification of cyclostomes up to classes	**08**	**12**
Unit-2 A **Unit-2 B**	**Pisces** 2.1 General characters, habit, habitat and distribution, 2.2 Classification up to orders; **Amphibia** 2.3 General characters, habit, habitat and distribution 2.4 Classification up to orders	**10**	**12**
Unit-3 A **Unit-3 B**	**Reptiles** 3.1 General characters, habit, habitat and distribution 3.2 Classification up to orders; **Aves** 3.3 General characters, habit, habitat and distribution 3.4 Classification up to orders	**10**	**12**

Unit- 4	**Mammals** 4.1 General characters, habit, habitat and distribution 4.2 Classification up to orders;	**07**	**10**
Unit- 5	**General Topics** **a)** Accessory Respiratory Organs **b)** Migration in Fishes **c)** Metamorphosis in frog and Parental care in Amphibians **d)** Poisonous and non-poisonous snakes, Importance of snake venom **e)** Flight adaptations in birds, Migration in birds **f)** Origin and Evolution of mammals	**10**	**14**
Suggested Readings	• Young, J. Z. (2004). *The Life of Vertebrates*. III Edition. Oxford university press. • Grove, Newell and Carthy . Animal Biology University Tutorial Press Ltd. London • Kotpal R L (2009): *Modern textbook of Zoology Vertebrates*, Rastogi Publicationa. . • Lal S.S. (1996): Textbook of Practical Zoology Vertebrates, Rastogi Publications • Varma P. S. A Manual of Practical Zoology Chordates. S. Chand & Company Ltd. Delhi • Dhami & Dhami Chordate Zoology R. Chand & Co. New Delhi • Jayaraman : Fishes of India. • Salim Ali, : Indian Birds. • Vishwapremi K.K., : Economic Zoology (Akashdeep Pub.House,New Delhi). • Dalela, R.C. : A text book of Chordate Zoology, (Jai Prakash Nath publications, Meerut.). • Newman, H.H. : The phylum Chordate, (Satish Book Enterprise, Agra). • Jordon, E.L.: Vertebrate Zoology, (S. Chand and Co., New Delhi.). • Parker and Haswell Vol. II. A. Z. T. B. S. Publishers and distributers, New Delhi.		

F.Y.B.Sc. Zoology Semester II

Core Course A-II Theory			
Zoo: 202: Frog-The Chordate			
	Course objective • To understand habit, habitat and taxonomic status of vertebrates • To explain the basic aspects of structural and functional details of Frog		
	Learning outcomes After successful completion of this course, students are expected to: • Understand the systematic position, habit and habitat of Frog • Acquire the knowledge about structural and functional details about Frog.		
Unit	Study of Frog (*Hoplobatrachus tigerinus)* with respect to following points	**Lectures 45**	**Marks: 60**
1	**1.1 External Characters and sexual dimorphism** d) Shape, size and Colour e) Division of the body f) Sexual dimorphism	**08**	**12**
	1.2 Digestive system: d) Alimentary canal e) Digestive glands, f) Food, feeding and g) Digestion		
2	**2.1 Respiratory system:** a) Types and process of respiration	**08**	**12**
	2.2 Circulatory system: a) Heart, b) Arterial system, c) Venous system, d) Blood- Composition and functions		
3	**3.1 Nervous system:** a) Brain, b) Ventricles and c) Spinal cord	**12**	**12**
	3.2 Sense organs: a) Eye and b) Ear		
	3.3 Excretory system: a) Kidney b) Ureters c) Urinary bladder d) Cloaca		
4	**Reproductive system:** a) Male Reproductive system: Testes, Vasa efferntia, Urino-genital duct and Cloaca b) Female Reproductive system: Ovaries, Oviduct, Cloaca	**10**	**12**

5	**Frog Development:** a) Structure of egg and sperm, b) Amplexus and Fertilization c) Cleavage, Tadpoles d) Metamorphosis	**7**	**12**

Suggested Readings

- Robert Rugh: The Frog: Its reproduction and development - Tata McGraw Hill Edition, New Delhi.
- Ganguly, B.B., Sinha, A.K., Adhikari, S.: Biology of Animals - New Central Book Agency, Kolkata
- Bhamrah, MS and Juneja, K.: Introduction to Amphibia - Amol Publications, Delhi.
- Young, J. Z.:Life of Vertebrates - III Edition, Clarendon Press, London
- Goodnight and others: General Zoology, IBH Publishing Co.
- Prasad, ASN. : Life of Vertebrates - Vikas Publishing House, New Delhi
- Prasad, S. N. and Kashyap V.: Textbook of Vertebrate Zoology - New Age India Publishers, New Delhi
- Kotpal, R. L: Modern Text-Book of Zoology, Vertebrates, Rastogi and Co., Meerut.
- Jhingran, JG.: Fish and Fisheries of India, Hindustan Publishing corporation, New Delhi
- Kershaw, D. R. :Animal Diversity, Redwood Burn Ltd, Trowbridge
- Parker J. and Haswell, W.: Text-Book of Zoology, ELBS Edition
- Vidyarthi: Text-Book of Zoology - Agrasia Publishers, Agra.
- Jordan E.L and Verma P.S.: Chordate Zoology , S. Chand and Co., New Delhi
- Nigam, HC and Sobti, R.: Functional Organization of Chordate (parts I and II), S. Chand and Co., New Delhi

F.Y.B.Sc. Zoology Sem II

Core Courses A-II **Zoo - 203: Practical II (Corresponding to Zoo 201 & 202)**			
Zoo 201: Vertebrate Zoology & Zoo 202: Frog-The Chordate			
	Course objective: ➢ To acquire the practical skill about classification of Vertebrate animals ➢ To perform mountings of various significant parts of Vertebrate animals like ➢ Fins and scales of fishes. ➢ beaks and feet in birds ➢ poisonous and non-poisonous snakes ➢ To understand the concept of systematics or taxonomic features of vertebrate animals.		
	Learning outcomes: After successful completion of this course, students are expected to: • Enlighten themself with knowledge related to systematic features of vertebrate animals. • Enrich themselves with understandings of accessory organs. • Know the poisonous and nonpoisonous snakes.		
	Title of Practical	**Lectures 45**	**Marks 60**
	• Study of external morphology body forms, fins and scales of the fishes. • Systematic position, habit and habitat of *Balanoglossus* (Hemichordata), *Herdmania Branchiostoma, Petromyzon, Sphyrna, Pristis, Torpedo, Labeo, Exocoetus, Anguilla, Ichthyophis/ Ureotyphlus, Salamandra, Bufo, Hyla, Chelone,Hemidactylus, Chamaeleon, Draco, Vipera, Naja, Crocodylus, Gavialis,* Any six common birds from different orders, *Sorex*, Bat, *Funambulus, Loris* • Economic importance of two animals from each class. • Study of beaks and feet in birds. • Identification of poisonous and non-poisonous snakes. **Study of Frog with the help of diagrams / chart / model / simulations / etc**. a) External characters and sexual dimorphism b) Digestive system c) Respiratory system d) Circulatory system – Arterial and Venous system		

	e) Excretory and Reproductive system – Male and Female f) Brain – Dorsal and Ventral view g) Permanent slides of – Sperm, Egg, Blastula and Gastrula, Tadpole Larvae • Report on compulsory visit to a Zoo/Sanctuaries.		
Suggested Readings	• Kotpal R L (2009): Modern textbook of Zoology Vertebrates, Rastogi Publications. • Lal S.S. (1996): Textbook of Practical Zoology Vertebrates, Rastogi Publications • Varma P. S. A Manual of Practical Zoology Chordates. S. Chand & Company Ltd. Delhi • Jayaraman : Fishes of India. • Salim Ali : Indian Birds. • Dalela, R.C.: A text book of Chordate Zoology, (Jai Prakash Nath publications, Meerut.).		

Kavayitri Bahinabai Chaudhari North Maharashtra University, Jalgaon

FYBSc Zoology (CBCS Pattern)

Equivalence of courses in old syllabus 2018-19 to new syllabus 2022-23

Old Courses in 2018-19	**New course in 2022-23**
ZOO-101: Animal Diversity I	ZOO 101: Invertebrate Zoology
ZOO-101: Animal Diversity II	ZOO 102: Grasshopper- The Nonchordate
ZOO-201: Comparative Anatomy of Vertebrates	ZOO 201: Vertebrate Zoology
ZOO-202: Developmental Biology of Vertebrates	ZOO 202: Frog- The Chordate
ZOO-103 (Ist Sem) and ZOO-203 (IInd Sem): Practical Courses	ZOO-103 (Ist Sem) and ZOO-203(IInd Sem): Practical Courses

F. Y. B. Sc.

Ability Enhancement Compulsory Course (AEC)

ENG-BSc-101 AEC- A) English Communication

(w.e.f. 2022-23)

Course Credits: 02

Teaching Lectures: 30 hrs

Objectives-

1. To introduce the students with spoken and written English skills
2. To acquaint the students with oral and written forms in English language communication
3. To enable the students use correct English grammar in English language communication

Sem. I /II

Unit- 1 – Spoken and Written Skills

1. Introduce Yourself
2. Group Discussion and Personal Interview
3. Writing Job Application
4. Preparing Resume, Curriculum Vitae (CV), & Bio-data

Unit- 2 Grammar

1. Nouns, Pronouns, Adjectives, Verbs
2. Adverbs, Prepositions, Conjunctions, Interjections

External Exam- 60 marks

Question Paper Format for Sem. I /II–

Q1. Introduce Yourself (2/4) (Unit-1)-	12 marks
Q2. A) Questions on Group Discussion (1/3) (Unit-1)	6 marks
B) Questions on Personal Interview (1/3)(Unit-1)	6 marks
Q3. A) Letter Writing (1/2)(Unit-1)	6 marks
B) Prepare Resume/CV/Bio-data- (1/2) (Unit-1)	6 marks
Q4. Fill-in the blanks/ exercises (Unit 2)	12 marks
Q.5 Do as directed(Unit-2)	12 marks

Internal Exam- 40 marks

Two written tests will be conducted, each for 20 Marks.

Recommended Reading

1. *Business Communication* - SusmitaDey and others, Reliable Publications, Mumbai: June 2008
2. *Language, Literature and Creativity*, Editorial Board, Orient Black swan
3. *Developing Language Skills*- 2, Ed. S.C. Soodet. Al. Spantch Delhi, 1992.
4. *English at the Workplace*, Part I and II, Ed, Pramodini Varma and others,

   OUP, Delhi, 2006.
5. *Strengthen Your English*, M. Bhanskaran and D. Horeburgh, OUP, Delhi,1973.

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ACADEMIC CALENDAR

2018 – 2019

Internal Assurance Quality Report

(IQAC)

Academic Calendar 2018 - 19

Sr. No.	Particular		Dates	Remark
1	**Academic Session**	A) First Term	15 June 2018 to 31 Oct.2018	139 Days
		B) Winter Vacation	1 Nov. 2018 to 25 Nov. 2018	25 Days
		C) Second Term	26 Nov. 2018 to 30 April 2019	154 Days
		D) Summer Vacation	1May 2019 To 14 June 2019	45 Days
2	**Last Date of Admission**		**16 August 2018**	
3	**Examinations Session**	Test / Tutorial (Theory) First Term (Tentative)	16 October 2018 Onwards	
		Test / Tutorial (Theory) Second Term (Tentative)	15 March 2019 Onwards	
		Practical (First Term) (Tentative)	4 Oct. 2018 to 14 Oct. 2018	10 Days
		Practical (Second Term) (Tentative)	11 Feb.2019 to 24 Feb. 2019	10 Days

Academic Calendar 2018 - 19

(Each meeting is chaired by the Principal of the college)

Sr. No.	Date	Nature of the Event	Organizer
1	15/06/2018	Opening of the college	
2	18/06/2018	Meeting of the staff	
3	19/06/2018	Planning with admission Committee	Admission Committee
4	21/06/2018	Planning with academic Committee & the various Heads of Departments	Academic Committee
5	25/06/2018	Meeting in relation to academic time table.	Time-Table Committee
6	28/06/2018	Planning with sports Committee	Sports Committee
7	04/07/2018	Organization of Tree plantation.	NSS unit
8	07/07/2018	Meeting in relation to grievance.	Grievance Committee
9	10/07/2018	Meeting in relation to anti raging	Anti-raging Committee
10	16/07/2018	Meeting in relation to admission process.	Admission Committee
11	18/07/2018	Meeting in relation to discipline in the college.	Disciplinary Committee
12	21/07/2018	Meeting in relation to library management in college.	Library Advisory Committee
13	22/07/2018	Organization of lecture on ‘voters registration awareness’	Student Welfare circle
14	24/07/2018	Inauguration of student Welfare circle and welcome ceremony of F. Y. B. Sc. students.	Student Welfare circle
15	30/07/2018	Prepare various Committees for students all round developments.	Planning Committee
16	09/08/2018	Celebration of Kranti Diwas	Academic Committee
17	11/08/2018	Organization of anti- addiction rally and rally for the message like ‘save female child’ and ‘tree plantation awareness’.	
18	15/08/2018	Celebration of Independence Day	Academic Committee
19	20/08/2018	Celebration of Sadbhavna Day	Academic Committee
20	23/08/2018	Meeting in relation to Free ship and scholarship.	Scholarship Advisory Committee

21	03/09/2018	Meeting with non-teaching staff	Academic Committee
22	05/09/2018	Teachers Day	Debate and cultural
23	09/09/2018	Celebration of International literacy day	Academic Committee
24	22/09/2018	Organization of Debate competition	
25	28/09/2018	Organization of Essay & Poster competition	
26	03/10/2018	Planning with exam Committee in regard of term end test of first term.	Examination Committee
27	12/10/2018	Meeting on Academic Committee	Academic Committee
28	22/10/2018 to 30/10/2018	Organization of Term end test of first term.	Examination Committee
29	31/10/2018	Meeting on the Staff, teaching and non-teaching	
30	01/11/2018 to 24/11/18	Start of winter Vacations	
31	25/11/2018	Re-opening the college	
32	26/11/2018	Meeting on the Staff	
33	27/11/2018	Planning with Academic Committee	
34	31/12/2018	Celebration of year end day, 2018.	Debate and Art Circle
35	03/01/2019	Celebration of the birth anniversary of Savitribai Fule	Student Welfare Circle
36	12/01/2019	Celebration of ‘Rashtriya Yuva Divas’.	Student Welfare Circle
37	26/01/2019	Celebration of Republic Day	Academic Committee
38	06/02/2019	Planning with Exam Committee about the second term end test	Examination Committee
39	19/02/2019	Celebration of Birth anniversary of Chatrapati Shivaji Maharaj.	

40	18/02/2019 to 26/02/2019	II Term end test Exam And Internal Practical Examination	Examination Committee
41	27/02/2019	Planning with the Heads of various departments in regard of annual practical examination	Examination Committee
42	01/03/2019	Send off to third year students of B. Sc.	Students Welfare
43	4/3/2019 to 23/3/2019	Annual Practical Examination	Examination Committee
44	08/03/2019	Celebration of the International women's Day	
45	20/03/2019	Planning with exam Committee & Staff in regard of annual theory examination	Examination Committee
46	08/04/2019	Meeting on academic Committee	Academic Committee
47	14/04/2019	Celebration of Birth anniversary of Bharatratna Dr. Babasaheb B. R. Ambedkar	
48	30/04/2019	Annual meeting on the Staff	
49	01/05/2019	Celebration of Maharashtra Din	
50	01/05/2019 to 14/06/2019	Summer Vacation	

(Also, memories and tributes to all national Heroes, Saints and Social Reformers like, Mahatma Gandhi, Mahatma Phule, Anna Bhau Sathe, Saint Gadge Maharaj, Savitribai Phule, Birsa Munda, etc.)

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ACADEMIC CALENDAR

2019 – 2020

Internal Assurance Quality Report

(IQAC)

Academic Calendar 2019 - 20

Sr. No.	Particular		Dates	Remark
1	**Academic Session**	A) First Term	15 June 2019 to 31 Oct. 2019	139 Days
		B) Winter Vacation	1 Nov. 2019 to 26 Nov. 2019	25 Days
		C) Second Term	27 Nov. 2019 to 30 April 2020	156 Days
		D) Summer Vacation	1 May 2020 to 14 June 2020	45 Days
2	**Last Date of Admission**	-	10 August 2019	-
3	**Examinations Session**	Test / Tutorial (Theory) First Term (Tentative)	17 Oct. 2019 Onwards	10 Days
		Test / Tutorial (Theory) Second Term (Tentative)	25 Mar.2020 Onwards	10 Days
		Practical Second Term (Tentative)	3 Oct. 2019 to 10 Oct. 2019	7 Days
		Practical Second Term (Tentative)	23 Feb. 2020 to 21 Mar. 2020	28 Days

Academic Calendar 2019 - 20

(Each meeting is chaired by the Principal of the college)

Sr. No.	Date	Nature of the Event	Organizer
1	15/06/2019	Opening of the college	
2	18/06/2019	Meeting of the staff	
3	19/06/2019	Planning with Admission Committee	Admission Committee
4	21/06/2019	Planning with Academic Committee and other various Heads of Departments	Academic Committee
5	25/06/2019	Meeting in relation to academic time table	Time Table Committee
6	28/06/2019	Planning with Sports Committee	Sports Committee
7	04/07/2019	Organization of Tree plantation	NSS unit
8	07/07/2019	Meeting in relation to grievance	Grievance Committee
9	10/07/2019	Meeting in relation to anti raging	Anti-raging Committee
10	16/07/2019	Meeting in relation to admission process	Admission Committee
11	18/07/2019	Meeting in relation to discipline in the college	Disciplinary Committee
12	21/07/2019	Meeting in relation to library management in college	Library Advisory Committee
13	24/07/2019	Inauguration of student Welfare circle and welcome ceremony of F. Y. B. Sc. students.	Student Welfare Circle
14	30/07/2019	Prepare various Committees for students all round developments.	Planning Committee
15	09/08/2019	Celebration of Kranti Diwas (Quit India Movement)	Academic Committee
16	15/08/2019	Celebration of Independence Day	Academic Committee
17	23/08/2019	Meeting in relation to Free ship and scholarship.	Scholarship Advisory Committee

18	29/08/2019	National Sports Day	Sports Committee
19	03/09/2019	Meeting with non-teaching staff	Academic Committee
20	05/09/2019	Teachers Day	Debate and Cultural
21	09/09/2019	Celebration of International literacy day	Academic Committee
22	22/09/2019	Organization of Debate competition	Department of Marathi
23	28/09/2019	Organization of Poster presentation competition	Department of Chemistry
24	03/10/2019	Planning with exam committee in regard of term end test of first term.	Examination Committee
25	12/10/2019	Meeting on Academic Committee	Academic Committee
26	22/10/2019 to 30/10/19	Organization of Term end test of first term.	Examination Committee
27	31/10/2019	Meeting on the Staff, teaching and non-teaching	
28	01/11/2019 to 24/11/19	Start of winter Vacations	
29	25/11/2019	Re-opening the college	
30	26/11/2019	Indian Constitution Day	
31	27/11/2019	Planning with Academic Committee	
32	30/11/2019	Meeting of teaching and non-teaching staff	
33	06/12/2019	Mahaparinirvan Diwas	
34	31/12/2019	Celebration of year end day 2019	
35	03/01/2020	Celebration of the birth anniversary of Savitribai Fule	Student Welfare Circle
36	12/01/2020	Celebration of ‘Rashtriya Yuva Divas’.	Student Welfare Circle
37	26/01/2020	Celebration of Republic Day	Academic Committee

38	06/02/2020	Planning with Exam Committee about the second term end test.	Examination Committee
39	19/02/2020	Celebration of Birth anniversary of Chatrapati Shivaji Maharaj.	
40	18/02/2020 to 26/02/2020	Second Term end test exam and Internal Practical Examination	Examination Committee
41	27/02/2020	Planning with the Heads of various departments regarding annual practical examination	Examination Committee
42	28/02/2020	National Science Day	
43	01/03/2020	Send off to third year students of B. Sc.	Students Welfare
44	04/03/2020 to 23/03/2020	Annual Practical Examination	Examination Committee
45	08/03/2020	Celebration of the International women's Day	
46	20/03/2020	Planning with exam committee and staff in regard of annual theory examination	Examination. Committee
47	08/04/2020	Meeting on academic committee	Academic Committee
48	14/04/2020	Celebration of Birth anniversary of Bharatratna Dr. Babasaheb B. R. Ambedkar	
49	30/04/2020	Annual meeting of teaching and non-teaching staff	
50	01/05/2020	Celebration of Maharashtra Din	
51	01/05/2020 to 14/06/2020	Summer Vacation	

(Also, memories and tributes to all national Heroes, Saints and Social Reformers like, Mahatma Gandhi, Mahatma Phule, Anna Bhau Sathe, Saint Gadge Maharaj, Savitribai Fule, Birsa Munda, etc.)

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ACADEMIC CALENDAR

2020 – 2021

Academic Calendar 2020 - 21

(Each meeting is chaired by the Principal of the college)

Note: All Scheduled program are organized by college administration by obeying rules of the COVID – 19 governing by State and Central Government.

Sr. No.	Date	Nature of the Event	Organizer
1	09/06/2020	Meeting called by Principal for tacking the decision of academic year 2020-21	
2	25/07/2020	Meeting regarding admissions of S.Y. B.Sc. and T.Y. B. Sc.	
3	09/08/2020	Celebration of Kranti Diwas	Academic Committee
4	13/08/2020	Online meeting of time table Committee online teaching schedule of SY, TY.	
5	15/08/2020	Celebration of Independence Day	
6	21/08/2020	Meeting in with Heads of all faculties regarding on various issues and subjects	
7	22/08/2020	Meeting with all science faculty students regarding online teaching schedule	
8	24/08/2020	Online teaching schedule started for all faculties	
9	09/09/2020	Celebration of International literacy day with essay writing	Academic Committee
10	11/09/2020	Meeting with admission Committee regarding first year	
11	21/09/2020	Meeting with time table Committee in relation of first year teaching schedule	
12	22/09/2020	Meeting in relation to library management in college	Library Advisory Committee
13	01/10/2020	Online teaching start of first year UG	
14	02/10/2020	Celebration of Birth Anniversary of Mahatma Gandhi	Mahatma Gandhi Study and Research Centre
15	29/10/2020	Meeting with Heads of Science faculties for discussion on practical schedule	
16	14/11/2020	Birth Anniversary of Pandit Jawaharlal Neharu	
17	25/11/2020	Meeting with exam Committee regarding internal exam	

18	01-10/12/ 2020	Internal exams of S. Y. B. Sc. and T. Y. B.Sc.	Exam Committee
19	03/01/2021	Celebration of the birth anniversary of Savitribai Fule	Student Welfare Committee
20	1-7/01/2021	Final Exam run by KBCNMU, Jalgaon	Exam Committee
21	12/01/2021	Celebration of 'Rashtriya Yuva Divas'.	Student Welfare circle
22	26/01/2021	Celebration of Republic Day	Academic Committee
23	10/02/2021	Birthday Celebration of Matoshree Savitribai Randhe	
24	12/02/2021	Internal Examination of F.Y.B.Sc.	Exam Committee
25	19/02/2021	Celebration of Birth anniversary of Chatrapati Shivaji Maharaj.	
26	03/03/2021	Meeting regarding online practical schedule of all science faculties	
27	08/03/2021	Celebration of the International Women's Day	Student Welfare Committee
28	01-04/2021	Final exam of F.Y. B.Sc. students start run by KBCNMU, Jalgaon	
29	08/04/2021	Meeting on Academic Committee	Academic Committee
30	14/04/2021	Celebration of Birth anniversary of Bharatratna Dr. Babasaheb B. R. Ambedkar	
31	01/05/2021	Celebration of Maharashtra Din	
32	06/05/2021	Second semester will be started	
33	07/05/2021	Staff meeting regarding teaching and practical schedule of second term for all faculties	
34	30/06/2021	Internal examination of all faculties.	
35	01/07/2021	Annual exam started	
36	21/06/2021	Celebration of international Yoga Day	Sports and Gymkhana
37	31/07/2021	Staff meeting and term end	

(Also, memories and tributes to all national Heroes, Saints and Social Reformers like, Mahatma Gandhi, Mahatma Phule, Anna Bhau Sathe, Saint Gadge Maharaj, Savitribai Phule, Birsa Munda, etc.)

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ACADEMIC CALENDAR

2021 – 2022

Internal Assurance Quality Report

(IQAC)

Academic Calendar 2021 - 22

Sr. No.	Particular		Dates	Remark
1	Academic Session	A) First Term	1 Sept. 2021 to 16 Jan. 2022	145 Days
		B) Semester Break	17 Jan.2022 to 24 Jan. 2022	07 Days
		C) Second Term	24 Jan. 2022 to 5 June 2022	133 Days
		D) Semester Break	6 June 2022 to 15 June 2022	10 Days
2	Examinations Session	Test / Tutorial (Theory) First Term (Tentative)	20 Nov.2021 to 30 Nov. 2021	10 Days
		Test / Tutorial (Theory) Second Term (Tentative)	20 April 2022 to 30 April 2022	10 Days
		Practical (First Term) (Tentative)	04 Dec. 2021 to 10 Dec. 2021	06 Days
		Practical (Second Term) (Tentative)	01 May 2022 to 10 May 2022	10 Days

Academic Calendar 2021-22

(Each meeting is chaired by the Principal of the college)

Sr. No.	Date	Nature of Event	Organizer
1	01/08/2021	Birth Anniversary of Anna Bhau Sathe and Lokmanya Tilak	
2	04/08/2021	Meeting with admission Committee	
3	05/08/2021	Meeting with cultural Committee	
4	09/08/2021	Kranti Divas, International Adiwasi Divas	
5	11/08/2021	Library Day Celebration	Library
6	12/08/2021	International Youth Day	
7	15/08/2021	Independent Day	
8	21/08/2021	National level webinar on Research Methodology	
9	01/09 /2021	First Term started	
10		Meeting of the staff	
11	03/09/2021	Planning with admission Committee	Admission Committee
12	04/09/2021	Planning with academic Committee and Head of Departments	Academic Committee
13	05/09/2021	Teachers Day	Debate and cultural
14	14/09/2021	Meeting in relation to academic time table	Time Table Committee
15	08/09/2021	Planning with sports Committee	Sports Committee
16	11/09/2021	Meeting in relation to grievance.	Grievance Committee
17		Meeting in relation to anti-raging	Anti-raging Committee
18	15/09/2021	Meeting in relation to admission process review.	Admission Committee
19	16/09/2021	Meeting in relation to discipline in the college.	Disciplinary Committee
20	02/10/2021	Celebration of Birth Anniversary of Mahatma Gandhi	
21	03/10/2021	Planning with exam committee in regard of term end test of first term.	

22	04/10/2021	Inauguration of student Welfare Circle and welcome ceremony of F. Y. B. Sc. students.	
23	14/10/2021	Meeting of teaching and non-teaching staff	
24	29/10/2021	Meeting with Head of Science faculties for discussion on practical schedule	
25	14/11/2021	Birth Anniversary of Pandit Jawaharlal Nehru	
26	25/11/2021	Meeting with exam Committee regarding internal exam	
27	26/11/2021	Indian Constitution Day	
28	27/12/2021	Organization of lecture on 'Students rights' to celebrate 'Indian Consumer Day'.	Student Welfare circle
29	31/12/2021	Celebration of year end day, 2021.	Debate & Art Circle
30	03/01/2022	Celebration of the birth anniversary of Savitribai Fule	Student Welfare Circle
31	1-7/01/2022	'Road Safety Week'.	Student Welfare Circle
32	12/01/2022	Celebration of 'Rashtriya Yuva Divas'.	Student Welfare circle
32	26/01/2022	Celebration of Republic Day	Academic Committee
34	19/02/2022	Celebration of Birth anniversary of Chatrapati Shivaji Maharaj.	
35	08/03/2022	Celebration of the International women's Day	Student Welfare Circle & Yuvati Sabha
36	08/04/2022	Meeting on academic Committee	Academic Committee
37	14/04/2022	Celebration of Birth anniversary of Bharatratna Dr. Babasaheb B. R. Ambedkar	
38	16/04/2022	Meeting regarding internal exam	
39	01/05/2022	Celebration of Maharashtra Din	
40	05/06/2022	Staff meeting and term end	

(Also, memories and tributes to all national Heroes, Saints and Social Reformers like, Mahatma Gandhi, Mahatma Phule, Anna Bhau Sathe, Saint Gadge Maharaj, Savitribai Phule, Birsa Munda, etc.)

Godhatma Shaikshanik Bahuuddeshiya Sanstha's

M. G. Tele Commerce College, C. and B. R. Tele Science College, and K. Tele College of Management.

Thalner, Tal.- Shirpur, Dist.- Dhule. (Maharashtra) 425421

ACADEMIC CALENDAR

2022 – 2023

Internal Assurance Quality Report

(IQAC)

Academic Calendar 2022 - 23

Sr. No.	Particular		Dates	Remark
1	Academic Session	A) First Term	01/08/2022 to 18/12/2022	140 Days
		B) Semester Break	19/12/2022 to 02/01/2023	15 Days
		C) Second Term	03/01/2023 to 23/05/2023	141 Days
		D) Semester Break	24/05/2023 to 02/07/2023	40 Days
2	Examinations Session	Test / Tutorial (Theory) First Term (Tentative)	21 to 30 Sept. 2022	10 Days
		Test / Tutorial (Practical) (Tentative)	14 to 19 Oct. 2022	6 Days
		Practical (First Term) (Tentative)	11 to 20 March 2023	10 Days
		Practical (Second Term) (Tentative)	21 to 30 April 2023	10 Days

Academic Calendar 2022-23

(Each meeting is chaired by the Principal of the college)

Sr. No.	Date	Nature of Event	Organizer
1	01/08/2021	Birth Anniversary of Anna Bhau Sathe and Lokmanya Tilak	
2	04/08/2021	Meeting with admission Committee	
3	05/08/2021	Meeting with cultural Committee	
4	09/08/2021	Kranti Divas, International Adiwasi Divas	
5	11/08/2021	Library Day Celebration	Library
6	12/08/2021	International Youth Day	
7	15/08/2021	Independent Day	
8	21/08/2021	National level webinar on Research Methodology	
9	01/09 /2021	First Term started	
10		Meeting of the staff	
11	03/09/2021	Planning with admission Committee	Admission Committee
12	04/09/2021	Planning with academic Committee and Head of Departments	Academic Committee
13	05/09/2021	Teachers Day	Debate and cultural
14	14/09/2021	Meeting in relation to academic time table	Time – Table Committee
15	08/09/2021	Planning with sports Committee	Sports Committee
16	11/09/2021	Meeting in relation to grievance.	Grievance Committee
17		Meeting in relation to anti-raging	Anti-raging Committee
18	15/09/2021	Meeting in relation to admission process review.	Admission Committee
19	16/09/2021	Meeting in relation to discipline in the college.	Disciplinary Committee
20	02/10/2021	Celebration of Birth Anniversary of Mahatma Gandhi	
21	03/10/2021	Planning with exam committee in regard of term end test of first term.	

22	04/10/2021	Inauguration of student Welfare Circle and welcome ceremony of F. Y. B. Sc. students.	
23	14/10/2021	Meeting of teaching and non-teaching staff	
24	29/10/2021	Meeting with Head of Science faculties for discussion on practical schedule	
25	14/11/2021	Birth Anniversary of Pandit Jawaharlal Nehru	
26	25/11/2021	Meeting with exam Committee regarding internal exam	
27	26/11/2021	Indian Constitution Day	
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(Also, memories and tributes to all national Heroes, Saints and Social Reformers like, Mahatma Gandhi, Mahatma Phule, Anna Bhau Sathe, Saint Gadge Maharaj, Savitribai Phule, Birsa Munda, etc.)

Kavayitri Bahinabai Chaudhari North Maharashtra University

'A' Grade NAAC Re-Accredited (4th Cycle) Jalgaon-425001, Maharashtra (India)

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Blank Mark List For

B.Sc.(with Credits) - Regular-under CBCS [June-2019] Pattern - TY B.Sc. - Sem-VI For April-2023

College : M. G. Tele Commerce, C. and B. R. Tele Science, K Tele Management College (240120), At Po Thalner, Thalner, Shirpur, Dhule Pin: 425405

Paper Name:	CH-609 Practical Course based on Organic Chemistry Practical (861309)	Practical CA	(Max Mark: 40 Min Mark: 16)	Count of Student: 8

Sr. No.	Seat Number	PRN	Student Name	Marks	Total
1	361908	2012015400189701	ADHAVE SWAPNALI RAJU	30	thirty
2	361909	2019015400123552	DHANGAR RAMESHWARI SAMADHAN	38	Thirty eight
3	361910	2020015400046497	PATIL NEELESH DIPAK	36	Thirty six
4	361911	2020015400222281	PATIL VAISHNAVI JIJABRAO	30	Thirty
5	361912	2020015400039346	SAINDANE GAURAV KAILAS	35	Thirty five
6	361913	2020015400039331	SHIMPI SEEMA GULAB	38	Thirty eight
7	361914	2018015400196216	SHINDE PRATHAMESH MAHESH	38	Thirty eight
8	361915	2020015400039362	SHIRSATH MAYURI DYANESHWAR	38	Thirty eight

Seal

Signature of Examiner

Date

Instruction
1. While entering the marks, please ensure a clear, legible hand-writing, without any scratches or over-writing.
2. In case of scratches, over-writing or corrections, please re-write the marks separately with your signature.
3. Use English number while entering the marks.
4. Usage of whitner is strictly prohibited.

Kavayitri Bahinabai Chaudhari North Maharashtra University

'A' Grade NAAC Re-Accredited (4th Cycle) Jalgaon-425001, Maharashtra (India)

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Blank Mark List For

B.Sc.(with Credits) - Regular-under CBCS [June-2019] Pattern - SY B.Sc. - Sem-IV For April-2023

College : M. G. Tele Commerce, C. and B. R. Tele Science, K Tele Management College (240120), At Po Thalner, Thalner, Shirpur, Dhule Pin: 425405

Paper Name: MAR-Vinodi Katha ani Vidnyanpar Lekhan (840201)	Theory CA (Max Mark: 40 Min Mark: 16)	Count of Student: 13

Sr. No.	Seat Number	PRN	Student Name	Marks	Total
1	346930	2021015400069725	BAGUL CHETANA BHAUSAHEB	30	Thirty
2	346931	2021015400069717	SONAWANE MAHESH DAGADU	31	Thirty one
3	346932	2021015400021535	PATIL RINAL SANDIP	30	Thirty
4	346933	2021015400020427	PATIL SHEJAL GOPAL	36	Thirty six
5	346934	2021015400016712	CHAUDHARI TUSHAR BHIMRAJ	30	Thirty
6	346935	2018015400275225	GIRASE MANOJ YUVARAJ	31	Thirty one
7	346936	2021015400021543	PATIL MAHENDRA RAMKRISHNA	30	Thirty
8	346937	2020015400178071	PATIL MAMATA BHIKA	30	Thirty
9	346938	2021015400305064	PATIL NUTAN SANTOSH	31	Thirty one
10	346939	2021015400313551	PATIL PRIYANKA SUNIL	30	Thirty
11	346940	2021015400021551	PATIL ROHIT DIPAK	31	Thirty one
12	346941	2019015400123625	RAJPUT HARSHADA DONGARSING	31	Thirty one
13	346942	2021015400016727	SANER YOGESH PRADIP	36	Thirty six

Seal

Signature of Examiner

Date

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Kavayitri Bahinabai Chaudhari North Maharashtra University

A' Grade NAAC Re-Accredited (4th Cycle) Jalgaon-425001, Maharashtra (India)

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Blank Mark List For

B.Sc.(with Credits) - Regular-under CBCS (June-2022) Pattern - FY B.Sc. - Sem-II For April-2023

College : M. G. Tele Commerce, C. and B. R. Tele Science, K Tele Management College (240120), At Po Thalner, Thalner, Shirpur, Dhule Pin: 425405

Paper Name:	PHY-201 Electricity and Electrostatics (1152221201)	Theory CA	(Max Mark: 40 Min Mark: 16)	Count of Student: 17

Sr No.	Seat Number	PRN	Student Name	Marks	Total
1	325534	2022015400212257	BAGUL SAGAR SHALIGRAM	32	Thirty Two
2	325535	2021015400261981	BILADE VISHAL BHAGWANT	23	Twenty Thre
3	325536	2022015400243774	BORSE SNEHAL PRAVIN	25	Twenty fiv
4	325537	2022015400212145	GUJAR BHUPESH LILACHAND	23	Twenty Thr
5	325538	2019015400309883	GUJARATHI BHAKTI SANAD	24	Twenty four
6	325539	2022015400212163	JADHAV KALPESH DARBAR	22	Twenty Tw
7	325540	2022015400328145	JADHAV VISHWAJIT VIJAYSINH	23	Twenty Thr
8	325541	2022015400212176	PATIL AMOL PRAKASH	29	Twenty Nin
9	325542	2022015400243766	PATIL MANOJ SATISH	24	Twenty four
10	325543	2022015400212242	PATIL PURVA CHANDRAKANT	25	Twenty five
11	325544	2022015400201567	PATIL SONALI SURESH	24	Twenty four
12	325545	2022015400243751	PATIL TEJAS SARILAL	23	Twenty Thr
13	325546	2022015400212234	PATIL TOSHNA VIKAS	26	Twenty Six
14	325547	2022015400220574	RAJPUT KALYANI CHARANSHING	30	Thirty
15	325548	2015015400337012	SANER ANANDA JAGANNATH	26	Twenty Six
16	325549	2022015400212226	SAWALE NEHA KISHOR	33	Thirty Thre
17	325550	2022015400212265	SHIRSATH SUHAS LAXMAN	23	Twenty Thr

Dr. A. E. Mali

Seal

Signature of Examiner

Date

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