



Arihant Education Foundation's
Arihant College of Arts, Commerce and Science, Bavdhan, Pune-21

Department of Science

F.Y. B.Sc. SYLLABUS STRUCTURE AS PER NEP 2020

SEMESTER-I

Sr. No.	Vertical	Subject	Credit	No. of Lecture		Evaluation			Total Marks
				per week	Total Lectures	Internal	External	Practical	
1	DSC-I	CHE-101-T: Fundamentals of Chemistry-I	2	2	30	20	30		50
		CHE-102-P: Chemistry Practical -I	2	4	60	20		30	50
2	DSC-II	PHY-101-T : Fundamentals of Physics-I	2	2	30	20	30		50
		PHY-102-P : General Physics Lab-I	2	4	60	20		30	50
3	DSC-III (Select Any one Group)	GROUP A							
		MTS 101-Algebra and Calculus I	2	2	30	20	30		50
		MTS 102 - Practicals based on MTS-101 (Algebra and Calculus I)	2	4	60	20		30	50
		GROUP B							
		BOT-101-T Applied Aspects of Plant Sciences	2	2	30	20	30		50
		BOT-102-P Practical Based on BOT-101-T	2	4	60	20		30	50
4	OE	Psychology of Adjustment and Stress(Arts) OR Finacial Literacy (Commerce)	2	2	30	20	30		50
5	SEC	SEC-101-PHY-P : Experimental Skills in Physics	2	4	60	20	30		50
6	AEC	English : Professional Communication Skills	2	2	30	20	30		50
7	IKS	Generic	2	2	30	20	30		50
8	VEC	VEC-101-T: Environment Education-I	2	2	30	20	30		50
		Total	22						500



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SEMESTER-II

Sr. No.	Vertical	Subject	Credit	No. of Lecture		Evaluation			Total Marks
				per week	Total Lectures	Internal	External	Practical	
1	DSC-I	CHE-151-T: Fundamentals of Chemistry-II	2	2	30	20	30		50
		CHE-152-P: Chemistry Practical-II	2	4	60	20		30	50
2	DSC-II	PHY-151-T : Fundamentals of Physics-II	2	2	30	20	30		50
		PHY-152-P : General Physics Lab-II	2	4	60	20		30	50
3	DSC-III (Select Any one Group)	GROUP A							
		MTS-151:Algebra and Calculus II	2	2	30	20	30		50
		MTS 152 - Practicals based on MTS-151 (Algebra and Calculus II)	2	4	60	20		30	50
		GROUP B							
		BOT-151-T Basics of Plant Sciences	2	2	30	20	30		50
		152-BOT-P Practical Based on BOT 151-BOT-T	2	4	60	20		30	50
4	OE	Psychology of Interpersonal Relationships(Arts) OR Financial Accounting, Paper-I (Commerce)	2	2	30	20	30		50
5	SEC	SEC-154-PHY-P : Basic Lab Electric devices and Circuits	2	4	60	20	30		50
6	AEC	English : Professional Communication Skills	2	2	30	20	30		50
7	VEC	VEC-151-T: Environment Education-II	2	2	30	20	30		50
8	CC	N.S.S./ Sports and Fitness/ Physical Fitness	2	2	30	20	30		50
		Total	22						500

Syllabus of Courses

Semester-I

CHE-101-T: Fundamentals of Chemistry-I

Course type: Major (Theory)

No. of Credits: 2

Course Outcomes

After the completion of this course, student will be able to-

CO1: recall the fundamental concepts of the mole concept, atomic structure, organic chemistry, catalysis, and surface chemistry.

CO2: explain the principles of chemical stoichiometry, Hund's rule, Aufbau principle and catalysis.

CO3: utilize the knowledge of the mole concept, atomic structure, factors affecting the reactivity of organic compounds, and surface chemistry.

CO4: apply the principles of the mole concept, atomic structure, organic reactivity, catalysis, and surface chemistry to solve the problems.

CO5: evaluate the solutions based on their concentration, and organic structures based on their reactivity and surface chemistry.

CO6: propose solutions to problems related to organic chemistry reactions, catalysis mechanisms, and atomic structure concepts, and apply them to real-world scenarios.

Course Content

Chapter 1: Essentials of Analytical Chemistry

[08 hours]

What is analytical Chemistry, the analytical perspectives, Common analytical problems. Importance in various fields. Some important units of measurements-SI units, distinction between mass and weight, mole, millimole and Calculations, Solution and their concentrations- Molar, Normal and Molar concentrations, percent Concentration, part per million, part per billion, part per thousand, density and specific gravity of solutions, problems. Empirical and Molecular Formulas, Stoichiometric Calculations, Problems. Introduction to errors, limitations of analytical methods, classifications of errors, accuracy, precision, minimization of errors, significant figures and computation.

Chapter 2: Atomic Structure

[07 hours]

Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Sommerfield modification. Quantum numbers, introduction to the concept of atomic orbitals; shapes, radial and angular probability diagrams of s, p and d orbitals (qualitative idea). Many electron atoms and ions: Pauli's exclusion principle, Hund's rule, exchange energy, Aufbau principle and its limitations. Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals. Quantum Mechanics: Wave particle duality, de Broglie hypothesis, and the uncertainty principle.

Chapter 3: Essentials of organic chemistry

[09 hours]

Organic Compounds: Classification and Nomenclature, Structure and reactivity of organic molecules, Structural effects- Inductive Effect, Resonance Effect, Hyperconjugation Effect, Steric Effect, Hydrogen bonding and Tautomerism. Comparative study of strength of acids and bases based on Inductive and Resonance effect. HSAB principle, Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond fission, Types of reagents – electrophiles and nucleophiles, Types of organic reactions, Reactive intermediates – carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples). Aromaticity: Huckel's rule and Benzenoids.

Chapter 4: Catalysis and Surface chemistry

[06 hours]

Catalysis, Types of catalyst and catalysis, specificity and selectivity, mechanism of catalyzed reactions at solid surfaces (diffusion theory of catalysis). Introduction to surface Chemistry - some basic terms related to surface Chemistry adsorption, adsorption materials, factors affecting adsorption, characteristics of adsorption, types of adsorption, classification of adsorption isotherms, Langmuir adsorption isotherm, Freundlich's adsorption isotherm, application of adsorption, problems

References

1. Analytical Chemistry, G. D. Christian, P. K. Dasgupta, K. A. Schug, 7th Ed, Wiley, 2004..
2. Fundamentals of Analytical Chemistry- Skoog, west, Holler, Crouch, 9th Ed. Brooks / Cole, 2014/2004.
3. Basic Concept of Analytical Chemistry- S. M. Khopkar.
4. Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. Organic Chemistry, John Wiley & Sons, 2014.

5. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
6. Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi 1988.
4. Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.
7. Kalsi P. S. Organic Reactions and Their Mechanisms, New Age International (P) Limited Publishers, 2001
8. J. D. Lee. Concise Inorganic Chemistry, 5th Ed. Blackwell Science
9. CNR Rao. University general Chemistry, an introduction to chemical science, Macmillan.
10. Brian W. Pfennig. Principles of Inorganic Chemistry, 2015 John Wiley & Sons.
11. Essential of Physical Chemistry, Bahl and Tuli (S. Chand).
12. Principles of Physical Chemistry by Puri, Sharma, Pathania.
13. Physical Chemistry, Singh, N.B., et al. Volume 2, New Age International Ltd, 2000
14. Physical Chemistry by, R. A. Alberty, Wiley Eastern Ltd.
15. The Elements of Physical Chemistry by P. W. Atkins, Oxford

CHE-102-P: Chemistry Practical -I

Course type: Major (Practical)

No. of Credits: 2

Course Outcomes

After the completion of this course, student will be able to-

CO-1: acquire basic knowledge of experiments of including adsorption, organic qualitative analysis, and inorganic preparations and estimations.

CO-2: utilize theoretical concepts to perform experiments, interpret data, and formulate conclusions.

CO-3: foster critical thinking abilities to assess and enhance the reliability and accuracy of experimental findings.

CO-4: report scientific findings of laboratory experiments.

CO-5: evaluate experimental outcomes to draw insightful conclusions.

CO-6: develop problem-solving skills.

Course Content

Set I: Physical and Analytical Chemistry (Any four)

1. To Investigate the Adsorption of acetic acid by activated charcoal and verify Freundlich adsorption isotherm.
2. Investigate the adsorption of oxalic acid by activated charcoal and verify Langmuir adsorption isotherm.
3. Estimation of aspirin from given tablet and find error in qualitative analysis.
4. Balancing of chemical equation using titration data between Oxalic acid and KMnO_4
5. Determination of oxidation state and equivalent weight of magnesium and zinc metals by Eudiometric method.
6. Estimation of hardness of water by EDTA method

Set II: Organic Chemistry

A. Organic Qualitative Analysis (Any three)

1. Determination of physical constant, functional group and elements of the organic compound (acidic, basic, phenolic or neutral compound).

B. Preparation of Organic Derivative

1. Preparation of semicarbazone derivative of aldehyde and ketone and purity by TLC

Set III: Inorganic Chemistry

a. Inorganic Preparations (Any three)

2. Synthesis of potash alum from aluminium metal (scrap Aluminium metal) and qualitative test for anion and cation.
3. Synthesis of Mohr's Salt $[(\text{FeSO}_4)(\text{NH}_4)_2\text{SO}_4]\cdot 6\text{H}_2\text{O}$ and qualitative test for anion and cation.
4. Synthesis of $\text{FeSO}_4\cdot 7\text{H}_2\text{O}$ and qualitative test for anion and cation.
5. Preparation of Dark red inorganic pigment: Cu_2O and qualitative test for cation.

b. Estimation of Purity of salt (Compulsory)

Determination of purity of any one of the synthesized salt by volumetric method.

For Self-Learning and Internal Evaluation:

1. Safety symbol on labels of pack of chemicals and its meaning
2. Precautions in handling of hazardous substances.
3. Toxicity of the compounds used in chemistry laboratory and classification of toxicity.
4. Preparation of solutions of different strengths (Percentage solutions, Molar, molal and normal solutions)

References:

1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
3. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Text book of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
4. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960
5. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).
6. R.K. Gupta and O.P. Gupta, Practical Chemistry.
7. Daniel C. Harris, Quantitative Chemical Analysis.
8. O.P. Tandon, Practical Chemistry.
9. N.K. Verma and S.C. Kheterpal, Comprehensive Practical Chemistry
10. K.C. Jain, Advanced Practical Chemistry.

Semester-II

CHE-151-T: Fundamentals of Chemistry-II

Course type: Major (Theory)

No. of Credits: 2

Course Outcomes

After the completion of this course, student will be able to-

CO1: recall and explain the fundamental principles and concepts from Photochemistry, Chemical Kinetics, Periodicity, Stereochemistry, and Chemical Bonding.

CO2: identify experimental key concepts involved in Photochemistry, Chemical Kinetics, Periodicity, Stereochemistry, and Chemical Bonding.

CO3: draw conclusions about reaction mechanisms, kinetics, periodic trends, stereochemical relationships, and bonding properties.

CO4: apply the principles of Photochemistry, Chemical Kinetics, Periodicity, Stereochemistry, and Chemical Bonding to solve complex problems and scenarios.

CO5: evaluate the significance of photochemical reactions, kinetic processes, periodicity, bonding theories like VBT and MOT and stereochemical structures.

CO6: propose solutions, and contribute to the advancement of scientific knowledge applications.

Course Content

Chapter 1: Photochemistry

[06 hours]

Introduction, Difference between thermal and photochemical processes. b. Laws of photochemistry i) Grothus - Draper law ii) Stark-Einstein law. c. Quantum yield, Reasons for high and low quantum yield. Factors affecting Quantum yield, Experimental method for the determination of quantum yield & Problems. d. Fluorescence, Phosphorescence, Chemiluminescence.

Chapter 2: Chemical Kinetics

[04 hours]

Recapitulation: Rate of a reaction (Average and instantaneous), order and Molecularity of a reaction, rate law and specific rate constant, First order and Pseudo molecular reaction (Without derivation).

Second order reaction expression, Numerical based on rate of reaction, half-life period and rate constant of First order reaction only.

Chapter 3: Periodicity

[07 hours]

The long form of periodic table. s, p, d, f block elements, Detailed discussion of the following properties of the elements, with reference to s & p-blocks. (a) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table. (b) Atomic radii (van der Waals) (c) Ionic radii. (d) Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy. (e) Electron gain enthalpy; trends of electron gain enthalpy. (f) Electronegativity, Pauling's/ Mullikan's electronegativity scales. (g) Oxidation states of elements

Chapter 4: Stereochemistry

[09 hours]

Concept of isomerism, Types of isomerism; Optical isomerism – elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro diastereomers, meso compounds, Racemic mixture and resolution, Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature. Geometric isomerism – determination of configuration of geometric isomers, E & Z system of nomenclature.

Chapter 5: Chemical bonding

[04 hours]

Atomic orbitals, multiple bonding (σ , π and delta bond approach) and bond lengths, the Valence Bond Theory (VBT), Concept of hybridization, hybrid orbitals and molecular geometry, Bent rule, Valence Shell Electron Pair Repulsion theory (VSEPR), shapes of the following simple molecules and ions containing lone pairs and bond pairs of electrons: H_2O , NH_3 , PCl_5 , SF_6 , SF_4 , ClF_3 , I_3^- , and H_3O^+ .

References

1. Essential of Physical Chemistry, Bahl and Tuli (S. Chand).
2. Principles of Physical Chemistry by Puri, Sharma, Pathania.
3. Physical Chemistry, Singh, N.B., et al. Volume 2, New Age International Ltd, 2000
4. Physical Chemistry by, R. A. Alberty, Wiley Eastern Ltd.
5. The Elements of Physical Chemistry by P. W. Atkins, Oxford
6. Eliel, E.L. Stereochemistry of Carbon Compounds, Tata McGraw Hill education, 2000.
7. Stereochemistry of Organic Compounds: Principles and Applications Paperback – 7 January 2018 by D. Nasipuri
8. Stereochemistry : conformation and mechanism by Kalsi, P. S
9. Stereochemistry of Organic Compounds by VK Ahluwalia
10. Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.

11. J. D. Lee. Concise Inorganic Chemistry, 5th Ed. Blackwell Science
12. CNR Rao. University general Chemistry, an introduction to chemical science, Macmillan.
13. Brian W. Pfennig. Principles of Inorganic Chemistry, 2015 John Wiley & Sons.

CHE-152-P: Chemistry Practical-II

Course type: Major (Practical)

No. of Credits: 2

Course Outcomes

After the completion of this course, student will be able to-

CO-1: learn vital lab techniques: colorimetry, kinetics, organic purification, investigative inorganic experiments, and Avogadro applications.

CO-2: apply theoretical principles to design and conduct experiments, analyze data, and draw conclusions.

CO-3: cultivate critical thinking skills to ensure the reliability and accuracy of experimental results.

CO-4: communicate scientific findings through laboratory reports, utilizing proper scientific formatting, terminology, and data analysis techniques.

CO-5: evaluate experimental outcomes to draw insightful conclusions.

CO-6: develop problem-solving skills.

Course Content

Set I: Physical and Analytical Chemistry (Any four)

1. Determination of unknown concentration of KMnO_4 by Colorimetry.
2. Estimation of Cu^{++} ion by using EDTA Calorimetrically.
3. Determination of Heat of Neutralization of Strong Acid & Strong Base.
4. Study the kinetics of acid hydrolysis of methyl acetate with hydrochloric acid.
5. Compare the strengths of HCl and H_2SO_4 by studying kinetics of hydrolysis of methyl acetate
6. Study of kinetics of decomposition of H_2O_2 (Clock Reaction)

Set II: Organic Chemistry

A. Organic Purification Techniques (Any two)

1. Purification of organic compounds by-
 - i) Crystallization (from water and alcohol)
 - ii) Sublimation
 - iii) Simple distillation
 - iv) Steam distillation

C. Analysis of Organic Compound (Any two)

1. Detection of elements (N, S, Cl, Br, I) in the organic compounds

Set III: Inorganic Chemistry

A. Investigative Experiments in Inorganic Chemistry (Any two)

1. Study stoichiometry of reaction between KMnO_4 and FeSO_4 by titration method hence determination of number of electrons involved in the reaction and equivalent weight of oxidizing agent - KMnO_4 .
2. Determination of dissociable H^+ ions (basicity) of boric acid hence determination of its equivalent weight by acid base titration. Explain observed basicity of the boric acid.
3. Estimation of number of water of crystallization in Mohr's salt by titrating with KMnO_4 .

B. Table work (Compulsory)

1. Polar plots of s and p orbitals

C. Chemistry with Computers (Any one)

2. Study of molecular properties of some molecules using open access computational Chemistry package Avogadro and give the explanations for observed properties.
3. Draw the structure of using Avogadro. Record their bond length and dipole moment of these molecules and explain observed trend in periodicity of these two properties of in halide group elements.
4. Draw the structure of H_2O , H_2S , H_2Se and H_2Te molecules using Avogadro. Optimize structure. Record their bond length, bond Angle and dipole moment of these molecules. Explain observed trend in periodicity of these three properties of in halide group elements.
5. Draw the structure of CH_4 , NH_3 , H_2O , molecules using Avogadro. Optimize structure. Record their bond length, bond Angle and dipole moment of these molecules. Explain observed bond angles.

References:

1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
3. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Text book of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
4. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960
5. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).
6. R.K. Gupta and O.P. Gupta, Practical Chemistry.

7. Daniel C. Harris, Quantitative Chemical Analysis.
8. O.P. Tandon, Practical Chemistry.
9. N.K. Verma and S.C. Kheterpal, Comprehensive Practical Chemistry
10. K.C. Jain, Advanced Practical Chemistry.
11. <https://avogadro.cc/>

Syllabus of Courses

19) Syllabus of Discipline Specific Core (DSC) Courses (Major Core)

Major Core (Semester I) (4 Credits) (2T+2P)

Semester-I

F.Y.B.Sc. (Physics) (Sem-I)

PHY-101-T : Fundamentals of Physics-I

Lectures: 30 hrs

(Credits-02)

- A) Course Objectives:** - This course aims to introduction of Mechanics.
- 1) Explain the concept of center of mass of systems of individual particles and of continuous distributions of matter, explain the principle of momentum conservation. Describe the difference between inelastic and elastic collisions.
 - 2) Describe the rotational motion of rigid bodies using the concepts of angular velocity and acceleration, rotational inertia, torque, and the rotational analog of Newton's law.
 - 3) Explain the relation between pressure and force. Explain why some objects float and others sink. Express conservation of mass and energy for fluids through the continuity equation and Bernoulli's equation.
 - 4) Introduce basic concept and principles in Physics.
 - 5) Introduce applications of basic Physics concept and principles for modern life.
- B) Course Outcomes (CO):** - Upon completion of this course student will able to
- 1) Articulate and apply the principle of conservation of mechanical energy to solve real life problems. Show the relation between force and energy using potential-energy curves.
 - 2) Understood the concept of center of mass and find out center of mass of systems of individual particles and of continuous distributions of matter. Apply principle of momentum conservation to systems of particles. Apply the appropriate conservation laws to analyze real world problems.
 - 3) Calculate the rotational inertias of objects with sufficient symmetry by summing or integrating. Solve problems that involve both linear and rotational motion. Calculate rotational kinetic energy, and explain its relation to torque and work.
 - 4) Understand relation between pressure and force; calculate pressure as a function of depth in liquids. Determine quantitatively the position of floating objects and the apparent weight of submerged objects. Use the continuity equation and Bernoulli's equation to solve problems involving fluid dynamics.
 - 5) Understand basic principles in Physics.
 - 6) Applications of physics principles to resolve community problems.
 - 7) Develop advanced thinking in future life style.
 - 8) Apply Knowledge of Physics principles in day today life

C) Instructional Design: -

- 1) Lecture method 2) Tutorial method 3) Use of Computer

D) Evaluation Strategies

- 1) Descriptive written exam 2) Assignments 3) Seminars, Oral, Viva.

E) Prerequisites:

1. **Algebra and trigonometry:** Basic foundation in algebra and trigonometry
2. **Calculus:** Basic background of Calculus
3. **Physics Fundamentals:** Knowledge about the basic physical quantities and their SI and CGS unit system along with dimensions

F) Course Contents: -

Lectures: 30 hrs

Module - 01	Rotational Dynamics	10 H
	1.1 Torque, Angular Velocity and Angular Acceleration. (Revision) 1.2 Principle of Conservation of Angular Momentum. 1.3 Centre of Mass in uniformly distributed object. (Revision) 1.4 Statement of parallel axis and perpendicular axis theorem. 1.5 Moment of Inertia and Radius of gyration. 1.6 Calculation of moment of inertia for solid cylindrical, and spherical. 1.7 Kinetic Energy of Rotation 1.8 Rolling Motion on inclined plane 1.9 Moment of Inertia of a Flywheel Numerical Problem	
Module - 02	Fluid Mechanics	06 H
	i) Fluid Statics 2.1 Definition of a Fluid. 2.2 Pressure, Absolute Pressure and Gauge Pressure. (Revision) 2.3 Variation of Pressure with Depth. 2.4 Pascal's Laws (Statement) 2.5 Buoyancy and Archimedes Principle. (Statement) Numerical Problem ii) Fluid Dynamics 2.6 Equation of Continuity. 2.7 Bernoulli's Theorem.(Statement) 2.8 Application Based on Bernoulli's Equation: Torricelli's Theorem and Venturimeter.(only theory) 2.9 Viscosity, Viscous force and Effect of Temperature. (Revision) 2.10 Stokes' Law and Terminal Velocity. 2.11 Surface Tension, Surface Energy and angle of contact. (Revision) 2.12 Excess Pressure Inside liquid drop and Soap Bubble. 2.13 Determination of Surface Tension by Jaeger's Method. Numerical Problem	
Module - 03	Atomic Spectra	08H

	3.1 Inadequacy of classical physics, 3.2 Brief Review of Black body Radiation, 3.3 Photoelectric effect, (Statement) 3.4 Compton Effect, (Statement) 3.5 Dual nature of radiation wave nature of particles, 3.6 Atomic spectra, 3.7 Line spectra of hydrogen atom, 3.8 Ritz Rydberg combination principle, (only principle) 3.9 Alpha Particle Scattering, (Review) 3.10 Rutherford Scattering Formula, (Revision) 3.11 Rutherford Model of atom and its limitations. Numerical Problem	
Module - 04	Atomic Models	07H
	4.1 Bohr's Model of Hydrogen atom, 4.2 Explanation of atomic spectra, 4.3 Correction for finite mass of the nucleus, (Revision) 4.4 Bohr correspondence principle, 4.5 Limitations of Bohr model, 4.6 Discrete energy exchange by atom, 4.7 Frank Hertz Experiment, 4.8 Sommerfeld's modification of Bohr's Theory (Review) Numerical Problem	

Activities: Conduct **any one** classroom activity during class lecture for each module.

Module 1: Rotational Dynamics

Activity 1: Linear velocity of rotating objects.

Compare velocities of solid sphere, solid cylinder, hollow sphere and hollow cylinder on inclined plane.

Activity 2: Exploring Rotational Dynamics with Spinning Tops

Explain principle of rotational dynamics through hands on experiment with spinning top.

Activity 3: Spinning Wheel Challenge

Apply concepts of rotational dynamics, specifically related to angular velocity and angular acceleration.

Module 2: Fluid Mechanics

Activity 1: Sticky and non-sticky liquid

Demonstrate viscosity using sticky or non-sticky liquids.

Activity 2: Mixture of Sticky and non-sticky liquid

Mix non sticky liquid to the sticky liquid in defined quantities and measure viscosity. Find out viscosity is increasing or decreasing with increase of non-sticky liquid concentration.

Activity 3: Surface Tension

- Spread of oil on water
- Formation of water droplets with different surface tensions on various leaves
- Floating Needle
- Soap-powered boat

- Soap film Interference Pattern
- Explain surface tension using soap solution and piece of paper

Module 3: Atomic Spectra

- Line spectra of hydrogen atom
- Photoelectric effect
- Compton Effect,
- Scattering of particles
- Black body Radiation

Module 4: Atomic Models

- Correction for finite mass of the nucleus
- Discrete energy exchange by atom
- Frank Hertz Experiment

Reference Books:

1. Richard Wolfson, “Essential UNIVERSITY PHYSICS” 2nd Ed., Pearson Education, Inc., 2012.
2. David Halliday, Robert Resnick, and Jearl Walker, “Fundamentals of Physics”, 9th Ed., 2011.
3. H.C Verma, “Concept of Physics Part – I”, Bharati Bhawan Publication, 2021.
4. Hugh D. Young and Roger A. Freedman, “University Physics With Modern Physics”, 14th Ed., Pearson Education, 2017.
5. David Kleppner, Robert Kolenkow, “An Introduction to Mechanics (SIE)”, 1st Ed., McGraw Hill Education, 2017.
6. Surface Tension by C. V. Boys, <https://www.gutenberg.org/ebooks/33370>
7. Concepts of Modern Physics: A Beiser (6th ed., McGraw Hill, 2003)
8. Intermolecular and Surface Forces by Jacob N. Israelachvili
9. Problems in Physics: P. K. Srivastava, Wiley Eastern Ltd.
10. Mechanics-M. Das, P. K. Jena and R.N. Mishra (Srikrishna Publications)
11. Mechanics: D. S. Mathur, Revised by P. S. Hemne, S. Chand and Company, New Delhi.
12. Physics: Resnick, Halliday & Walker, Wiley
13. Mechanics: D. S. Mathur, Revised by P. S. Hemne, S. Chand and Company, New Delhi.
14. Modern Physics-Serway (CENGAGE Learnings)
15. Physics of Atoms and Molecules Bransden and Joachim (Pearson India)
16. Atomic and Nuclear Physics-A. B. Gupta (New Central)

*****XXX*****

PHY-102-P : General Physics Lab-I**Lectures: 60 hrs****(Credits-02)**

- A) Course Contents:** - This course aims to introduce the practical related with Mechanics and Physics Principles and its applications.
- B) Course Outcomes:** The practical knowledge of mechanics doing experiments. They would also learn optical phenomena such as interference, diffraction and dispersion and do experiments related to optical devices: Prism, grating, spectrometers

Section I: Mechanics and its application (Any-6)

Sr. No.	Title of the Experiments
1	To study and use of various measuring instrument's 1. Vernier caliper 2. Micrometer Screw Gauge 3. Travelling Microscope 4. Spectrometer
2	To determine an acceleration due to gravity "g" by using Bar Pendulum
3	To determine an acceleration due to gravity "g" by using Kater's Pendulum
4	To determine the Coefficient of Viscosity by using Poiseuille's method
5	To study and verify Bernoulli's Theorem.
6	To determine the moment of inertia of Disc by Torsional Oscillations.
7	To determine the moment of inertia of a Flywheel.
8	To determine the surface tension using Capillary Rise method
9	To determine the Surface Tension of Water by using Jaeger's method
10	To determine the Surface Tension of Mercury by using Quincke's Method.
11	To determine the Surface Tension of Mercury by using Method of Ripples.

Section II: Physics Principles and Applications (Any-6)

Sr. No.	Title of the experiments
1	To study of Spectrometer Calibration (Determination of Angle of the Prism and Refractive Indices of different colors)
2	To determine the Dispersive Power of the Material of a Prism.
3	To determine the Cauchy's Constants A and B of the Material of a Prism
4	To determine the Planck's Constant.
5	To study the I-V characteristics, and calculate FF, Efficiency of p-n junction Solar Cell
6	To determine the first excitation potential of gas by Frank Hertz Experiment
7	To study of Divergence of LASER beam.
8	To determine the Diameter of Thin Wire by using LASER light.
9	To determine the wavelength of LASER light by using Plane Diffraction Grating.
10	To study of Total Internal Reflection using LASER light.
11	To determine the particle size of any sample material powder by using LASER light.
12	To determine wavelength of LASER using Metric Ruler (Scale)
13	To demonstrate how the gamma-ray energy varies following Compton scattering.

Section III: Additional Activities to be conducted during the semester (Any-3)

1. Mini Projects with report (Minimum 10 pages with completion certificate daily signed by project guide and HOD of Department).
2. Study tour / Industrial visit / Field visit with report.
3. Plotting of any two graphs using spreadsheets (of data obtained from various experiments performed by the student in the semester).
4. Any two computer aided demonstrations (Using computer simulations or animations on YouTube).
5. Demonstrations – Any one demonstrations of other experiments.

Study tour: Student have to participate in study tour organized by department to study about physics in Industry / Company / Organization / Research Institute / Research organization / Small scale industry / University Department and compulsory submitted study tour report.

Note: Students have to perform **12**-experiments (6-experiments from Section-I and 6 experiments form Section-II)

And

Participated in additional any **three** activities equivalent to **3-experiments** with 12-experiments. Total laboratory work with additional activities should be **15**-experiments.

References :

1. B. L. Flint and H.T. Worsnop, “*Advanced Practical Physics for students*”, Asia Publishing House, 1971.
2. Michael Nelson and Jon M. Ogborn, “*Advanced level Physics Practical*”, 4th Edition, Heinemann Educational Publishers, reprinted 1985.
3. I. Prakash and Ramakrishna, “*A Text Book of Practical Physics*”, 11th Edition, Kitab Mahal, 2011.

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Semester-II

Major Core (Semester-II) (6 Credits) (2T+1P)

Note: Every subject has 2 credits

F.Y.B.Sc. (Physics) (Sem-II)

PHY-151-T : Fundamentals of Physics-II

Lectures: 30 hrs

(Credits-02)

- A) Course Objectives:** - This course aims to introduce Physics of Thermodynamics to the students. Objectives are.
- 1) To Study the basic concepts of Thermal Physics.
 - 2) To Study the basic concepts of electricity and magnetism
 - 3) To impart the knowledge and applications about thermal physics, electricity and magnetism in our day to day life.
- B) Course Outcomes (CO):** Upon Completion of this course, the students will be able to:
- 1) Understand the basic concepts of Thermodynamics and laws of thermodynamics.
 - 2) Identify the different states of system and their dependence on various thermodynamic variables.
 - 3) Understand different thermodynamic processes and their applications.
 - 4) Understand different heat engines and their working principles.
 - 5) Learn the heat radiation mechanism and relate this course to the daily chores through some applications.
 - 6) Understand concept of electricity and magnetism.
- C) Instructional Design:** -
- 1) Lecture Method
 - 2) Tutorial Method
 - 3) Seminars
 - 4) Use of Multimedia
 - 5) Creation of online resources
- D) Evaluation Strategies**
- 1) Descriptive written exam
 - 2) Assignments
 - 3) Seminars, Oral, Viva.
- E) Prerequisites:**
- Physics Fundamentals:** Knowledge about the basic physical quantities and their SI and CGS unit system along with dimensions, and basics concept about electric circuits
- F) Course Contents:** - **Lectures: 30 hrs**

Module - 01	Thermal Physics	15 H
	1.1 Concepts of Heat and Temperature, 1.2 Zeroth law of thermodynamics, 1.3 Thermodynamic variables, and equation of state. (Revision) 1.4 Van der Waal's equation of state, 1.5 First Law of Thermodynamics and its differential form (Revision)	

	1.6 Application of the first law of Thermodynamics 1.7 Second law of thermodynamics (Kelvin's & Clausius' statements), 1.8 Carnot's cycle, and its efficiency 1.9 Concept of Entropy, principle of increase of entropy, Entropy of steam 1.10 Applications of Second law of thermodynamics: 1.11 Third law of Thermodynamics 1.12 Applications of Third law of thermodynamics: Numerical problems	
Module - 02	Electrostatics	10 H
	2.1 Concept of Electric Charge, Electrostatic Forces (Coulomb's law) 2.2 Electric lines, field & its Physical significance 2.3 Concept of electric flux 2.4 Gauss's law in electrostatics and its applications 2.5 Concept of Electric Potential 2.6 Concept of Electrostatic Energy 2.7 The four quantities for point charges 2.8 Relationship between Electric Field, Electric Force, Electric Potential, and Electric Potential Energy 2.9 Concept of Electric dipole & Dipole moment 2.10 Torque on a dipole placed in an electric field 2.11 Concept of Dielectric & Polarization 2.12 Relation between E, D & P 2.13 Gauss law in dielectric 2.14 Concept of Capacitor, Capacitance and it applications Numerical Problem	
Module - 03	Magnetostatics	05H
	○ Magnetic Field Lines, Magnetic Force & its properties ○ Biot-Savart's law and its applications ○ Ampere's circuital law and its applications ○ Introduction to Magnetization ○ Types of Magnetic Materials Numerical Problem	

Activities: Conduct **any one** classroom activity during class lecture for each module.

Module 1: Thermal Physics

Activity 1: Perform an activity to understand the concept of Carnot Engine:

Activity 2: Perform an activity to explain the concept of Otto Engine:

Activity 3: Perform an activity to explain the concept of Diesel Engine:

Activity 4: Perform an activity to understand the applications of Thermodynamics first law:

Activity 5: Perform an activity to understand the applications of Thermodynamics second law:

Activity 6: Perform an activity to understand the applications of Thermodynamics third law:

Module 2: Electrostatics

Activity 1: Perform an activity to explain the concept of static charges:

Activity 2: <https://phet.colorado.edu/en/simulations/capacitor-lab-basics>

Use the [link](#) to

1. Explain the relationships between voltage, charge, stored energy, and capacitance
2. Predict how capacitance changes when the plate area or plate separation changes
3. Describe how charge drains away from a capacitor into a light bulb

Module 3: Magnetostatics

Activity 1:

1. Levitating magnets with eddy currents
2. Maglev train
3. Perform an activity to show magnetic field lines using bar magnet and iron filings(particles)

Reference Books:

- 1) Concept of Physics: H. C. Verma, Bharati Bhavan Publisher.
- 2) Heat and Thermodynamics: Brijlal, N. Subrahmanyam, S. Chand and Company Ltd.
- 3) Heat and Thermodynamics: Mark W. Zemansky, Richard H. Dittman, 7th Edition, Mc-Graw Hill, International Edition.
- 4) Thermodynamics and Statistical Physics: J. K. Sharma, K. K. Sarkar, Himalaya Publishing House.
- 5) Thermal Physics (Heat and Thermodynamics): A. B. Gupta, H. P. Roy books and Allied (P) Ltd. Calcutta.
- 6) Instrumentation: Devices & Systems by Rangan, Mani, and Sarma.
- 7) Theory and Experiments on Thermal Physics by P. K. Chakrabarti, New Central Book Agency (P) Ltd. Landon.
- 8) Electricity and Magnetism: Brij Lal, N. Subramanyan, S. Chand & Co.
- 9) Electricity and Magnetism : R. Murugesan, S. Chand & Co.
- 10) Concept of Physics : H. C. Verma
- 11) Fundamentals of Physics: D. Halliday and R. Resnick and J. Walker, Wiley Publications
- 12) Electromagnetics: B.B. Laud, New Age International (P) Ltd.
- 13) Electricity and Electronics: D.C. Tayal, Himalaya Publishing House, Mumbai
- 14) Introduction to Electrodynamics: D.G. Griffith, Pearson Publications
- 15) Electricity and Magnetism: N.S. Khare and S.S. Shrivastav, Atmaram and Sons
- 16) Classical Electromagnetism: H.C. Verma, Bharati Bhavan Publisher

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F.Y.B.Sc. (Physics) (Sem-II)

PHY-152-P : General Physics Lab-II

Lectures: 60 hrs

(Credits-02)

- A) Course Objectives:** - This course aims to introduce the practical related with thermal Physics and Electricity and Magnetism.
- B) Course Outcomes:** The practical knowledge of Thermodynamics, Electricity and magnetism doing experiments: Engine, electric vibrations. They would also learn electric phenomena such as diode, CRO and do experiments related to electric devices.

Section I: Thermal Physics (any 6)

Sr.No	Title of the Experiments
1	To determine the Coefficient of Thermal Conductivity by Lee's method.
2	To determine the Specific Heat of Graphite.
3	To study the Carnot's cycle by drawing graphs of Isothermal and Adiabatic curves.
4	To investigate the first law and Second law of thermodynamic using heat Engine
5	To study the 2 / 4-Stroke Petrol Engine.
6	To study the 4-Stroke Diesel Engine.
7	To determine the Temperature Coefficient of Thermistor.
8	To study the Thermocouple as a Thermometer
9	To determine the Calorific Values of Different Fuels.
10	To determine the Temperature Coefficient of Resistivity of PTC / NTC type Material.
11	To determine the Coefficient of Linear Expansion of Metals.
12	To determine the specific heat capacity of water by electrical method.
13	To determine the specific heat capacity of a given solid by the method of mixtures.

Section II: Electricity and Magnetism (any 6)

Sr. No	Title of the experiments
1	Study of Kirchhoff's Voltage and Current Law.
2	Study of AC and DC Voltage Sensitivity by using CRO.
3	Study of I-V Characteristics of p-n Diode and Zener Diode.
4	Study of Charging and Discharging of a Capacitor.
5	Study of L-R Circuit
6	Study of Impedance of series LCR series circuit.
7	Study of Series and Parallel circuit using Capacitor (Voltage-Current Division Rule)
8	Determination of Frequency of AC by using Sonometer.
9	Study of Digital Multimeter for measuring (i) Resistances, (ii) AC and DC Voltages, (iii) DC Current, and (iv) checking electrical fuses.
10	Comparison of Capacitor using De Sauty's Method
11	Measurement of Dielectric Constant using Schering Bridge Experiment
12	Charges and Fields 1.0.59 (colorado.edu) :

	To study lines of forces and electric field due to a dipole. Place 1 nC charge at 2m apart and determine the electric field at given positions(0,0,), (1,0), (0,1), (0,-1), (-1,0), (2,0), (3,0), (2,1),(2,-1), (1,1),(-1,-1) and also draw equipotential surface for 1 V, 2 V, 3 V, 5 V, 10 V, 20 V and -1V, -2V, -3V, -5V, -10V, -20V
13	To verify Ampere's Law experimentally by graphing the magnetic field strength.

Section III: Additional Activities to be conducted during the semester (Any Three)

1. Mini Projects with report.
2. Study tour / industrial visit / Field visit with report.
3. Plotting of any two graphs using spreadsheets (of data obtained from various experiments performed by the student).
4. Any two computer aided demonstrations (Using computer simulations or animations).
5. Demonstrations – Any one demonstrations.

Study tour: Student have to participate in study tour organized by department to study about physics in Industry / Company / Organization / Research Institute / Research organization / Small scale industry / University Department and compulsory submitted study tour report.

Note: Students have to perform **12**-experiments (6-experiments from Section-I and 6 experiments form Section-II)

And

Participated in additional any **three** activities equivalent to **3-experiments** with 12-experiments. Total laboratory work with additional activities should be **15**-experiments.

References :

1. B. L. Flint and H.T. Worsnop, “*Advanced Practical Physics for students*”, Asia Publishing House, 1971.
2. Michael Nelson and Jon M. Ogborn, “*Advanced level Physics Practical*”, 4th Edition, Heinemann Educational Publishers, reprinted 1985.
3. I. Prakash and Ramakrishna, “*A Text Book of Practical Physics*”, 11th Edition, Kitab Mahal, 2011.
4. D. P. Khandelwal, “*A Laboratory Manual of Physics for undergraduate classes*”, Vani Publication, 1985,

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Syllabus for F.Y.B.Sc. as per NEP-2020

Subject: Mathematics

Semester - I

MTS 101-Algebra and Calculus I

Course type: Theory

No. of Credits: 02

Course Objectives: This course aims

1. To provide a first approach to Algebra, a basic pillars of mathematics.
2. To cover the basic knowledge of integers and polynomials.
3. To study the theory of integers and polynomials.
4. To establish the fundamental theorem and applications of single variable functions.
5. To understand real numbers and its properties.
6. To understand the concept of limiting process, and continuity in terms of limit.
7. To develop mathematical thinking and skills.

Course Outcomes: The student will able

1. To know the concept of divisibility in integers.
2. To find Greatest Common Divisor of integers using the Euclidean algorithm.
3. To understand the concept of Fermat's theorem and Euler's phi function.
4. To understand the method of finding roots of polynomials and relationship between roots and coefficients of a polynomial.
5. To classify real numbers and recognize various properties of real numbers.
6. To understand the concept of limit and continuity.
7. To draw the graphs of algebraic and transcendental functions considering limits and continuity.
8. To apply the concept of limit and continuity for advanced study of different mathematics courses, and in physical, chemical and biological sciences.

Course Content

Section I: Algebra

Unit 1: Integers

(09 Hours)

- 1.1 Well Ordering Principle and Principle of Mathematical Induction (First Principle).
- 1.2 Divisibility in integers ($\mathbb{Z}$) -Definition and elementary properties, Division algorithm, Greatest Common Divisor (GCD), Least Common Multiple (LCM) of integers, basic properties of GCD, Euclidean Algorithm, relatively prime integers.

- 1.3 Prime numbers- Definition, fundamental theorem of Arithmetic, Euclid's lemma, Theory of Congruences, basic properties, Fermat's theorem, Euler's phi function, Euler's theorem.

Unit 2: Polynomials

(06 Hours)

- 2.1 Definition of a polynomial, degree of a polynomial, algebra of polynomials, division algorithm (Statement only) and examples, Greatest Common Divisor (GCD) of two polynomials (Definition and examples).
- 2.2 Synthetic division, Remainder theorem, Factor theorem.
- 2.3 Relation between roots and co-efficient of a polynomial.

Reference Books:

1. Elementary Number Theory, David M. Burton, Tata McGraw Hill, Seventh Edition. Chapter 1: Sec. 1.1, Chapter 2: Sec. 2.2, 2.3, 2.4, Chapter 3: Sec. 3.1, Chapter 4: Sec. 4.2, Chapter 5: Sec. 5.2 up to corollary on Theorem 5.1, Chapter 7: Sec. 7.2 only definition, Section 7.3, lemma and Theorem 7.5.
2. Theory of Equations, J. V. Uspensky, McGraw Hill Book Company. Chapter 2, Chapter 3: Sec. 5
3. Textbook of Algebra, S. K. Shah and S. C. Garg, Vikas Publishing House Pvt. Ltd. Edition 2017.

Section II: Calculus

Unit 3: Real Numbers

(06 Hours)

- 3.1 Number system - $\mathbb{N}, \mathbb{Z}, \mathbb{Q}, \mathbb{R}$, Algebraic and Order properties of $\mathbb{R}$.
- 3.2 Absolute Value of a real number, geometrical meaning, Absolute value properties of $\mathbb{R}$, triangle inequality, examples on absolute value of $\mathbb{R}$.
- 3.3 Boundedness of $\mathbb{R}$ - Neighborhood of a point on real line, Intervals, Lower bound, Upper bound and examples, Well Ordering Principle of $\mathbb{N}$, Supremum and Infimum of a subset of $\mathbb{R}$ and examples, Completeness property of $\mathbb{R}$.

Unit 4: Limits and Continuity

(09 Hours)

- 4.1 Limit of Real valued function-Definitions and examples, Algebra of limits and examples.
- 4.2 Limit theorems- Squeeze theorem and some results, one sided limits and limits at infinity and examples.
- 4.3 Continuity - Definition of deleted neighborhood of a point, Continuity of a function at a point - Definitions and examples, Algebra of continuous functions, properties, Continuity on an interval - Definition and examples, Bounded function, Boundedness theorem (Statement only), Absolute maximum and minimum of a function - definition, Maximum-Minimum theorem (statement only), Location of roots theorem statement only), Bolzano's theorem (statement only) the intermediate value theorem

Text Books:

1. Calculus, Vol. I: One Variable Calculus with an Introduction to Linear Algebra- Tom M. Apostol, Second Edition, Reprint 2011, Wiley Students Edition, John Wiley and Sons Inc., U.K

- (a) Introduction Part 3: 1.3.1, 1.3.2, 1.3.4, 1.3.7, 1.3.8, 1.3.13 (without Theorem 1.3.5), 1.4.3, 1.4.8 (Theorem 1.3.8, Theorem 1.3.9, Theorem 1.4.0)
- (b) Chapter 3: 3.2, 3.3, 3.4, 3.5 - Theorem 3.2, Theorem 3.3, Theorem 3.4, Theorem 3.6, Theorem 3.7, Theorem 3.8, Theorem 3.10, Theorem 3.11 (without proof), Theorem 3.12.

Reference Books:

1. Introduction to Real Analysis - R. G. Bartle and D. R. Sherbert, Third Edition, John Wiley and Sons, Inc.
 - (a) Chapter 1: Section 1.2 - 1.2.1, 1.2.2, 1.2.3.
 - (b) Chapter 2: Section 2.1: 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.1.6, 2.1.7 Theorem), 2.1.8 (Theorem), 2.1.9 (Statement only), 2.1.10 (Theorem), 2.1.11, 2.1.12, 2.1.13. Section 2.3: 2.3.1, 2.3.2, 2.3.3, 2.3.6, 2.4.3, 2.4.8, 2.4.9.
2. Differential Calculus- Shantinayan Tenth Revised Edition
3. Introduction to Real Analysis - William F. Trench, Free Edition, 2010.
4. Calculus of single Variable - Ron Larson, Bruce Edwards, Tenth Edition.
5. Elementary analysis: the theory of Calculus - Kenneth A. Ross, Second Edition, Springer Publication.

MTS 102 - Practicals based on MTS-101 (Algebra and Calculus I)

Course type: Practical

No. of Credits: 02

IKS 101 MTS: Generic IKS

Course type: IKS

No. of Credits: 02

Semester - II

MTS-151:Algebra and Calculus II

Course type: Theory

No. of Credits: 02

Course Objectives:

1. To study matrix properties, algebraic properties, and methods for finding the inverse of a matrix.
2. To explore the solution of systems of linear equations and evaluate determinants by row reduction.
3. To learn the properties of determinants and study the applications of matrices and determinants.
4. To learn how to find the derivative of a function using limits, and understand the geometrical and physical significance of derivatives.
5. To explore methods to find the n^{th} derivatives of functions.
6. To generalize the comprehensive study of combined algebra and calculus.

Course Outcomes: The successful completion of these course students will able to:

1. Understand the various types of matrices, their properties, and how to convert matrices to echelon form using elementary row operations.
2. Learn methods to solve systems of linear equations, understand the concept of determinants, evaluate determinants by different methods, and solve problems using properties of determinants.
3. Apply the concept of matrices and determinant to the problems in chemistry, electronics, cryptography, etc.
4. Understand differentiation and fundamental theorem in differentiation.
5. Apply Mean Value Theorems and it's applications
6. Explore the combined application of algebra and calculus to various mathematical problems.

Course Content

Unit 1 : Systems of Linear Equations and Matrices: (08 Hours) Section I: Matrix Algebra

- 1.1 Matrices and Matrix Operations.
- 1.2 Inverses; Algebraic Properties of Matrices
- 1.3 Elementary Matrices and a Method for Finding A^{-1}
- 1.4 Matrix, Matrix Notation and Size of Matrix.

- 1.5 Diagonal, Triangular, and Symmetric Matrices [Definitions and examples only]
- 1.6 More on Linear Systems and Invertible Matrices
- 1.7 Introduction to Systems of Linear Equations
- 1.8 Gaussian Elimination Method.

Note: Theorems 1.4.1,1.4.3,1.4.8,1.5.3,1.6.1-1.6.4,1.7.1 are without proof.

Unit 2: Determinants

(07 Hours)

- 2.1 Determinants by Cofactor Expansion.
- 2.2 Evaluating Determinants by Row Reduction.
- 2.3 Properties of Determinants; Cramer's Rule (Without Proof).
- 2.4 Applications towards Balancing Chemical Equations.
- 2.5 Applications in Cryptography.

Note: Theorems 2.1.1, 2.1.2, 2.2.3, 2.2.4, 2.3.1, 2.3.6, 2.3.8 are without proof

Recommended book:

1. Elementary Linear Algebra by Howard Anton, Chris Rorres, 11th Edition [Applications Version] Unit 1: Section 1.1 to 1.7 , Unit 2: Section 2.1 to 2.3, 2.4 [1.10 Balancing Chemical Equations]

Reference Books:

1. Matrix and Linear Algebra by K. B. Datta, Prentice Hall India Pvt., Limited, 2004.
2. Fundamentals of Matrix Algebra, (3rd Edition) by G. Hartman
3. Linear Algebra and its Applications, David Lay, Third Edition, Pearson Publications.

Section II: Calculus

Unit 3: Differentiation

(06 Hours)

- 3.1 The Derivative as a Function.
- 3.2 Differentiation Rules
- 3.3 The Derivative as a Rate of Change
- 3.4 Derivatives of Trigonometric Functions
- 3.5 The Chain Rule
- 3.6 Applications

Unit 4: Mean Value Theorems

(09 Hours)

- 4.1 Extreme Values of Functions.
- 4.2 The Mean Value Theorem
- 4.3 L'Hospital's Rule (without proof)

4.4 Cauchy's Mean Value Theorem

Recommended book:

1. Applied Finite Mathematics by R. Sekhon and R. Bloom, Libre Texts. Unit 2 (2.5): Section 2.5
2. Thomas Calculus: EARLY TRANSCENDENTALS (12th Edition), Pearson Education
Unit 3: Section 3.2 - 3.6 and 3.10 Unit 4: Section 4.1 - 4.2 and 4.5

Reference Books:

1. Calculus Volume I (Second Edition) Wiley Student Edition, T. M. Apostol, John Wiley, New Delhi.
2. Elements of Real Analysis, Shanti Narayan, M. D. Raisinghaniya (Revised Edition 2012), S. Chand and Company Ltd.

MTS 152 - Practicals based on MTS-151 (Algebra and Calculus II)

Course type: Practical

No. of Credits: 02

F. Y. B. Sc. Botany [Semester - I]**Course Code - BOT-101-T****Course Title: Applied Aspects of Plant Sciences****[No. of Credits: 2 C]****[No. of Lectures: 30 L]**

Sr. No.	Topic Details	No. of Lectures
	Credit I	15
1	Introduction to Applied Plant Sciences 1.1. Overview of key concepts and principles 1.2. Importance of applied plant sciences in addressing global challenges.	02
2	Plant Biotechnology 2.1. Genetic engineering techniques in crop improvement. 2.2. Plant Tissue Culture for improvement of crop productivity. 2.3. Biopharmaceuticals and plant-derived drugs. 2.4. Applications of biotechnology in plant breeding and biotic/abiotic stress tolerance.	04
3	Precision Agriculture 3.1. Remote sensing and GIS applications in agriculture. 3.2. Use of drones and sensors for crop monitoring and management.	03
4	Sustainable Agriculture Practices 4.1. Organic farming methods and principles. 4.2. Integrated pest management strategies.	03
5	Plant-Microbe Interactions 5.1. Role of plant-associated microbes in plant health and productivity. 5.2. Applications of beneficial microbes in agriculture.	03
	Credit II	15
6	Climate Change and Plant Sciences 6.1. Impact of climate change on plant growth and agriculture. 6.2. Strategies for mitigating climate change effects through plant science interventions.	03
7	Urban Agriculture and Vertical Farming 7.1. Challenges and opportunities in urban agriculture. 7.2. Vertical farming technologies and their applications. 7.3. Ornamental plant cultivation. 7.4. Urban gardening and landscaping.	03
8	Plant Health and Disease Management 8.1. Diagnosis and management of plant diseases. 8.2. Emerging technologies for disease detection and control.	03
9	Postharvest Technology 4.1. Techniques for prolonging shelf life and maintaining quality of harvested produce. 4.2. Importance of postharvest management in reducing food loss and waste.	03
10	Environmental applications 10.1. Plant ecology and conservation 10.2. Ecological restoration techniques 10.3. Phytoremediation and air purification.	03

References:

1. "Principles of Applied Botany" by Mary E. Gressel
2. "Applied Plant Science: Principles and Practices" by Pamela M. Vance and Vance C. Ostolaza.
3. "Plant Pathology" by George N. Agrios.
4. "Soil Science: Principles and Practices" by R.K. Mehra.
5. "Principles of Plant Biotechnology" by P.K. Gupta.
6. "Principles of Weed Science" by S.S. Hundal.
7. "Introduction to Horticulture" by Kumar and Singh.
8. "Plant Physiology" by Pandey and Sinha.
9. "Principles of Plant Pathology" by S.N. Agarwal.
10. "Principles of Agronomy" by S.R. Reddy and G.H. Sankara Reddy.
11. "Plant Breeding: Principles, Methods and Applications" by B.D. Singh.
12. "Postharvest: An Introduction to the Physiology and Handling of Fruit, Vegetables and Ornamentals" by R. Wills, B. McGlasson, D. Graham, and D. Joyce
13. "Plant Nutrition and Soil Fertility Manual" by J. Benton Jones Jr.
14. "Sustainable Agriculture" edited by Eric Lichtfouse
15. "Crop Production: Evolution, History, and Technology" by C. Wayne Smith and Julian R. Smith.
16. "Plant Physiology and Development" by Lincoln Taiz, Eduardo Zeiger, Ian M. Møller, and Angus Murphy.
17. "Plant Biotechnology and Agriculture: Prospects for the 21st Century" edited by Arie Altman and Paul Michael Hasegawa.
18. "Principles of Plant Genetics and Breeding" by George Acquaah.
19. "Remote Sensing Applications in Agriculture: Opportunities and Constraints" edited by B.S. Bhattacharya and S.K. Ghosh.
20. "Precision Agriculture: Technology and Economic Perspectives" edited by P. Sengupta and S. Shankar.
21. "Precision Farming in Horticulture: Approaches and Applications" edited by Debashis Mandal, V.K. Gupta, and R.N. Pal.
22. "Smart Technologies for Sustainable Smallholder Agriculture: Upscaling in Developing Countries" edited by Justice O. Alabi and Harjit Kaur.
23. "Precision Agriculture: Principles and Applications" edited by Manjit Singh and Rajan Bhatia.
24. "Climate Change and Agriculture: Adaptation Strategies and Mitigation Options" edited by Mannava V.K. Sivakumar, Raju Goyal, and Ashwani Kumar.
25. "Climate Change and Plant Biodiversity" edited by Dinesh Kumar and Anil K. Singh.
26. "Climate Change and Agricultural Ecosystems" edited by Mannava V.K. Sivakumar and James Hansen.
27. "Plant Responses to Climate Change: From Molecular to Ecosystems Perspective" edited by Chittaranjan Kole.
28. "Climate Change and Plant Abiotic Stress Tolerance" edited by Narendra Tuteja, Sarvajeet Singh Gill, Antonio F. Tiburcio, and Renu Tuteja.
29. "Urban Agriculture: Policy, Law, Strategy, and Implementation" by Mark Roseland and Wayne J. Caldwell.
30. "Vertical Farming: Concepts, Applications, and Challenges" edited by Kotikalapudi Sriram and Anuj Bhatia.
31. "Rooftop Urban Agriculture" by Francesco Orsini, Marielle Dubbeling, and Henk de Zeeuw.
32. "Urban Agriculture: A Global Perspective of the Role of Cities in Food Systems" edited by René van Veenhuizen.
33. "Vertical Farming: Sustainable Indoor Agricultural Systems" edited by Toyoki Kozai, Genhua Niu, and Michiko Takagaki.

F. Y. B. Sc. Botany [Semester - I]**Course Code – BOT-102-P****Course Title: Practical Based on BOT-101-T****[No. of Credits: 2 C]****[No. of Lectures: 60 L]**

Sr. No.	Title of the Practical	No. of Practical
1	Study of principles, working and practical applications of instruments and equipment used in plant tissue culture - pH meter, Autoclave, Hot air oven, Laminar Air Flow, Micropipettes, Digital One Pan Balance, Glass Distillation Unit).	1 P
2	Demonstration of genetically modified crops – Bt –Cotton, Bt-Maize, Golden Rice, Round-up ready Soybean.	1 P
3	Estimation of soil organic carbon by using Walkley-Black or Similar method (Wet oxidation).	1 P
4	To study the degradation of toxic textile dyes using plant biomass and its characterization using UV-Spectrophotometer and/or FTIR.	1 P
5	Study of petiole analysis of stressed and unstressed plants.	1 P
6	To demonstrate the composting of kitchen waste for the preparation of biofertilizer.	1 P
7	Demonstration of <i>Azolla</i> cultivation, nutrition and production attributes and its application as biofertilizer.	1 P
8	Preparation of 'Sanjivani Amrut' and its application to the crop and garden plants.	1 P
9	To study the effect of Mycorrhiza on growth attributes of crop plants.	1 P
10	Study on preparation of Dashparni Ark and EM solution.	1 P
11	Study of various plant-associated microbes useful in improvement of plant health and productivity – Rhizobia – <i>Rhizobium</i> ; Mycorrhizal Fungi - arbuscular mycorrhizal fungi (AMF) such as <i>Glomus</i> spp., and ectomycorrhizal fungi (ECM) like <i>Laccaria</i> spp. and <i>Pisolithus</i> spp.; Plant Growth-Promoting Rhizobacteria (PGPR) - <i>Pseudomonas</i> , <i>Bacillus</i> , and <i>Azospirillum</i> spp.; Endophytic fungi - <i>Trichoderma</i> and <i>Claviceps</i> spp.; Nitrogen-Fixing Cyanobacteria: <i>Nostoc</i> .	1 P
12	To demonstrate the Post-Harvest techniques w.r.t. preparation of amla candy and alepak (Zinger wadi), aloe-vera gel.	1 P
13	To study the vertical farming structures for its application in urban agriculture or vertical gardening.	1 P
14	Demonstration of Hydroponics and aeroponics.	1 P
15	Visit to the nursery for the exploration of exotic ornamental plants and preparation of visit report for their application in in-door gardening practices.	1 P
16	Visit to the plant based industry for exploring the products and byproducts of the industry and its importance in the economics.	1 P
17	Case study on ecological restoration of the any environmental site available in nearby locality.	1 P

Note: Conduct any 15 practical's from the above mentioned list.

F. Y. B. Sc. Botany [Semester - II]**Course Code - BOT-151-T****Course Title: Basics of Plant Sciences****[No. of Credits: 2 C]****[No. of Lectures: 30 L]**

Sr. No.	Topic Details	No. of Lectures
	Credit I - PLANT KINGDOM	15
1	Introduction to Plant Diversity 1.1. Definition and concept of Plant Diversity. 1.2. General outline of Plant Kingdom.	01
2	Algae 2.1. Introduction, definition and characters of Algae, suitable examples. 2.2. Economic and Biotechnological Importance of Algae – 2.2.1. Algae as food: nutritional value and culinary uses. 2.2.2. Algae in industry: biofuels, pharmaceuticals, and bioremediation. 2.2.3 Biotechnological applications: algae cultivation, genetic engineering, and algae-based products. 2.2.4. Future prospects and challenges in algae research and utilization.	02
3	Fungi 3.1. Introduction, definition and general characters of fungi; suitable examples. 3.2. Ecological and Economic Importance of Fungi – 3.2.1. Fungi in nutrient cycling and decomposition. 3.2.2. Symbiotic relationships: mycorrhizae, lichens. 3.2.3. Pathogenic fungi and their impact on plants, animals and humans. 3.2.4. Economic importance of fungi in industry and agriculture. 3.2.5. Fungi in food production and fermentation processes.	02
4	Lichen 4.1. Introduction; definition and general characters of lichen; Types– crustose, foliose and fruticose. 4.2. Importance of Lichen – 4.2.1. Ecological significance: contribution to nutrient cycling, soil formation, and erosion control; Role of lichens as bio-indicators of environmental health. 4.2.2. Cultural significance: use in traditional medicine, dyeing, and food for some cultures 4.2.3. Economic significance: use in pharmaceuticals, cosmetics, and environmental monitoring.	02
5	Bryophytes 5.1. Introduction; definition and general characters; suitable examples. 5.2. Ecological and Economic Importance of Bryophytes – 5.2.1. Ecological Importance of bryophytes - in Ecosystems, Soil	02

	formation and Stabilization, Habitat creation, Water retention and nutrient cycling. 5.2.2. Economic Importance of bryophytes – role of mosses in horticulture and landscaping, traditional and modern uses of bryophytes in medicine, economic value of bryophytes in industries such as forestry and agriculture.	
6	Pteridophytes 6.1. Introduction; definition and general characters; suitable examples. 6.2. Ecological and Economic Importance of Pteridophytes – 6.2.1. Ecological Importance of Pteridophytes - Role of Pteridophytes in plant evolution; transition from aquatic to terrestrial habitat; Contribution to ecosystem diversity; Role in soil stabilization and conservation. 6.2.2. Economic Importance of Pteridophytes – Ornamental uses: landscaping and indoor plants; Medicinal uses: traditional and modern applications.	02
7	Gymnosperms 7.1. Introduction; definition and general characters of gymnosperms; suitable examples. 7.2. Ecological and Economic Importance – 7.2.1. Ecological roles of gymnosperms in various ecosystems; adaptations to environment. 7.2.2. Economic significance: timber, paper, resin, ornamental and medicinal uses, etc.	02
8	Angiosperms 8.1. Introduction; definition and general characters of angiosperms; suitable examples. 8.2. Ecological and Economic importance of Angiosperms: – 8.2.1. Ecological Importance of Angiosperms: Role as Primary producers, in habitat and biodiversity, soil conservation, water regulation; pollinator support. 8.2.2. Economic Importance of Angiosperms: Food, Fodder, Fiber, Medicine, Timber, Ornamental, Horticulture and Landscaping, Biofuel production, Ecosystem services (carbon sequestration, oxygen production, soil stabilization, and water filtration), etc.	02
	Credit II – PLANT MORPHOLOGY	15
9	Introduction to Plant Morphology 9.1. Introduction, Definition; Types of morphology – Descriptive and Interpretative. 9.2. Importance of Morphology.	01
10	Root Morphology 10.1. Definition, Parts / regions of root; Types – Tap root and fibrous / adventitious root. 10.2. Modifications of roots – Aerial roots (Hanging roots) with velamen tissue in Epiphytes; Haustorial (sucking) roots in Parasites - <i>Cuscuta</i>,	02

	Respiratory roots / Pneumatophores in Mangrove; Fleshy / Storage roots - Conical, Fusiform, Napiform, and Tuberous roots; Roots modified for Mechanical supports – Stilt, Prop, Climbing, and Clinging roots with examples. 10.3. Functions of roots.	
11	Stem Morphology 11.1. Definition, Parts of stem – nodes, internodes, buds, types of buds (Apical, Axillary, Accessory Adventitious and Floral). 11.2. Types of stem – a) Erect – Strong, Weak (Creepers, Trailers and Climbers); b) Prostrate – Procumbent, Decumbent and Diffuse; Modifications of stem – a) Aerial – Phylloclade, Bulbil b) Sub-aerial – Runner, Sucker, Stolon, Offset; c) Underground – Rhizome, Corm, Tuber, Bulb (Tunicated and Scaly). 11.3. Functions of stem.	02
12	Leaf Morphology 12.1. Definition, Parts of leaf; Stipule, Petiole, Leaf margins, Apices and Base, Surface, Venation, Phyllotaxy, Leaf duration (Caducous, Deciduous, Persistent- Evergreen). 12.2. Types of leaves – Simple and Compound – Pinnately (Unipinnate – Paripinnate and Imparipinnate; Bipinnate, Tripinnate and Decompound) and Palmately (Uni-, Bi-, Tri-, Quadri- and Multifoliate); Leaf Modifications: Tendrils, Spines, Phyllode, Scaly, Reproductive, Trap leaves. 12.3. Functions of leaves.	02
13	Morphology of Inflorescence 13.1. Definition, Parts of Inflorescence. 13.2. Types of Inflorescence – a) Racemose – i) Main Axis Elongated – Raceme, Spike, Catkin, Spadix; ii) Main Axis Shortened – Umbel and Corymb; iii) Main Axis Flattened – Capitulate, Head / Capitulum; b) Cymose – Solitary, axillary, Terminal, Uniparous (Monochasial) – Helicoid and Scorpoid, Biparous (Dichasial), Multiparous (Polychasial) Cyme; c) Special Type – Verticillaster, Cyathium, Hypanthodium.	02
14	Morphology of Flower 14.1. Definition, typical structure of flower. 14.2. Types of flowers based on Symmetry, Insertion of floral whorls on thalamus. 14.3. Floral whorls – I) Accessory whorls: a) Calyx: member - sepals, number, cohesion, types of calyx; Modifications of calyx – Petaloid, Pappus, Spurred; b) Corolla: member – petals: Claw and Limb; number, cohesion, types / forms of corolla – Polypetalous Regular – Cruciform, Caryophyllous, Rosaceous; Polypetalous irregular – Papillionaceous; Gamopetalous Regular – Tubular, Infundibuliform, Campanulate, Salvar shaped, Rotate; Gamopetalous Irregular – Bilabiate, Personate and Ligulate;	05

	c) Perianth: member – tepals, number, cohesion, modifications – sepaloid and petaloid tepals. Aestivation – Definition; aestivation in calyx, corolla and perianth; types of aestivation. II) Necessary / Essential whorls: a) Androecium: member – stamen, Structure of stamen; Cohesion and Adhesion; b) Gynoecium: member – Carpel / Pistil; structure of carpel; Types of gynoecium based on carpel number and fusion; Placentation- Definition; types – Marginal, Parietal, Axile, Free-central, Basal, superficial.	
15	Morphology of Fruit and Seed 15.1. Fruit: Definition and parts of fruit. 15.2. Seed: Definition, Parts of typical seed.	01

References:

1. Ainswarth, Sussman and Sparrow (1973). The Fungi. Vol. IV-A and IV-B. Academic Press.
2. Bendre, Ashok and Kumar, Ashok (1993). A Text Book of Practical Botany, Rastogy Publications, Meerut.
3. Bilgrami, K.S. and Saha, L.C. (1992) A Textbook of Algae. CBS Publishers and Distributors, Delhi.
4. Chamberlain, C.J. (1934). Gymnosperms- Structure and Evolution. Chicago.
5. Coulter, J.M. and Chamberlain, C.J. (1917). Morphology of Gymnosperms. Chicago.
6. Davis, P.H. and Heywood, V.H. (1963). Principles of Angiosperms taxonomy. Oliver and Boyd Publ. London.
7. Dube, H.C. (1990). An Introduction to Fungi. Vikas Publishing House Pvt. Ltd., Delhi.
8. Dutta, S.C. (1988). Systematic Botany. Wiley Eastern Ltd., New Delhi.
9. Eames, E.J. (1983). Morphology of Vascular Plants. Standard University Press.
10. Gangulee and Kar (2006). College Botany. New Central Book Agency (P.) Ltd. Kolkata.
11. Gangulee, Das and Dutta (2002). College Botany. Vol. I, New Central Book Agency (P) Ltd.
12. Krishnamurty, V. (2000). Algae of India and neighboring countries, Chlorophyta, Oxford and IBH, New Delhi.
13. Naik, V.N. (1994). Taxonomy of Angiosperms. Tata McGraw Hill Publishing Comp., New Delhi.
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15. Parihar, N.S. (1980). Bryophyta, An Introduction of Embryophyta. Vol. I. Central Book Distributors, Allahabad.
16. Puri, P. (1980). Bryophyta: Broad prospective. Atma Ram & Sons, Delhi.
17. Rashid, A. (1999). An Introduction to Pteridophyta. Vikas Publishing House Pvt. Ltd. New Delhi.
18. Sharma, O.P. (1990). Text Book of Pteridophyta. McMillan India Ltd. Delhi.
19. Singh, V. and Jain, D.K. (2010). Taxonomy of Angiosperms. Rastogy Publications, Meerut.
20. Singh, V., Pande, P.C., and Jain, D.K. (2011). A Text Book of Botany: Angiosperms. Rastogy Publications, Meerut.

21. Smith, G.M. (1955). Cryptogamic Botany Vol. II. McGraw Hill.
22. Smith, G.M. (1971). Cryptogamic Botany. Vol. I: Algae & Fungi. Tata McGraw Hill Publishing Co., New Delhi.
23. Smith, G.M. (1971). Cryptogamic Botany. Vol. II: Bryophytes & Pteridophytes. Tata McGraw Hill Publishing Co., New Delhi.
24. Sporne, K.R. (1986). The Morphology of Pteridophytes. Hutchinson University Library, London.
25. Sundar Rajan, S. (1999). Introduction to Pteridophyta. New Age International Publishers, New Delhi.
26. Vashishta, P.C., Sinha, A.R. and Kumar, Anil (2006). Gymnosperms. S. Chand and Comp. Ltd. New Delhi.
27. Vashista, B.R., Sinha A.K. and Kumar, A. (2008). Botany for degree students- Pteridophyta, S. Chand and Comp. Ltd. New Delhi.
28. Vashista, B.R., Sinha, A.K. and Singh, V.B. (2005). Botany for degree students- Algae, S. Chand Publication.
29. Vashista, B.R., Sinha, A.K. and Singh, V.B. (2005). Botany for degree students- Fungi, S. Chand Publication.
30. Vashista, B.R., Sinha, A.K. and Singh, V.B. (2005). Botany for degree Students- Bryophytes, S. Chand Publication.
31. Plant Systematics by Michael G. Simpson, Elsevier, Academic Press.
32. Plant Systematics – An Integrated approach. Third edition, by Gurucharan Singh, Science Publishers.

F. Y. B. Sc. Botany [Semester - II]**Course Code - 152-BOT-P****Course Title: Practical Based on BOT 151-BOT-T****[No. of Credits: 2 C]****[No. of Lectures: 60 L]**

Sr. No.	Title of the Practical	No. of Practical
1	Study of life cycle of <i>Spirogyra</i> w.r.t. thallus, cell structure and reproduction.	1 P
2	Study of life cycle of <i>Albugo</i> w.r.t. host, occurrence, morphology and reproduction.	1 P
3	Study of forms of lichens on the basis of their external morphology – Crustose, Foliose and Fruticose.	1 P
4	Study of life cycle of <i>Riccia</i> w.r.t. external and internal morphology of thallus and reproduction.	1 P
5	Study of <i>Nephrolepis</i> w.r.t. external morphology of sporophyte; Internal morphology of rachis and leaflet/ pinna passing through sori.	1 P
6	Study of <i>Cycas</i> w.r.t. external morphology of sporophyte; Internal morphology of leaflet / pinna; Reproduction – male and female cone.	1 P
7	Study of comparative account of Dicotyledonous and Monocotyledonous plants with suitable examples.	1 P
8	Study of root w.r.t. its types and modifications.	1 P
9	Study of stem w.r.t. its types and modifications.	2 P
10	Study of leaf w.r.t. its types and modifications.	1 P
11	Study of types of inflorescences.	1 P
12	Study of typical flower w.r.t. floral whorls calyx, corolla, perianth, androecium, gynoecium (<i>Hibiscus, Datura, Brassica, Glyricidia / Clitoria / Bean, Adhatoda / Ocimum, Polyanthus, Bouganvelia, Citrus, Sunflower, Cucurbita</i>)	1 P
13	Study of types of fruits.	1 P
14	Botanical Excursion to nearby locality to study the vegetation and diversity among various plant groups.	1 P

21) Syllabus of Skill Enhancement Courses (SECs) :

F.Y.B.Sc. (Physics) (Sem-I)

SEC-101-PHY-P : Experimental Skills in Physics

Lectures: 60 hrs

(Credits-02[P])

A) Course Objective- The course aims to introduce

1. To understand working principle and its applications the various instruments in physics
2. To impart knowledge about the measurement of physical quantity and its analysis

B) Course Outcomes- Upon completion of the course, the students will able to

1. Understand the working principles of various measuring instruments.
2. Acquire the scientific information of various physical and electrical instruments used in physics practical.
3. Identify the errors in instrument and study their analysis.

C) Instructional Design-

1. Lecture Method
2. Use of Multimedia,
3. Creation of Online resources
4. Seminars

D) Evaluation Strategies-

1. Descriptive
2. Assignments
3. Seminars

E) Course Content- (Any 12 experiments + 3 Experimental Activities)

- 1) To plot the graph of distance verses time, velocity verses time by given data and write the conclusion.
- 2) To determine the least count of instruments like Vernier Calliper, Micrometer Screw Gauge, Travelling Microscope, Spectrometer, etc.
- 3) To determine the inner and outer radius of given pipe by using Vernier Calliper and determine the diameter of pin by using micrometer screw gauge.
- 4) To determine the radius of curvature of the lenses by using spherometer.
- 5) To measurement of relative humidity using hygrometer.
- 6) To find unknown incident power using solar insolation calibration curve.
- 7) To determine the coefficient of viscosity of water by Viscometer.
- 8) To determine the angle of prism by using spectrometer.
- 9) To measure ac, and dc voltage of signals by using CRO.
- 10) To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance.
- 11) To measurement of 'Q' factor using LCR circuit.
- 12) To measure 'Q' of a coil and its dependence on frequency, using a Q-meter.
- 13) To measurement of rise, fall and delay times using a CRO.
- 14) To measure frequency of different signals by using CRO.
- 15) To check and repairing the fault of DC circuit.
- 16) To study how to plot the graph of any single observation on graph paper and how to observe the readings from graphs (e.g. I-V, V-T, I-T, etc.)

- 17) To study how to plot the graph of two or more observations on a single graph. (e.g. Charging and discharging of capacitor, Line and Load regulation, etc.)
- 18) To study and repairing of Power supply.
- 19) To study and repairing of LED bulb or Strip light, etc.
- 20) To study the measurement of sound frequency of audio speaker.
- 21) Calibration of Spectrometer to determine RI of prism.
- 22) To study and measurement of value of resistance, and capacitor using multimeter.
- 23) To measure the viscosity of a liquid using viscometer.

Additional Activities to be conducted related to subject (Any-3)

1. Mini Projects with report.
2. Industrial /Research organization /Working organization /Field visit with report.
3. Any one computer aided demonstrations (Using computer simulations or animations).
4. Demonstrations – Any one demonstrations.

Note: Students have to perform **12-experiments** **and** participated in additional any **three** activities equivalent to **3-experiments** with 12-experiments. Total laboratory work with additional activities should be **15-experiments**.

Reference Books:

1. Digital Circuits and systems - K. R. Venugopal, Tata McGraw Hill Publishing Company Ltd.
2. Electronic circuits: Handbook of design and applications - U. Tietze, Ch. Schenk
3. A text book in Electrical Technology – B. L. Theraja- S. Chand and Co. (Volume III) Publishers, New Delhi
4. BSc Practical Physics, -Harnam Singh, S Chand Publishers, New Delhi
5. Advanced Practical Physics, B.L. Worsnop and H. T. Flint, Khosla Publishing House, New Delhi
6. B.Sc. Practical Physics, Arora C.L., S Chand & Company, New Delhi

*******XoX*******

SEC-154-PHY-P : Basic Lab Electric Devices and Circuits

Lectures: 60 hrs

(Credits-02[P])

- A) **Course Objectives:-** This course aim to introduce “Electric circuits and Networks” to contribute the knowledge of electric elements and its uses, and also aware about Instrumentation and its Industrial Application.
- B) **Course outcome (CO):** Upon completion of the course the student will be able
- 1) To expose the students to the basic concepts of electric elements and their functions.
 - 2) To provide adequate knowledge about the Industrial applications of electric instruments.
 - 3) To provide adequate knowledge about its applications.
 - 4) Students can study Electrical Engineering.
 - 5) Students can understand about devices and systems that use electricity and electromagnetism and their design and application.
- C) **Instructional Design:**
- 1) Lecture method
 - 2) Tutorial method
 - 3) Lab sessions
 - 4) Group projects
 - 5) Seminars,
 - 6) Create online resources: YouTube or other platform
- D) **Evaluation Strategies:**
- Descriptive written examinations, Assignments, Seminars, Orals and Viva, etc.
- E) **Course Contents:** (Any 12 experiments + 3 Experimental Activities)
1. To study of CRO.
 2. To study V-I Characteristics of p-n Junction Diode.
 3. To study V-I Characteristics of Zener Diode and Zener Regulator Characteristics.
 4. To study V-I Characteristics of LED.
 5. To study Half-Wave Rectifier with and without Filter.
 6. To study Full-Wave Rectifier with and without Filter.
 7. To study Bridge-Wave Rectifier with and without Filter
 8. To study output characteristics of Transistor in CB mode.
 9. To study output characteristics of Transistor in CE mode.
 10. To measure h-Parameters of Transistor in CE mode.
 11. To measure h-Parameters of CB Configuration.
 12. To study Drain and Transfer Characteristics of JFET.
 13. To study Frequency Response of CE Amplifier.
 14. To study Frequency Response of CS-FET Amplifier.
 15. To study comparison of performance of Self Bias and Fixed Bias Circuits.
 16. To study applications of Diodes.
 17. To study characteristics of Thermistor.
 18. To study oscillator.
 19. To study simple power supply.
 20. To study introduction to Integrated Circuit (e.g. IC 555).

Additional Activities to be conducted related to subject (Any-3)

1. Mini Projects with report.
2. Industrial /Research organization /Working organization /Field visit with report.
3. Any one computer aided demonstrations (Using computer simulations or animations).
4. Demonstrations – Any one demonstrations.

Note: Students have to perform **12-experiments** **and** participated in additional any **three** activities equivalent to **3-experiments** with 12-experiments. Total laboratory work with additional activities should be **15-experiments**.

References:

- 1) Basic Electronics and Linear Circuit by NN Bhargava, Kulshreshta and SC Gupta, Tata McGraw Hill Education Pvt Ltd., New Delhi.
- 2) Principles of Electrical and Electronics Engineering by VK Mehta; S Chand and Co., New Delhi
- 3) Electrical and Electronics Engineering by SK Bhattacharya, Pearson Education, New Delhi
- 4) Principles of Electronics by SK Bhattacharya and Renu Vig, SK Kataria and Sons, Delhi
- 5) Electronics Devices and Circuits by Millman and Halkias; McGraw Hill.

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Ability Enhancement Course

Subject : English : *Professional Communication Skills*

(Board of Editors) Orient BlackSwan, 2024

Course outcomes:

- CO-1 Read and understand texts in English
- CO-2 Enrich and use vocabulary effectively
- CO-3 Understand and Develop Communicative Competence
- CO-4 Use body language in different situations
- CO-5 Acquaint with digital platforms and technology
- CO-6 Write letter, notice, agenda, minutes and blog

Semester – I

Vertical	Ability Enhancement Course
Course Code	AEC-101
Course Title	English : Professional Communication Skills
Credit	2
Total Hours	30 hours

Unit No.	Topic	Allotted Lectures (L)
1.	Basic Language Skills: A) Grammar 1. Sentence Structures/Patterns 2. Subject - Verb agreement 3. Tenses	10
2.	B) Vocabulary : 1. Synonyms and Antonyms 2. Homonyms 3. One-word substitutes	10

Unit No.	Topic	Allotted Lectures (L)
	4. Idioms 5. Suffixes and prefixes 6. Collocations.	
3.	C) Speaking for Different Purpose: a) Meeting and Greeting People 1. Introducing your Self 2. Introducing People to One another 3. Apologies and Responses 4. Agreeing and Disagreeing 5. General Speaking Strategies b) Group Discussion, Interview and Interviewing Skills 1. Initiating a Group Discussion 2. Continuing a Group Discussion 3. Concluding Group Discussion 4. Preparing for an Interview 5. Facing an Interview 6. Interviewing Techniques c) Presentation Skills 1. Kinds of Presentation 2. Structuring Content 3. Visual Aids 4. The Language of Presentations 5. Making a Presentation	10

Semester – II

Vertical	AEC
Course Code	AEC-102
Course Title	English : Professional Communication Skills
Credit	2
Total Hours	30 hours

Unit No.	Topic	Allotted Lectures (L)
1.	Forms of Writing: 1. Letter Writing 2. Writing Resume 3. Report Writing 4. Notice/ Agenda and Minutes 5. Email 6. Blog Writing	10
2.	Soft Skills a) Introduction to Soft Skills 1. Definitions and Nature 2. Soft Skill vs Hard Skill 3. Importance of Soft Skill 4. Types of Soft Skill b) Soft Skills in Career Prospects 1. Role of Soft Skills in Professional Success 2. Time and Stress Management 3. Decision Making and Moral values 4. Leadership Skills and Team Building 5. Negotiation Skills and Etiquettes	10
3.	Business Communication: 1. Nature and Importance of Business Communication 2. Process of Communication 3. Types of Communication 4. Channels of Communication 5. Digital Communication	10

References

- Ajmani, J. C. *Good English: Getting it Right*. New Delhi: Rupa Publications, 2012.
- Amos, Julie-Ann. *Handling Tough Job Interviews*. Mumbai: Jaico Publishing, 2004.
- Barret Grant. *Perfect English Grammar: The Indispensable Guide to Excellent Writing and Speaking*. Fall River Press, 2016
- Monippally, Matthukutty, M. *Business Communication Strategies*. New Delhi: Tata McGraw-Hill Publishing Company Ltd., 2001.
- Neuliep, James W. *Intercultural Communication: A Contextual Approach*. Boston: Houghton Mifflin Co., 2003.
- Prasad, H. M. *How to Prepare for Group Discussion and Interview*. New Delhi: Tata McGraw-Hill Publishing Company Limited, 2001.
- Pease, Allan. *Body Language*. Delhi: Sudha Publications, 1998
- Raman, Meenakshi & Sangeeta Sharma. *Technical Communication: Principles and Practice*. Second Edition. New Delhi: Oxford University Press, 2011.
- Raymond Murphy. *Essential Grammar in Use with Answers: A Self-Study Reference and Practice Book for Elementary Learners of English*. Cambridge University Press, 2015
- Seely, John. *Writing Reports*. New York: Oxford University Press, 2002.
- Sharma, R. C. & Krishna Mohan. *Business Correspondence and Report Writing*: Third Edition. New Delhi: Tata McGraw-Hill Publishing company Limited, 2007.
- Thill, John V. & Courtland L. Bovée, *Excellence in Business Communication*, 10th edition. Boston : Pearson, 2013.
- Thorpe, Edgar & Showick Thorpe. *Winning at Interviews*. 2nd Edition. Delhi: Dorling Kindersley, 2006.

VEC-101-T: Environment Education-I

Course type: VEC (Theory)

No. of Credits: 2

Semester : I

Course Outcomes

After the completion of this course, student will be able to-

CO-1: describe how human activities impact the environment.

CO-2: explain principles of sustainable development and resource management.

CO-3: analyze local, regional, and global environmental issues and their effects.

CO-4: evaluate different strategies for conserving biodiversity and ecosystems.

CO-5: apply relevant environmental policies and ethical considerations to real-world scenarios.

CO-6: design and implement action plans for community-based environmental projects.

Course Content

Chapter 1: Humans and the Environment

[06 hours]

The man-environment interaction: Humans as hunter-gatherers; Mastery of fire; Origin of agriculture; Emergence of city-states; Great ancient civilizations and the environment; Middle Ages and Renaissance; Industrial revolution and its impact on the environment; Population growth and natural resource exploitation; Global environmental change.

The emergence of environmentalism: Anthropocentric and eco-centric perspectives (Major thinkers); The Club of Rome- Limits to Growth; UN Conference on Human Environment 1972; World Commission on Environment and Development and the concept of sustainable development; Rio Summit and subsequent international efforts.

Suggested Readings

1. Fisher, Michael H. (2018) An Environmental History of India- From Earliest Times to the Twenty-First Century, Cambridge University Press.
2. Headrick, Daniel R. (2020) Humans versus Nature- A Global Environmental History, Oxford University Press.
3. Hughes, J. Donald (2009) An Environmental History of the World- Humankind's Changing Role in the Community of Life, 2nd Edition. Routledge.
4. Perman, R., Ma, Y., McGilvray, J., and Common, M. (2003) Natural Resource and Environmental Economics. Pearson Education.
5. Simmons, I. G. (2008). Global Environmental History: 10,000 BC to AD 2000. Edinburgh University Press

Chapter 2: Natural Resources and Sustainable Development

[08 hours]

Overview of natural resources: Definition of resource; Classification of natural resources- biotic and abiotic, renewable and non-renewable.

Biotic resources: Major type of biotic resources- forests, grasslands, wetlands, wildlife and aquatic (fresh water and marine); Microbes as a resource; Status and challenges.

Water resources: Types of water resources- fresh water and marine resources; Availability and use of water resources; Environmental impact of over-exploitation, issues and challenges; Water scarcity and stress; Conflicts over water.

Soil and mineral resources: Important minerals; Mineral exploitation; Environmental problems due to extraction of minerals and use; Soil as a resource and its degradation.

Energy resources: Sources of energy and their classification, renewable and non-renewable sources of energy; Conventional energy sources- coal, oil, natural gas, nuclear energy; Non-conventional energy sources- solar, wind, tidal, hydro, wave, ocean thermal, geothermal, biomass, hydrogen and fuel cells; Implications of energy use on the environment.

Introduction to sustainable development: Sustainable Development Goals (SDGs)- targets and indicators, challenges and strategies for SDGs.

Suggested Readings

1. Chiras, D. D and Reganold, J. P. (2010). Natural Resource Conservation: Management for a Sustainable Future. 10th edition, Upper Saddle River, N. J. Benjamin/Cummins/Pearson.
2. John W. Twidell and Anthony D. (2015). Renewable Energy Sources, 3rd Edition, Weir Publisher (ELBS)
3. William P. Cunningham and Mary A. (2015) Cunningham Environmental Science: A Global Concern, Publisher (Mc-Graw Hill, USA)
4. Gilbert M. Masters and W. P. (2008). An Introduction to Environmental Engineering and Science, Ela Publisher (Pearson)
5. Singh, J.S., Singh, S.P. & Gupta, S.R. 2006. Ecology, Environment and Resource Conservation. Anamaya Publications <https://sdgs.un.org/goals>

Chapter 3: Environmental Issues: Local, Regional and Global

[08 hours]

Environmental issues and scales: Concepts of micro-, meso-, synoptic and planetary scales; Temporal and spatial extents of local, regional, and global phenomena.

Pollution: Impact of sectoral processes on Environment, Types of Pollution- air, noise, water, soil, municipal solid waste, hazardous waste; Transboundary air pollution; Acid rain; Smog.

Land use and Land cover change: land degradation, deforestation, desertification, urbanization. Biodiversity loss: past and current trends, impact.

Global change: Ozone layer depletion; Climate change.

Suggested Readings

1. Harper, Charles L. (2017) Environment and Society, Human Perspectives on Environmental Issues 6th Edition. Routledge.
2. Harris, Frances (2012) Global Environmental Issues, 2nd Edition. Wiley- Blackwell.
3. William P. Cunningham and Mary A. (2015). Cunningham Environmental Science: A global concern, Publisher (Mc-Graw Hill, USA)
4. Manahan, S.E. (2022). Environmental Chemistry (11th ed.). CRC Press. <https://doi.org/10.1201/9781003096238>
5. Rajagopalan, R. (2011). Environmental Studies: From Crisis to Cure. India: Oxford University Press.

Chapter 4: Conservation of Biodiversity and Ecosystems

[08 hours]

Biodiversity and its distribution: Biodiversity as a natural resource; Levels and types of biodiversity; Biodiversity in India and the world; Biodiversity hotspots; Species and ecosystem threat categories.

Ecosystems and ecosystem services: Major ecosystem types in India and their basic characteristics- forests, wetlands, grasslands, agriculture, coastal and marine; Ecosystem services- classification and their significance.

Threats to biodiversity and ecosystems: Land use and land cover change; Commercial exploitation of species; Invasive species; Fire, disasters and climate change.

Major conservation policies: in-situ and ex-situ conservation approaches; Major protected areas; National and International Instruments for biodiversity conservation; the role of traditional knowledge, community-based conservation; Gender and conservation.

Suggested Readings

1. Bawa, K.S., Oomen, M.A. and Primack, R. (2011) Conservation Biology: A Primer for South Asia. Universities Press.
2. Sinha, N. (2020) Wild and Wilful. Harper Collins, India.
3. Varghese, Anita, Oommen, Meera Anna, Paul, Mridula Mary, Nath, Snehlata (Editors) (2022) Conservation through Sustainable Use: Lessons from India. Routledge.
4. Bhagwat, Shonil (Editor) (2018) Conservation and Development in India: Reimagining Wilderness, Earthscan Conservation and Development, Routledge.
5. Krishnamurthy, K.V. (2003) Textbook of Biodiversity, Science Publishers, Plymouth, UK

VEC-151-T: Environment Education-II

Course type: VEC (Theory)

No. of Credits: 2

Semester : II

Course Outcomes

After the completion of this course, student will be able to-

CO-1: identify various types of environmental pollution and their impacts on health.

CO-2: explain the basic concepts of climate change, including its causes and effects.

CO-3: analyze different strategies for adapting to and mitigating the effects of climate change.

CO-4: evaluate various environmental management practices and their effectiveness.

CO-5: apply the principles of key environmental treaties and legislation to case studies.

CO-6: create action plans that address specific environmental issues based on current policies and management practices.

Course Content

Chapter 1: Environmental Pollution and Health

[08 hours]

Understanding pollution: Production processes and generation of wastes; Assimilative capacity of the environment; Definition of pollution; Point sources and non-point sources of pollution.

Air pollution: Sources of air pollution; Primary and secondary pollutants; Criteria pollutants- carbon monoxide, lead, nitrogen oxides, ground-level ozone, particulate matter and sulphur dioxide; Other important air pollutants- Volatile Organic compounds (VOCs), Peroxyacetyl Nitrate (PAN), Polycyclic aromatic hydrocarbons (PAHs) and Persistent organic pollutants (POPs); Indoor air pollution; Adverse health impacts of air pollutants; National Ambient Air Quality Standards.

Water pollution: Sources of water pollution; River, lake and marine pollution, groundwater pollution; water quality Water quality parameters and standards; adverse health impacts of water pollution on human and aquatic life.

Soil pollution and solid waste: Soil pollutants and their sources; Solid and hazardous waste; Impact on human health.

Noise pollution: Definition of noise; Unit of measurement of noise pollution; Sources of noise pollution; Noise standards; adverse impacts of noise on human health.

Thermal and Radioactive pollution: Sources and impact on human health and ecosystems.

Suggested Readings

1. Jackson, A. R., & Jackson, J. M. (2000). Environmental Science: The Natural Environment and Human Impact. Pearson Education.

2. Masters, G. M., & Ela, W. P. (2008). Introduction to environmental engineering and science (No.60457). Englewood Cliffs, NJ: Prentice Hall.
3. Miller, G. T., & Spoolman, S. (2015) Environmental Science. Cengage Learning.
4. Central Pollution Control Board Web page for various pollution standards.
<https://cpcb.nic.in/standards/>
5. Ahluwalia, V. K. (2015). Environmental Pollution, and Health. The Energy and Resources Institute (TERI).

Chapter 2: Climate Change: Impacts, Adaptation and Mitigation [06 hours]

Understanding climate change: Natural variations in climate; Structure of atmosphere; Anthropogenic climate change from greenhouse gas emissions– past, present and future; Projections of global climate change with special reference to temperature, rainfall, climate variability and extreme events; Importance of 1.5 °C and 2.0 °C limits to global warming; Climate change projections for the Indian sub-continent.

Impacts, vulnerability and adaptation to climate change: Observed impacts of climate change on ocean and land systems; Sea level rise, changes in marine and coastal ecosystems; Impacts on forests and natural ecosystems; Impacts on animal species, agriculture, health, urban infrastructure; the concept of vulnerability and its assessment; Adaptation vs. resilience; Climate-resilient development; Indigenous knowledge for adaptation to climate change.

Mitigation of climate change: Synergies between adaptation and mitigation measures; Green House Gas (GHG) reduction vs. sink enhancement; Concept of carbon intensity, energy intensity and carbon neutrality; National and international policy instruments for mitigation, decarbonizing pathways and net zero targets for the future; Energy efficiency measures; Renewable energy sources; Carbon capture and storage, National climate action plan and Intended Nationally Determined Contributions (INDCs); Climate justice.

Suggested Readings

1. Pittock, Barrie (2009) Climate Change: The Science, Impacts and Solutions. 2nd Edition. Routledge.
2. www.ipcc.org/; <https://www.ipcc.ch/report/sixth-assessment-report-cycle/>.
3. Adenle A., Azadi H., Arbiol J. (2015). Global assessment of technological innovation for climate change adaptation and mitigation in developing world, Journal of Environmental Management, 161 (15): 261-275.
4. Barnett, J. & S. O'Neill (2010). Maladaptation. Global Environmental Change—Human and Policy Dimensions 20: 211–213.
5. Berrang-Ford, L., J.D. Ford & J. Paterson (2011). Are we adapting to climate change ? Global Environmental Change—Human and Policy Dimensions 21: 25-33.

Chapter 3: Environmental Management

[06 hours]

Introduction to environmental laws and regulation: Constitutional provisions- Article 48A, Article 51A (g) and other derived environmental rights; Introduction to environmental legislations on the forest, wildlife and pollution control.

Environmental management system: ISO 14001 Life cycle analysis; Cost-benefit analysis Environmental audit and impact assessment; Environmental risk assessment, Pollution control and management; Waste Management- Concept of 3R (Reduce, Recycle and Reuse) and sustainability; Ecolabeling /Ecomark scheme

Suggested Readings

1. Jørgensen, Sven Marques, Erik João Carlos and Nielsen, Søren Nors (2016) Integrated Environmental Management, A transdisciplinary Approach. CRC Press.
2. Theodore, M. K. and Theodore, Louis (2021) Introduction to Environmental Management, 2nd Edition. CRC Press.
3. Barrow, C. J. (1999). Environmental management: Principles and practice. Routledge.
4. Tiefenbacher, J (ed.) (2022), Environmental Management - Pollution, Habitat, Ecology, and Sustainability, Intech Open, London. 10.5772/
5. Richard A. Marcantonio, Marc Lame (2022). Environmental Management: Concepts and Practical Skills. Cambridge University Press.

Chapter 4: Environmental Treaties and Legislation

[10 hours]

An overview of instruments of international cooperation; bilateral and multilateral agreements; conventions and protocols; adoption, signature, ratification and entry into force; binding and non-binding measures; Conference of the Parties (COP)

Major International Environmental Agreements: Convention on Biological Diversity (CBD); Cartagena Protocol on Biosafety; Nagoya Protocol on Access and Benefit-sharing; Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES); Ramsar Convention on Wetlands of International Importance; United Nations Convention to Combat Desertification (UNCCD); Vienna Convention for the Protection of the Ozone Layer; Montreal Protocol on Substances that Deplete the Ozone Layer and the Kigali Amendment; Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal; Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade; Stockholm Convention on Persistent Organic Pollutants; Minamata Convention on Mercury; United Nations Framework Convention on Climate Change (UNFCCC); Kyoto Protocol; Paris Agreement; India's status as a party to major conventions

Major Indian Environmental Legislations: The Wild Life (Protection) Act, 1972; The Water (Prevention and Control of Pollution) Act, 1974; The Forest (Conservation) Act, 1980; The Air

(Prevention and Control of Pollution) Act, 1981; The Environment (Protection) Act, 1986; The Biological Diversity Act, 2002; The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006; Noise Pollution (Regulation and Control) Rules, 2000; Industry-specific environmental standards; Waste management rules; Ramsar sites; Biosphere reserves; Protected Areas; Ecologically Sensitive Areas; Coastal Regulation Zone; Status phase-out of production and consumption of Ozone Depleting Substances by India; National Green Tribunal; Some landmark Supreme Court judgements

Major International organisations and initiatives: United Nations Environment Programme (UNEP), International Union for Conservation of Nature (IUCN), World Commission on Environment and Development (WCED), United Nations Educational, Scientific and Cultural Organization (UNESCO), Intergovernmental Panel on Climate Change (IPCC), and Man and the Biosphere (MAB) programme.

Suggested Readings

1. UNEP (2007) Multilateral Environmental Agreement Negotiator's Handbook, University of Joensuu, ISBN 978-952-458-992-5
2. Ministry of Environment, Forest and Climate Change (2019) A Handbook on International Environment Conventions & Programmes. <https://moef.gov.in/wp-content/uploads/2020/02/convention-V-16-CURVE-web.pdf>
3. Kanchi Kohli and Manju Menon (2021) Development of Environment Laws in India, Cambridge University Press.
4. India Code – Digital repository of all Central and State Acts: <https://www.indiacode.nic.in/>
5. Bohra, Saroj, Judicial Intervention and Evolution of Environmental Principles and Doctrines (January 7, 2019). Available at SSRN: <https://ssrn.com/abstract=3311406> or <http://dx.doi.org/10.2139/ssrn.3311406>

Note: Case Studies and Field Work is compulsory

The students are expected to be engaged in some of the following or similar identified activities:

1. Discussion on one national and one international case study related to the environment and sustainable development.
2. Field visits to identify local/regional environmental issues, make observations including data collection and prepare a brief report.
3. Documentation of campus biodiversity.
4. Campus environmental management activities such as solid waste disposal, water management, and sewage treatment.

Syllabus

Class: FYBA Economics

Semester: I

Course Type: Open Elective (OE)

Course Name: Indian Economic Policy - I

Course Code: OE-101-ECO

No. of Credits: 2 Credits [Theory]

No. of Hours: 30 Hours

Total Marks: 50 Marks

Course Outcomes:

After Learning this course, the students will be able to-

1. The Students shall be able to understand nature of Developed and Developing Economies.
2. Learners will understand major issues regarding economic development of India.
3. Ability to compare and contrast Indian Economy with other world economies.
4. After completing the course, the students will be able to appear for various competitive examinations.
5. To familiarize the students with the recent developments in the Indian Economy

UNITS AND CONTENTS

Unit No.	Unit Title and Contents	Hours
1	1. Introduction to Indian Economy	15
	1.1 – Economy: Meaning and Classification	
	1.2 - Developed and Developing Economies	
	1.3 - Indicators of Developed Economy	
	1.4 - Characteristics of Indian Economy as Developing Economy	
	1.5 - Major issues of Economic Development in India	
	1.6 – Monetary and Fiscal Policy in India	
2	2. Agriculture, Industry and Service Sector In India	15
	2.1 – Sectoral Structure of an Economy	
	2.2 – Contribution in Economic Development of India: Agriculture, Industry and Service Sector	

	2.3 – Sectoral Distribution of Gross Domestic Product (GDP) and Employment in India	
	2.4 – Interdependence between Agriculture, Industry and Service Sectors	
	2.5 – New Economic Policy	

References –

1. Agrawal A.N., Indian Economy Problems of Development & Planning, New Age International Publishers, New Delhi.
2. Gaurav Datt & Ashwani Mahajan (2022): 'Indian Economy' S. Chand Publishing Company Ltd., New Delhi.
3. V.K. Puri, S.K. Misra, 'Indian Economy', Himalaya Publishing House, Mumbai. (Latest Edition)
4. Gopal and Suman Bhakri (2013) Indian Economy Performance and Policies. Pearson Publication Delhi.
5. Uma Kapila (2023), Indian Economy: Performance and Policies.
6. Ministry of Finance, Government of India, Economic Survey, 2020
7. Department of Economic Affairs (Government of India).

Website-

1. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=NEp/xikgBgNtfA+sgFQAcA>
2. <https://www.ibef.org/economy>
3. <https://www.worldbank.org/en/country/india/overview>

Syllabus

Class: FYBA Economics

Semester: II

Course Type: Open Elective (OE)

Course Name: Indian Economic Policy - II

Course Code: OE-151-ECO

No. of Credits: 2 Credits [Practical]

No. of Hours: 60 Hours

Total Marks: 50 Marks

Course Outcomes:

After Learning this course, the students will be able to-

1. - Understand the Concept of Developed and Developing Economies and Status of Indian Economy.
2. - Discuss and debate the various aspects of Indian Economy.
3. - Understand Population Structure of India.
4. - Evaluate the performance of Indian Economy.
5. - Interpret various issues of Indian Economy.

UNITS AND CONTENTS

Unit No.	Unit Title and Contents	Hours
1	1. Population in India	15
	1.1 – Demographic Profile of India 1.1.1 Size and Growth 1.1.2 Sex Composition 1.1.3 Age Composition 1.1.4 Density of Population 1.1.5 Rural-Urban Distribution	
	1.2. – Occupational Distribution of Indian Population	
	1.3 – Population as a Human Capital for Economic Development	
	1.4 – Population Control Policy in India	

	1.5 - Poverty 1.5.1 - Meaning and Types of Poverty 1.5.2 - Poverty line : Need of Redefining 1.5.3 - Causes of Poverty in India 1.5.4 - Measures to Eradicate Poverty in India	
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PRACTICAL

Unit No.	Practical Contents	Hours
Conduct Any three Practical from Following		
1	1 - Study of Demographic Structure of a Village / Ward in respect of. 1.1 - Sex Composition 1.2 - Age Composition 1.3 - Density 1.4 - Literacy Rate 1.5 - Birth and Death Rate 1.6 - Infant Mortality Rate 1.7 - Life Expectancy 1.8 - Per-Capita Income 1.9 – Status of Poverty 1.10 - Status of Poverty line	45

Sr. No.	Practical Exam Pattern	Marks
1.	Internal Assessment - Teachers should choose any three tools out of given above for Internal Assessment	15
2.	Practical Assessment a] Practical work Book – 15 Marks b] Viva Voce / Presentation (Problem Solving / PPT / Poster) – 20 Marks	35
	Total	50

Restructured Syllabus (2024 Pattern as per NEP-2020)

Faculty: **COMMERCE & MANAGEMENT (Commerce)**

Generic Elective / Open Elective for Other Faculty

BOS: Business Administration

Subject: Financial Literacy

Academic Year: 2024-2025

Programme Name	Subject Code	Type of Course	Name of the Subject	Credits	Lectures per Week in Clock Hour
Humanities, Science & Technology, and Inter-Disciplinary		GE / OE	Financial Literacy	2	2

Course Objectives:

1. To understand the importance, principles and concept of Financial Literacy.
2. To familiarize students with different aspects of financial literacy such as savings, investment rules.
3. To help students understand the relevance and process of financial planning, digital payments and its types.
4. To promote understanding of financial well-being and role of modern digital payment system.

Unit	Title and Contents	No. of Lectures in Clock Hours
1	Introduction to Financial Literacy: 2.1 Meaning, Concept, Advantages of Financial Literacy 2.2 Objectives, Scope and Functions of Financial Literacy 2.3 Types of Financial Literacy 2.4 Principles and Pillars of Financial Literacy 2.5 Understanding Basic Rules of Financial Literacy: The 50-30-20 Rule	15
2	Financial Planning and Digital Payments: 2.1 Introduction to Saving, Investments and Expenditure 2.2 Time Value of Money 2.3 Management of Spending and Financial Discipline 2.4 Modern Digital Payment Trends: Credit / Debit Cards, QR Code Scanners, Mobile Point of Sale, NEFT and RTGS. Contactless Payments – Samsung Pay / Apple Pay and use of NFC Technology 2.5 Role of Modern Digital Payment Systems and Challenges faced in Indian Retail Sector	15

Course Outcomes: After completion of the course, students will be able:

2. To understand the importance, types, principles and concept of financial literacy.
3. To develop proficiency for personal and family financial planning.
4. To understand the importance and types of financial planning, digital payments and its types
5. To understand the financial well-being and role of modern digital payment system

Teaching Methodology		
The Teacher can use the following Methods as Teaching Methodology: 1. Class Room Lectures 2. Guest Lectures of Professionals, Industry Experts etc. 3. Teaching with the help of ICT tools 4. Visits to various Professionals Units, Companies and Business / Industry Units 5. Group Discussion / Debates 6. Assignments, Tutorials, Presentations, Role Play etc. 7. YouTube Lectures developed by MHRD, UGC, Government of Maharashtra, University etc. 8. Analysis of Case Studies		
Internship for Students if any: Not applicable		
List of Recommended Books and Study Materials		
1. Halan, Monika, Lets Talk Money: You've Worked Hard for It, Now Make It Work for You, July 2018 Harper Business. 2. Pandit Amar, The Only Financial Planning Book that You Will Ever Need, Network 18 Publications Ltd. 3. Financial Literacy for Young Adults Simplified: Discover How to Manage, Save, and Invest Money to Build a Secure & Independent Future Paperback – Import, 18 September 2023 by Raman Keane 4. Fundamentals of Financial Management by R P Rustagi Edition: 18th Edition, 2023 5. Finance for Everyone (UGCF) by Amit Kumar Singh, Rohit Kumar Shrivastav Edition: 1st Edition, 2023 6. Financial Literacy: Its effects on micro-insurance uptake Studienarbeit, 2020 7. How Finance Works Paperback – 23 April 2019 by Mihir Desai 8. T. R. Jain and V. K. Ohri, Money and Banking, VK Global Publications Pvt. Ltd, 2020 9. S. Braunstein and C. Welch, Financial literacy: An overview of practice, research, and policy, Fed. Res. Bull, 2002 10. T. R. Jain and R. L. Sharma, Indian financial System, by, VK Global Publications Pvt. Ltd, 2014 11. S. Cole and Gauri Kartini Shastry, Smart money: The effect of education, cognitive ability and financial literacy on financial market participation, Harvard Business School, 2009 12. Gitman, Joehnk and Billingsley, Personal financial planning, Cengage Learning, 2016 13. M. Jeff, Personal finance, Prentice Hall, 2016		
Scheme of Examination		
Scheme of Examination: 1. Internal Assessment: 30% and 2. External Assessment: 70%		
Scheme of Examination	Exam Format	Min. Passing Marks
Continuous Internal Evaluation (CIE) (15 Marks)	The colleges need to adopt any Two Methods out of the following Methods for Continuous Internal Evaluation: 1. Offline Written Examination 2. Power Point Presentations 3. Assignments / Tutorials 4. Oral Examination 5. Open Book Test 6. Offline MCQ Test 7. Group Discussion 8. Analysis of Case Studies	Min. 06 Marks (40% of Passing)

SEE / External Exam (35 Marks) (Total 2 Hours Duration)	Instructions: 1. Question No. 1 is Compulsory 2. Attempt any Two Question from Question No. 2 to 4 Q. 1: Fill in the Blanks on all Units = 05 Marks Q. 2: Theory Question on Unit-1 = 15 Marks Q. 3: Theory Question on Unit-2 = 15 Marks Q. 4: Short Notes on all Units (Any 2 out of 4) = 15 Marks	Min. 14 Marks (40% of Passing)
Total 50 Marks Separate Passing for Internal Assessment (CIE) and External Exam (SEE)		

Restructured Syllabus (2024 Pattern as per NEP-2020)

Faculty: **COMMERCE & MANAGEMENT (Commerce)**

Generic Elective / Open Elective for Other Faculty

BOS: Accountancy

Subject: Financial Accounting, Paper-I

Academic Year: 2024-2025

Faculty Name	Subject Code	Type of Course	Name of the Subject	Credits	Lectures per Week in Clock Hour
Humanities, Science & Technology, and Inter-Disciplinary		GE / OE	Financial Accounting, Paper-I	2	2

Course Objectives:

1. To familiarise the students with accounting as an information system of business entity.
2. To acquaint the students with principles, basic concepts, and conventions of accounting.
3. To develop the skills of using accounting analogy in processing business transactions.
4. To develop an understanding about recording of business transactions.

Unit	Title and Contents	No. of Lectures in Clock Hours
1	Introduction to Accounting: 1.1 Accounting: Meaning-Definition and Functions, Objectives, Accounting as source of information, Internal and External users of accounting information and their needs, Development of Accounting 1.2 Qualitative Characteristics of Accounting Information: Reliability, Relevance, Understandability and Comparability. 1.3 Basic Accounting Terms: Asset, Liability, Capital, Expense, Income, Expenditure, Revenue, Debtors (Bills Receivables), Creditors (Bills Payables), Goods, Cost, Gain, Stock, Purchase, Sales, Loss, Profit, Voucher, Discount, Transaction, Drawings etc.	10
2	Accounting Principles: 2.1 Accounting Principles: Meaning and Nature. 2.2 Accounting Concepts: Entity, Money Measurement, Going Concern, Accounting Period, Cost Concept, Dual Aspect, Revenue Recognition (Realisation), Matching, Accrual etc. 2.3 Accounting Conventions: Conservatism, Full Disclosure, Consistency, Materiality etc. 2.4 Fundamental Accounting Assumptions (IASC): Going Concern, Consistency, Accrual, Accounting Policies, Prudence, Substance Over Form, Materiality etc. 2.5 Accounting Standards: Concept and Meaning 2.6 Accounting Mechanism: Single Entry and Double Entry 2.7 Bases of Accounting: Cash Basis, Accrual Basis.	10

3	Recording of Business Transactions: 3.1 Voucher and Transactions: Origin of Transactions – Source Documents and Vouchers, Preparation of Vouchers; Accounting Equation Approach – Meaning and Analysis of Transactions using Accounting Equation; Rules of Debit and Credit. 3.2 Recording of Transactions: Books of Original Entry – Journal, Special Purpose Books: (i) Cash Book – Simple, Cashbook with Bank Column and Petty Cashbook, (ii) Purchases Book, Sales Book, Purchases Returns Book, Sale Returns Book; Ledger: Meaning, Utility, Format; Posting from Journal and Subsidiary Books; Balancing of Accounts, Problems on Journal and Cash Book 3.3 Bank Reconciliation Statement: Meaning and Objective of Bank Reconciliation Statement, Causes of Difference, Importance of Bank Reconciliation Statement, Technique of preparing Bank Reconciliation Statement, Problems on Bank Reconciliation Statement	10
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Course Outcomes: After completion of the course, students will be able:

1. To acquaint with accounting as an information system of business entity.
2. To understand the students with principles, basic concepts, and conventions of accounting.
3. To use the skills of accounting analogy for processing of business transactions.
4. To record the business transactions.

Teaching Methodology
The Teacher can use the following Methods as Teaching Methodology: 1. Class Room Lectures 2. Guest Lectures of Professionals, Industry Experts etc. 3. Teaching with the help of ICT tools 4. Visits to various Professionals Units, Companies and Business / Industry Units 5. Group Discussion / Debates 6. Assignments, Tutorials, Presentations, Role Play etc. 7. YouTube Lectures developed by MHRD, UGC, Government of Maharashtra, University etc. 8. Analysis of Case Studies
Internship for Students if any: Not applicable
List of Recommended Books and Study Materials
1. A Textbook of Accounting for Management, 3rd Edition, S. N. Maheshwari, Suneel K. Maheshwari and Sharad Maheshwari, Vikas Publishing House Pvt. Ltd., New Delhi. 2. Financial Accounting for BBA, 2nd Edition, S. N. Maheshwari, Suneel K. Maheshwari and Sharad Maheshwari, 3rd Edition, Vikas Publishing House Pvt. Ltd., New Delhi. 3. Financial and Management Accounting, Dr. S. N. Maheshwari and Sharad Maheshwari, Sultan Chand & Sons (Educational Publishers), New Delhi. 4. Students Guide to Accounting Standards by D. S. Rawat, Taxmann Publication (P.) Ltd., New Delhi 5. Students' Guide to Accounting Standards including Introduction of Ind AS (CA/CMA Final), Dr. D. S. Rawat (FCA) and CA Nozer Shroff, Taxmaan Publication (P.) Ltd., New Delhi 6. Students' Guide to Ind AS Converged IFRSs (CA/CMA Final), Dr. D. S. Rawat (FCA) and CA Pooja Patel, Taxmaan Publication (P.) Ltd., New Delhi 7. Taxmann's Accounting Standards (AS), Notified under Companies Act 2013, Taxmaan Publication (P.) Ltd., New Delhi 8. Taxmaan's Illustrated Guide to Indian Accounting Standards (Ind AS), CA B. D. Chatterjee and CA Jinender Jain, Taxmaan Publication (P.) Ltd., New Delhi. 9. Financial Accounting (For B.Com and Foundation Course of CA, CS and CMA), S. N. Maheshwari, Suneel K. Maheshwari and Sharad Maheshwari, 3rd Edition, Vikas Publishing

House Pvt. Ltd., New Delhi.		
10. An Introduction to Accountancy, S. N. Maheshwari, Suneel K. Maheswhari and Sharad Maheshwari, Vikas Publishing House Pvt. Ltd., New Delhi.		
11. Accountancy Volume-1 & 2, S. KR. Paul, Central Educational Enterprises (P) Ltd., Kolkata.		
12. Advanced Accountancy (Theory, Method and Application for Professional Competence Course), R. L. Gupta, M. Radhaswamy, Sultan Chand & Sons, New Delhi.		
13. Advanced Accountancy Volume-I & II, S. N. Maheshwari, Suneel K. Maheswhari and Sharad Maheshwari, Vikas Publishing House Pvt. Ltd., New Delhi.		
14. Advanced Accounts Volume-I & II, M. C. Shukla, T. S. Grewal, S. C. Gupta, S. Chand and Company Limited, New Delhi.		
15. Accounting for Management, N.P. Srinivas & M. Shaktivel Murugan, S. Chand Publication, New Delhi		
16. Fundamental of Financial Management, Amit Singhal, S. Chand Publication, New Delhi		
17. Accounting for Management, S. Ramanathan, Oxford University Press, New Delhi		
18. Study Materials of ICAI, ICSI, ICMA		
19. Journal of Chartered Accountants, Journal of Cost and Management Accountants and Journal of Company Secretary		
Scheme of Examination		
Scheme of Examination: 1. Internal Assessment: 30% and 2. External Assessment: 70%		
Scheme of Examination	Exam Format	Min. Passing Marks
Continuous Internal Evaluation (CIE) (15 Marks)	The colleges need to adopt any Two Methods out of the following Methods for Continuous Internal Evaluation: 1) Offline Written Examination 2) Power Point Presentations 3) Assignments / Tutorials 4) Oral Examination 5) Open Book Test 6) Offline MCQ Test 7) Group Discussion 8) Analysis of Case Studies	Min. 06 Marks (40% of Passing)
SEE / External Exam (35 Marks) (Total 2 Hours Duration)	Instructions: 1) Question No. 1 and 5 are Compulsory. 2) Attempt any Two Questions from Question No. 2 to 4 Q. 1: Fill in the Blanks = 05 Marks Q. 2: Theory Question on Unit-1 = 10 Marks Q. 3: Theory Question on Unit-2 = 10 Marks Q. 4: Short Notes on all Units (Any 2 out of 4) = 10 Marks Q. 5: Numerical Problem on Unit-3 = 10 Marks	Min. 14 Marks (40% of Passing)
Total 50 Marks		
Separate Passing for Internal Assessment (CIE) and External Exam (SEE)		