SREE NARAYANA COLLEGE CHENGANNUR

"ധനം വിദ്യയാകും, വിദ്യ സേവനമാകും"

ശ്രീനാരായണഗുരു

Programme & Course Outcome

Departments

1. Chemistry
2. Commerce
3. Economics
4. Mathematics
5. Physics

OUTCOME BASED EDUCATION IN CHEMISTRY

COURSES IN CHEMISTRY

UNDER GRADUATE PROGRAMME	POST GRADUATE PROGRAMME
B.Sc. CHEMISTRY	M.Sc. CHEMISTRY

B.Sc. CHEMISTRY

Programme Description:

- A 3 year Degree programme under Choice Based-Credit & Semester-System with Chemistry as the core course.
- The programme spanned over 6 semesters.
- Apart from the Core Course in Chemistry, there are Complementary Courses in Chemistry for B.Sc. Physics Programme, an Open Course Programme in Chemistry for students from all other subject backgrounds except those from the Core Chemistry, an Elective Course in Chemistry, Project and Scientific research, Research Institute/Science Museum visit, and Lab experiments for Core, and Complementary Chemistry Programmes.

CORE COURSES

SEM.	COURSE CODE	COURSE TITLE	COURSE OUTCOMES
I	CH 1141	Inorganic Chemistry I	➢ Student should understand the structure of atom, periodicity of properties ➢ Student will be able to know how inner structure of elements and their chemical properties. ➢ Student should understand how elements are arranged in periodic table. ➢ Understand properties and applications of s-block elements, hydrogen and their compounds. ➢ Understand the properties of acids bases and get clear idea about non aqueous solutions.

			➢ Awareness about environment pollution and control of pollution.
II	**CH 1221**	**Methodology and Perspective of Sciences and General Informatics**	➢ Student will be able to understand how science works. ➢ Will get a basic understanding to do self –directed experimentation work and research in chemistry. ➢ Analytical Chemistry helps to understand about the experimental parts of theory and safety measures.
III	**CH1341**	**Inorganic Chemistry**	➢ To understand the structure of molecules ➢ To acquire the knowledge about different types of bond ➢ Acquire the knowledge about periodic properties of elements and their applications in various field ➢ To understand the fundamental nuclear reactions and its applications in medical and industrial field ➢ To acquire the fundamental knowledge about nano materials
IV	**CH1441**	**Organic Chemistry Paper – I**	➢ To understand classification, nomenclature, mechanism of reaction aromaticity and chemistry of aliphatic and aromatic substituted compounds ➢ To acquire the knowledge about stereochemistry of organic compounds ➢ To acquire the basic idea about photo chemical reaction
	PRACTICALS CH1141	**Inorganic qualitative analysis**	➢ Able to do self-directed experimentation work about qualitative analysis ➢ Understand the experimental part of theory and safety measures which could follow when doing experiments using chemicals
V	**CH1541**	**Physical Chemistry I**	➢ Provides an introduction to various states of matter and gives a fundamental understanding of the different physical principles

			that are the basics of chemical systems. ➢ Enable the students to learn the different laws of thermodynamics and the relations that govern the various thermodynamic equations of state ➢ Learn the basics of group theory
	CH1542	**Inorganic Chemistry – III**	➢ Enable students to learn the important aspects of bioinorganic chemistry and organometallic chemistry ➢ Students get an idea of fundamental concepts of transition metal chemistry and the various properties of transition as well as inner tranisition elements
	CH1543	**Organic Chemistry – II**	➢ Learn the general principles of isolation of elements and understand the instrumental methods of analysis ➢ Enable the students to understand the preparation, properties and mechanism of various organic conversions. ➢ Students get an idea of sprectal analysis of organic compounds ➢ Students understand the new frontiers of organic chemistry such as supramolecular and green chemistry
	Open Course **CH1551.1**	**Essentials of Chemistry**	➢ Students get basic concepts of atomic structure and periodic classification of elements ➢ Learn the chemistry in biological process and day to day life ➢ Understand the impact of various pollutants on environment ➢ Learn the fundamentals of nuclear chemistry and polymer chemistry

PRACTICALS CH1544	**Volumetric Analysis**	➢ Students get basic concepts of atomic structure and periodic classification of elements ➢ Learn the chemistry in biological process and day to day life ➢ Understand the impact of various pollutants on environment ➢ Learn the fundamentals of nuclear chemistry and polymer chemistry
CH1545	**Physical Chemistry Experiments**	➢ Student learn quantitative methods of analysis by volumetric methods of analysis using permanganometry, dichrometry and acidimetry. ➢ Learn to determine various physical constants by experiments.
CH1641	**Physical Chemistry II**	➢ Enable the students to apply the basic concepts of thermodynamics, quantum mechanics and spectroscopy to chemical, physical and biochemical systems. ➢ Students learn the derivation of mathematical relations in thermodynamic and quantum mechanics ➢ Learn about non-spectroscopic methods of analysis
CH1642	**Organic Chemistry – III**	➢ Learn about various carbohydrates, heterocyclic compounds, amino acids and nucleic acids. ➢ Understand different natural products such as Terpenes, alkaloids, vitamins etc. ➢ Get a general idea of different polymers and polymerisation process. ➢ Learn the different reagents in organic synthesis and the application of organometallics in synthesis.

VI	**CH1643**	**Physical Chemistry III**	➢ Provides an insight into the thermodynamic and kinetic aspects of chemical reactions and phase equilibrium. ➢ Learn the basics of electrochemistry and its importance in modern industry and technology. ➢ Students understand the different types of reactions and the different factors that determine the rate of chemical changes.
	CH 1644	**Organic Chemistry Practicals**	➢ Learn to analyse common organic functional groups ➢ Learn the preparation of organic compounds by nitration, oxidation etc.
	CH1645	**Gravimetry practicals**	➢ Learn the gravimetric analysis of some common elements
	CH1646	**Chemistry Project and Factory Visit**	➢ Students will develop an aptitude for research in chemistry and inculcate proficiency to identify appropriate research topic.
	Elective Course CH1651 .1	**Supramolecular, Nano Particles and Green Chemistry**	➢ Students get an introduction to the world of nanoscience and technology ➢ Learn various methods for the synthesis of nanomaterials ➢ Learn the chemistry behind various environmental aspects.

COMPLEMENTARY COURSES

SEM.	COURSE CODE	COURSE TITLE	COURSE OUTCOMES
I	**CH1131 .1**	**Theoretical Chemistry**	➢ Learn the atomic structure and chemical bonding ➢ Understand the analytical principles and radioactivity

II	**CH1231**	**Physical chemistry-I**	➢ Enable the students to learn the fundamentals of thermodynamics ➢ Learn the principles of chemical and ionic equilibrium
III	**CH1331.1**	**Physical Chemistry- II**	➢ To understand Isotropy and anisotropy and symmetry elements in crystals ➢ To understand Conducto metric titrations involving strong acid – strong base, strong acid – weak base, weak acid – strong base and weak acid – weak base. ➢ To understand the Laws of Photo Chemistry ➢ To understand rates of reaction, various factors influencing rates of reactions
IV	**CH1431 .1**	**Spectroscopy and Material Chemistry**	➢ To acquire a basic knowledge about symmetry elements and symmetry property ➢ To acquire knowledge about molecular spectroscopy ➢ To understand the application in qualitative and quantitative analysis ➢ To study General principles of occurrence and extraction of metals ➢ To study about tools for measuring nano structure
	PRACTICAL CH1432 .2	**Inorganic qualitative and volumetric analysis**	➢ Enable to do self-directed experimentation work about qualitative analysis ➢ To acquire experimental skill in volumetric analysis

M.Sc. CHEMISTRY

SEM.	COURSE CODE	COURSE TITLE	COURSE OUTCOMES
I	**CH 211**	**Inorganic Chemistry I**	• Impart knowledge of chemistry of theories of metal complexes, analytical principles, molecular symmetry, isopoly and heteropoly acids, noble gases, interhalogens compounds and chemistry of natural environmental processes.
	CH 212	**Organic Chemistry I**	• Ensures the students to understand, concepts and the properties of stereochemistry of organic compounds, structure and reactivity of organic intermediates, substitution, elimination, addition reactions in organic chemistry and reagents in organic synthesis.
	CH 213	**Physical Chemistry I**	• The students should be able to understand the fundamental theoretical concepts of quantum chemistry, surface chemistry and catalysis, classical thermodynamics, chemical kinetics and gaseous and liquid state.
	CH 221	**Inorganic Chemistry II**	• Ensures the students to understand and acquire knowledge on sulphur, nitrogen, phosphorus and boron compounds, spectral and magnetic properties of transition metal complexes, crystalline state, lanthanides, actinides and solid-state chemistry.
	CH 222	**Organic Chemistry II**	• Appreciate the basic concepts of physical organic chemistry. Describe the chemistry of molecular rearrangement and transformation

		reactions, aromaticity and symmetry-controlled reactions, organic photochemistry, chemistry of natural products and biomolecules.
CH 223	**Physical Chemistry II**	• Ensures the students to understand, acquire knowledge on quantum mechanics of hydrogen-like systems, microwave, vibrational, Raman and electronic spectroscopy, applications of thermodynamics, statistical mechanics and electrochemistry
CH 214	**Inorganic Chemistry Practicals -1**	• Separation and identification of rare/less familiar cations such as Ti, W, Mo, Th, Zr, V, U and Li • Volumetric estimation using EDTA, ammonium vanadate, ceric sulphate etc. • Colorimetric estimation of Cr, Fe, Mn, Ni, Cu etc. • Preparation of metal complexes
CH 215	**ORGANIC PRACTICALS-1**	• Separation and identification of organic compounds • Quantitative wet chemistry separation of a mixture of two components by solvent extraction • TLC of the purified samples along with the mixture in same TLC plates and calculation of Rf values • Separation of a mixture of by column chromatography • Preparation of compounds by two stages. • Recording/downloading UV, IR, ^{1}H NMR and ^{13}C NMR and EI mass spectra of synthesized compounds.

CH 216	**PHYSICAL PRACTICALS –I**	**Adsorption** Freundlich and Langmuir isotherms for adsorption of acetic/oxalic acid on active charcoal. Determination of concentration of acetic/ oxalic acid. **Kinetics** • Determination of rate constant of acid hydrolysis of methyl acetate. • Determination of Arrhenius parameters. • Determination of concentration of given acid. • Determination of rate constant of the saponification of ethyl acetate and evaluation of Arrhenius parameters. • Determination of rate constant of reaction between $K_2S_2O_8$ and KI. • Study the kinetics of iodination of acetone in acid medium. **Phase rule** **Solid-liquid equilibria** • Construction of phase diagram and determination of the composition of unknown mixture • Construction of phase diagram with congruent melting point **Partially miscible liquid pairs**- CST of phenol-water system. • Effect of impurities on the miscibility temperature of phenol-water system and hence the determination of concentration of given unknown solution. • Three component system- Construction of ternary phase diagram of acetic acid chloroform-water system and hence the composition of given homogeneous mixture. Construction of tie-line. **Distribution law** • Distribution coefficient of ammonia between chloroform and water.

			• Determination of equilibrium constant of copper- ammonia complex by partition method or coordination number of Cu^{2+} in copper-ammonia complex. • Distribution coefficient of benzoic acid between toluene and water. • Distribution coefficient of iodine between hexane and water/$CHCl_3$ and water/ CCl_4 and water • Determination of the equilibrium constant of the reaction KI + I_2 and hence the concentration of given KI in hexane and water/$CHCl_3$ and water/ CCl_4 and water. • Determination of hydrolysis constant of anilinium hydrochloride. **Dilute Solutions** • Determination of K_f of solid solvent, molar mass of non-volatile solute, mass of solvent and composition of given solution • Determination of Vant Hoff's factor for benzoic acid in Naphthalene. • Determination of atomicity of sulphur. **Transition temperature** • Determination of KT of salt hydrate, molar mass of solute, mass of salt hydrate and composition of given solution **Thermochemistry** • Determination of the concentration of given strong acid/alkali. • Thermometric titration of NaOHVs standard HCl. • Heat of displacement of Cu^{2+} by Zn. • Determination of the heat of ionisation of acetic acid.
III	**CH231**	**INORGANIC CHEMISTRY-III**	• To learn about the Alkyls and Arene complexes • To understand the bonding in olefin, acetylene and allyl systems

		• To know about the concepts of synthesis, structure and bonding in metallocenes • To familiarize the Organometallic reaction mechanisms and its applications • body with their structure and stereochemistry • To study in detail about nitrogen fixation reactions and microorganisms involved in nitrogen fixation reactions • To learn about the different types of nuclear reactions • To study about the components of nuclear reactors • To familiarize with working of Nuclear power plant and breeder reactor. • To learn in detail of the mechanism in nuclear fission, fusion, photonuclear reactions and stellar energy
CH 232	**ORGANIC CHEMISTRY-III**	• To learn about the Principle and applications of ultraviolet and Woodward Fisher Rule • To understand the infra-red spectroscopy in organic structure determination • To know about the Nuclear magnetic resonance spectroscopy. Proton chemical shift, spin-spin coupling, coupling constants and applications to organic structures 13C resonance spectroscopy • To learn the Mass spectrometry and its applications • To learn about the Aldol, Claisen ester condensations, Cannizzaro reaction, Dieckmann cyclisation and Reformatsky reaction • To understand the Dakin reaction, Etard reaction, HVZ reaction, Umpolung synthesis and Stephen reaction

			• To know about the Barton reaction, Jones oxidation, Oppenauer oxidation and Michel addition. • To familiarize the different types of reduction reaction • To learn some technical knowledge of, and some practical experience with, analyses in gas and liquid chromatography, and in capillary electrophoresis • To develop skills in procedures and instrumental methods applied in analysis tasks • To understand principles and their practical application in publications describing chromatography or electro-migration techniques
	CH 233	**PHYSICAL CHEMISTRY-III**	• To familiarize the Partial molar properties and its determination • To learn about the chemical potential and its determination • To study the concept of thermodynamic probability • To get an idea of Quantum mechanical computational methods • To get a basic idea of construction of Z matrix for simple molecules • To know about the Vibrational spectroscopy, Vibrational coupling overtones and Fermi resonance. Raman Spectra • To study the spin-spin coupling, NMR of simple AX and AMX type molecules
IV	**CH242 (b)**	**ORGANIC CHEMISTRY-IV**	• To study some of the basic terminologies in polymers • To learn about the different mechanisms involved in the polymer preparation • To learn about the different polymerization techniques

- To study History of science and chemical information.
- To discuss the biological database and Gene expression
- To visualize the structure of different biological structures
- To understand the genetic basis of disease
- To get a clear knowledge about drugs and their structure and functions
- To study drug actions and enzymes
- To study the concepts of molecular recognition
- To highlight the importance of molecular recognition in DNA and protein structure
- To get basic knowledge of Combinatorial organic synthesis
- To know about the different classes of drugs
- To familiriaze with the synthesis of various types of drugs
- To understand the various peptide bond formation methods
- To get a clear idea of protein sequencing
- To explain the synthesis of various stereoregular polymers
- To understand the connection between common atoms and complex molecules
- To understand the connection at the chemical level between all matter and will develop your inquiry based activities to explore best practices related to organic farming and resource management.
- To about the advance technology in green chemistry
- How they impact the human body, to develop your particular interests on the topic To describe how Green chemistry and sustainability

		developments affect society, the environment and economic development • To explain how Green chemistry and sustainability relates to problems of societal concern
CH 241	**CHEMISTRY OF ADVANCED MATERIALS**	• To learn about the definition of a nano system and the basic concepts of nanoscience and technology • To understand the Scientific revolutions of nanotechnology • To know about the Scope of nanoscience and technology and commercial applications of Nanotechnology • To know about the Methods of self-assembly and applications of self-assembled monolayers • To know the detail study of Applications of metal nanoparticles in technologically imperative fields • To study some of the basic terminologies in polymers • To get an idea of the industrial polymers and conducting polymers • To get an insight into polymer-based nanoparticles and their applications • To get an overview of liquid crystalline polymers • To familiarize with the different types of smart materials • To know about the Photochromic coordination compounds • To learn about the various types of shape memory polymers

OUTCOME BASED EDUCATION IN COMMERCE

COURSES IN COMMERCE

UNDER GRADUATE PROGRAMME

B.Com.

Programme Description:

- A 3 year Degree programme under Choice Based-Credit & Semester-System with Commerce as the core course.
- The programme spanned over 6 semesters.
- Apart from the Core Course in Commerce, there is an Open Course Programme in Commerce for students from all other subject backgrounds except those from the Core Commerce, and an Elective Course in Commerce

Programme General Outcome:

- This program could provide Industries, Banking Sectors, Insurance Companies, Financing companies, Transport Agencies, warehousing etc. well-trained professionals to meet the requirements.
- After completing graduation, students can get skills regarding various aspects like Marketing Manager, Selling Manager, over all Administration abilities of the Company.
- Capability of the students to make decisions at personal and professional level will increase after completion of this course.
- Students can independently start up their own Business.
- Students can get thorough knowledge of finance and commerce.
- The knowledge of different specializations in Accounting, costing, banking and taxation with the practical exposure helps the students to stand inorganization.

Programme Specific Outcome:

- The students can get the knowledge, skills and attitudes during the end of the B.com degree course.
- After successful completion they can turn into a Manager, Accountant, Management Accountant, cost Accountant, Bank Manager, Auditor, Company Secretary, Teacher, Professor, Stock Agents, Government employments and so on.,
- Students will get opportunities for attending different professional exams like C.A, C S, CMA, MPSC, UPSC. As well as other courses.
- The students will acquire the knowledge and skill in different areas of business activities.
- Students will get thorough knowledge in various disciplines of commerce and management
- They also get the practical skills to work as accountant, auditor, tax consultant as well as other financial supporting services.
- Students will be able to do their higher education and can make research in the field of finance and commerce.

CORE COURSES

SEM.	COURSE CODE	COURSE TITLE	COURSE OUTCOMES
I	**CO 1141**	**METHODOLOGY AND PERSPECTIVES OF BUSINESS EDUCATION**	• To create a basic awareness about the business environment and the role of business in economic development. • To provide a holistic, comprehensive and integrated perspective to business education • To give a fundamental understanding about ethical practices in business.
	CO 1121	**ENVIRONMENTAL STUDIES**	• To develop knowledge and understanding of the environment

			and enable the students to contribute towards maintaining and improving the quality of the environment. • To enable the students to acquire basic ideas about environment and emerging issuesabout environmental problems. • To give awareness about the need and importance of environmental protection
	CO 1142	**MANAGEMENT CONCEPTS AND THOUGHT**	• To provide a comprehensive perspective on management theory and practice • To equip learners with knowledge of management concepts and their application in contemporary organizations • To facilitate overall understanding of the different dimensions of the management process.
	CO 1131	**MANAGERIAL ECONOMICS**	• To acquaint the students with the application of economics in managerial decision making. • To familiarise students with the economic principles and theories underlying various business decisions. • To equip the students to apply the economic theories in different business situations.
II	**CO 1221**	**INFORMATICS AND CYBER LAWS**	• Demonstrate basic concepts and fundamental knowledge in the field of informatics. • Update and expand informatics skills and attitudes relevant to the emerging society. • Create awareness about the cyber world and cyber regulations. • Equip the students to effectively utilize the digital knowledge resources for business studies

			• Analyse the impact of informatics on business decisions.
	CO 1241	**FINANCIAL ACCOUNTING**	• Understanding the principles and concept of financial accounting. • Develop the skills for preparation of financial statements and accounts of various business areas • Familiarise the accounting standards for solving the accounting problems
	CO 1242	**BUSINESS REGULATORY FRAMEWORK**	• Demonstrate the legal framework influencing business decisions and operations • Enable the students to apply the provisions of business laws in business activities. • Analyse the Indian business laws, Regulatory authorities • Aware students about the legal formalities comply with contracts, bailment and pledge, transfer of property in goods. • Motivate the students to take up higher studies in business laws.
	CO 1231	**BUSINESS MATHEMATICS**	• To enable students to acquire knowledge in applying basic mathematical tools in practical business decisions. • To familiarise the students with the basic mathematical tools. • To impart skills in applying mathematical tools in business practice
III	**CO 1341**	**ENTERPRENEURSHIP DEVELOPMENT**	• Impart knowledge regarding how to start a new venture. • Equip students to have a practical insight for becoming an entrepreneur • Familiarize the latest programs of government authorities in promoting small and medium industries

		• Promoting Women entrepreneurship, Training and development programs • Demonstrate the general principles of a good reporting system
CO 1342	**COMPANY ADMINISTRATION**	• Familiarise the provisions of Indian companies act 2013. • Create awareness about the management and administration of companies • Demonstrate the disclosure and transparency of related documents and online filing of documents • Investigation into the affairs of the company and winding up procedures and compliances requirements • Provide key managerial personnel,responsibility and challenges for becoming a company secretary
CO 1343	**ADVANCED FINANCIAL ACCOUNTING**	• Equip students with the preparation of accounts of partnernership firms. • Demonstrate the system of accounting for different branches and departments. • Enable the students aware about preparation of accounting of consignment and joint venture.
CO 1361.5	**COMPUTER APPLICATION FOR PUBLICATIONS**	• To update and expand skills in electronic data processing and computer application in business operations. • To give functional knowledge in the field of free software • To develop practical skills in document preparation, publishing and business presentation.
CO 1331	**E-BUSINESS**	• To expose the students to e- business and its potentialities. • To provide students a clear-cut idea of e-commerce and e-business and their types and models.

			• To acquaint students with some innovative e-business systems. • To impart knowledge on the basics of starting online business**.**
IV	**CO 1441**	**INDIAN FINANCIAL MARKET**	• Provide in-depth knowledge on Financial Market and its Operations • To provide a clear-cut ideasabout the functioning of Indian Financial Market in general and Capital market operations in particular. • Analysis of stock exchange indices, Derivatives, Dematerialization of securities
	CO1442	**BANKING AND INSURANCE**	• Expose the students to the changing scenario of Indian banking and insurance • Provide basic knowledge of theory and practices of banking • Awareness about innovations and reforms in banking sector • Familiarize the students with E-banking,Mobile banking, and Internet banking facilities and insurance • Demonstrate the product and services available in retail banking • Create an awareness about the Non-Performing Assets and its management. • To provide a basic understanding of Insurance business.
	CO1443	**CORPORATE ACCOUNTING**	• Demonstrate the accounting practices prevailing in the corporate sector • Develop awareness about corporate accounting in conformity with the provisions of companies Act,IAS, IFRS • Aware about Amalgamation, Absorptionand External reconstruction

		• Enable the students aware about internal reconstruction and interpretation of financial statement
CO1431	**BUSINESS STATISTICS**	• Create an awareness about statistical methods and techniques used in business • Application of different measures of correlation in business • Determination of Regression equation and its application in business sector
CO1561.5	**SOFTWARE FOR DATA MANAGEMENT**	• Introduce students to the various relevant aspects of computerised data processing. • Equip the students aware about the advanced uses of Microsoft excel • Provide information about the software packages in social science • Enable the student aware about the data base management security systems.
CO 1443	**CORPORATE ACCOUNTING**	• To expose the students to the accounting practices prevailing in corporate. • To create awareness about corporate accounting in conformity with the provisions of Companies Act, IAS and IFRS. • To help the students in preparation of accounts of banking and insurance companies. • To enable the students to prepare and interpret financial statements of joint stock companies.
CO 1461.5	**SOFTWARE FOR DATA MANAGEMENT**	• To update and develop theoretical and technical expertise in applying software for data management. • To familiarise the students with the basics of Software for data management.

			• To equip the students to meet the demands of the industry. • To develop practical skills in spread sheet application, statistical software and database application.
V	**CO 1541**	**FUNDAMENTALS OF INCOME TAX**	• Impart basic knowledge and understanding about the concepts and practices of income tax law in India • Demonstrate the determination of residential status and incidence of tax • Awareness about the exempted incomes involved in tax computation and practices about how to avoid tax • Acquire the skills required to compute the gross total income of a person • Enable the student in computation of income from salary, house property, profits and gains of business or profession and income from other sources.
	CO 1542	**COST ACCOUNTING**	• Understand the difference between cost accounting and financial accounting • Prepare the profit, reconciliation statement • To impart knowledge of cost accounting system and acquaint the students withthe measures of cost control. • To familiarize the students with cost and cost accounting concepts • To make the students learn cost accounting as a distinct stream of accounting
	CO 1543	**MARKETING MANAGEMENT**	• To impart the knowledge of various concepts of modern marketing management • To provide an understanding of the contemporary marketing process in the emerging business scenario.

			• To study various aspects of application of modern marketing techniques for obtaining a competitive advantage in business organizations.
	Open Course I: CO 1551.1	**FUNDAMENTALS OF FINANCIAL ACCOUNTING**	• To provide basic accounting knowledge as applicable to business and to form a background for higher learning in financial accounting. • To enable the students to acquire knowledge in the basic principles and practices of financial accounting. • To equip the students to maintain various types of ledgers and to prepare final accounts. to acquire knowledge in the basic principles and practices of financial accounting.
	CO 1561.5	**WEB DESIGNING AND PRODUCTION FOR BUSINESS**	• To expose students to environment for web designing and developing • To impart functional knowledge in the field of Web design • To develop practical skills in Web deigning and production for business organisations.
VI	**CO 1641**	**AUDITING**	• The acquaint the students with the principles and practice of auditing • To provide students the knowledge of auditing principles, procedures and techniques in accordance with current legal requirements and professional standards. • To familiarize students with the audit of Companies and the liabilities of the auditor.
	CO 1642	**APPLIED COSTING**	• To develop the skill required for the application of the methods and techniques of costing in managerial decisions. • To acquaint the students with different methods and techniques of costing.

			• To enable the students to apply the costing methods and techniques in different types of industries.
	CO 1643	**MANAGEMENT ACCOUNTING**	• To develop professional competence and skill in applying accounting information for decision making. • To enable students to acquire sound knowledge of concepts, methods and techniques of management accounting • To make the students develop competence with management accounting usage in managerial decision making and control.
	CO 1661.5	**COMPUTERISED ACCOUNTING**	• To update and expand the skills in the application of accounting packages. • To expose the students to computer application in the field of Accounting. • To develop practical skills in the application of Tally Package

OUTCOME BASED EDUCATION IN ECONOMICS

COURSES IN ECONOMICS

- **BA ECONOMICS**
- **MA BEHAVIOURAL ECONOMICS AND DATA SCIENCE**

UNDER GRADUATE PROGRAMME
BA
Programme Description: ➢ A 3-year Degree programme under Choice Based-Credit & Semester-System with Economics as the core course. ➢ The programme spanned over 6 semesters. ➢ Apart from the Core Course in Economics, there is an Open Course Programme in Economics for students from all other subject backgrounds except those from the Core Economics, and an Elective Course in Economics.

CORE COURSES			
SEM	**COURSE CODE**	**COURSE TITLE**	**COURSE OUTCOMES**

I	**EC 1141**	**Introductory Micro Economics**	• Explain the role of scarcity, specialization, opportunity cost and cost/benefit analysis in economic decision-making. • Identify the determinants of supply and demand; demonstrate the impact of shifts in both market supply and demand curves on equilibrium price and output. • Summarize the law of diminishing marginal utility; describe the process of utility maximization. • Calculate supply and demand elasticities, identify the determinants of price elasticity of demand and supply, and demonstrate the relationship between elasticity and total revenue.
II	**EC1241**	**Intermediate Microeconomics**	• Describe the production function and the Law of Diminishing Marginal Productivity; calculate and graph short-run and long-run costs of production. • Identify the four market structures by characteristics; calculate and graph the profit maximizing price and quantity in the output markets by use of marginal analysis. • Determine the profit maximizing price and quantity of resources in factor
III	**EC 1321**	**Informatics for Applied Econometrics**	• Ability to identify the functionality of various components of Computer System. • Ability to develop application using simple python. • Ability to use, develop & debug programs independently. • Ability to store and retrieve data using an RDBMS. • Ability to understand societal, legal and ethical aspect of technology. • Ability to ensure safety and security in cyber-space.
III	**EC 1341**	**Introductory Macroeconomics**	• Explain the objectives of government macroeconomic policy and describe how they can be pursued. • Define and measure national income and rates of unemployment and inflation. • Describe the causes and consequences of inflation and unemployment. • Explain the role of the European Central Bank and how exchange rates and interest rates are determined.

			• Construct the aggregate demand and aggregate supply model of the macro economy and use it to illustrate macroeconomic problems and possible fiscal policy and monetary policy solutions
IV	**EC 1441**	**Mathematical Methods for Economics**	• Demonstrate the role of quantitative techniques in the field of business/industry, illustrate different types of equations, solve equations and system of equations, understand the concept of sets, illustrate and apply basic set operations. • Explain the rules for calculating derivatives, uses and application in calculating inter-relationship among total, marginal and average cost and revenue, calculate maxima, minima, elasticity, decide the optimal level of production for a firm. • Demonstrate the rules for calculating integration, describe the importance and application of integration in consumers' and producers' surpluses, total revenue and cost. • Illustrate matrix operation, minors, cofactors, use cofactor method to find inverse of a matrix, use Cramer's rule to solve systems of equations. • Demonstrate knowledge of basic concept of linear program, duality, capacity to solve linear programming problems', familiar with the basic techniques most commonly used in economics.
IV	**EC 1442**	**Intermediate Macroeconomics**	• The meaning of unemployment and inflation data and how that data is collected and computed. • the meaning and components of the National Income Accounts, especially GDP; • the meaning of the business cycle and its phases; • and to manipulate the basic Aggregate Supply, Aggregate Demand model of the macro economy; • how fiscal policy operates, its tools, and its advantages and drawbacks; • how a fractional reserve banking system works;
V	**EC 1541**	**Methodology and Perspectives of Social Science**	• To familiarize the students with the broad contour of Social sciences. • It aims to create an enthusiasm among students about different schools of

			economic thought and various aspects of social sciences. • It creates an awareness about social science research, methodology, concepts etc.
V	**EC 1542**	**Statistical Methods for Economics**	• Collect appropriate data needed, manipulate and draw inferences, describe the concept of statistical averages, use and apply central tendency, dispersion, skewness, and kurtosis. • Demonstrate the basic concept of probability, theoretical distribution, probability theorems; solve probability problems by applying probability concept. • Explain concept of correlation, analyse and interpret covariance and correlation coefficient, illustrate ordinary least squares and use it to estimate regression coefficient. • Describe the components of time series, apply time series analysis in business scenarios, illustrate the different types of index numbers, and calculate index numbers
V	**EC 1543**	**Readings in Political Economy**	• To understand the emergence of political economy and its evolution to economics as a discipline.
V	**EC1544**	**Economic Growth and Development**	• To ensure that students begin to understand basic concepts of Economic Growth and .1 Development and thereby enable them to acquire multi-dimensional aspects of developmental issues • To convey knowledge about theoretical framework of Growth and Development under different Schools of economic thought • To impart knowledge about Political institutions, the role of the state in Economic Development and problems that affect state Governance
V	**EC1545**	**International Economics**	• Identify the basic difference between inter-regional and international trade, understand how international trade has helped countries to acquire goods at cheaper cost and explain it through the various international trade theories. • Show the benefits of international trade in a way how nations with strong international trade have become prosperous and have the power to control world economy and how

			global trade can be one of the major contributors of reducing poverty. • Explain how restrictions to international trade would limit a nation in the services and goods produced within its territories and at the same time explain that a rise in international trade is essential for the growth of globalization. • Show the importance of maintaining equilibrium in the balance of payments and suggests suitable measures to correct disequilibrium as well.
V	**EC1551.2**	**Human resource management (Open Course)**	• Identify each of the major HRM functions and processes of strategic HRM planning, job analysis and design, recruitment, selection, training and development, compensation and benefits, and performance appraisal. • Define strategic HR planning and the HRM process to the organization's strategic management and decision making process. • Recall the wide range of sources for attracting and recruiting talent and appropriate practices for job placement. • Recognize emerging trends, opportunities and challenges in performance appraisal. • • List training and development processes as well as future trends for HRM globalization
VI	**EC1641**	**Indian Economy**	• Develop ideas of the basic characteristics of Indian economy, its potential on natural resources. • Understand the importance, causes and impact of population growth and its distribution, translate and relate them with economic development • Grasp the importance of planning undertaken by the government of India, have knowledge on the various objectives, failures and achievements as the foundation of the ongoing planning and economic reforms taken by the government. • Understand agriculture as the foundation of economic growth and development, analyse the progress and changing nature of agricultural sector and its contribution to the economy as a whole.

			• Not only be aware of the economy as a whole, they would understand the basic features of Mizoram's economy, sources of revenue, how the state government finance its programmes and projects.
VI	**EC1642**	**Banking and Finance**	• Banking System a. Balance sheet and portfolio management. b. Indian banking system: Changing role and structure; banking sector reforms. • Central Banking and Monetary Policy Functions, balance sheet; goals, targets, indicators and instruments of monetary control; monetary management in an open economy; current monetary policy of India. • Explain the broad features of Indian financial institutions with its apex banks' objectives and purview. Also understand the instruments to control credit in the country. • Identify the existence and development of non-banking financial institutions, know the important role of Mutual funds, LIC, investment companies etc., utilize and effectively participate in the development process. • Understand the conditions of financial markets and its impact in the economy. • Demonstrate the role and significance of foreign exchange rate and its markets with its impact on various sectors in the economy
VI	**EC1643**	**Public Economics**	• Introducing the subject matter and scope of public economics, role of government, types of market failures and the concept of public good. • Providing a general understanding on the basic fiscal policy instruments. • Generating awareness on public economics in India, with special focus on budgetary system .and fiscal federalism.
VI	**EC 1644**	**Environmental Economics and Disaster Management**	• intends to create environmental awareness among students and provide exposure to disaster management.
VI	**EC1661. 1**	**Kerala Economy**	• Sensitize the overall development and engine of growth in agriculture. Draw distinctive features of rural and urban economy or agricultural and non-

			agricultural which can influence the whole economy. • Learn and identify the opportunities open/available in those flourishing sectors such as horticulture, fishing and floriculture and forestry. Find new investment opportunities to add income and employment. • Understand limited resources available in the economy. Realize the need to exploit and utilize through development and improvement of production techniques. • Make them aware of the availability of rich natural endowments to achieve sustainable agricultural development. With this knowledge they can challenge the problems of unemployment, inequality, shortage of food productions, poverty, and be useful to compete advanced agricultural economies. • Gain knowledge of the causes of regional variations in productivity and production, social and economic inequality, size of land holdings and lack of quality inputs etc. and suggest appropriate measures for the whole economy.
VI	**EC 1645**	**Project/ Dissertation**	

MA BEHAVIOURAL ECONOMICS AND DATA SCIENCE

CORE COURSES			
SEM	**COURSE CODE**	**COURSE TITLE**	**COURSE OUTCOMES**
I	**BEDS-CC-211**	**Micro Economic Theory**	• Familiarise with various consumer theories and apply them to analyse and predict the behaviour of individuals • Understands the concept of production and cost. • Familiarise with different market structures – Perfect and imperfectly competitive. • Understand about general equilibrium and concept of economic welfare. • To have greater insight into market failure and related aspects
I	**BEDS-CC-212**	**Macro-Economic Theory**	• Familiarise with various schools of macroeconomic thoughts • Understands the concept of ISLM approach

			• Understands the concept of Demand & supply of money. • To analyse the behavioural foundations of macro economics. • To familiarise with open economy macro economics.
I	**BEDS-CC-213**	**Quantitative Tools for Behaviour Economics**	• Familiarise with averages, dispersion and probability distributions • Understands the concept of exponents, polynomials, functions, limits, continuity etc.. • Familiarise with optimisation – maxima and minima. • To understand about linear algebra – vectors – matrix etc. • To familiarise with vectors and quadratic forms
I	**BEDS-CC-214**	**Principles of Cognitive Economics**	• Familiarise with economics of psychology & behavioural mental economics • Understands the concept of motivation & personality. • Familiarise with perception & condoning • To understand about information processing. • To familiarise with expectation, emotions & well being.
II	**BEDS-CC-221**	**Foundations in Behavioural Microeconomics**	• Familiarise with the discipline behavioural economics. • Understands the concept preference, risk etc. • Familiarise with inter temporal choice. • To understand about strategic interaction& behavioural game theory • To familiarise with nudges, policy & happiness
II	**BEDS-CC-222**	**Foundations in Behavioural Macroeconomics**	• Familiarise with the discipline behavioural macro economics. • Understands the new approaches to macro economic modelling • To understand about Inertia in macroeconomic variables and non-normality • To familiarise with transmission of shocks • To familiarise with nudges, policy & happiness
II	**BEDS-CC-223**	**Foundations of Data Science**	• Familiarise with the area of Data Science • Understands about data processing • Familiarise with machine learning • To understand about clustering

			• To familiarize with Data Visualization
II	**BEDS-CC-224**	**Basic Econometrics and Research Methodology**	• To create an understanding among the students on basic econometric methodology • To train the students in applying economic theories to real economic data by means of empirical models • To train the students in applying economic theories to real economic data by means of empirical models • To Familiarize about time series data • To have basic understanding about research methodology
III	**BEDS-CC-231**	**Applied Behavioural Economics**	• To conceptualising welfare and measuring welfare. • To familiarize with behaviour economics and development economics • To understand about behavioural economics & labour market • To Familiarize about behavioural economics and health economics • To have basic understanding behavioural economics and organisational behaviour
III	**BEDS-CC-232**	**Experimental Economics: Methods and Application**	• To familiarize with history and emergence of experiments in economics • To understand Need for experiments in economics • To understand how to design an experiment • To familiarize with econometrics of experimental data • To understand the external validity of an experiment
III	**BEDS-CC-233**	**Game Theory**	• To familiarize the concept of theory of games • To understand about strategic games & Nash equilibrium • To understand about the illustrations of Nash Equilibrium • To Familiarize with mixed Strategy Nash Equilibrium • To understand about extensive Games and Nash Equilibrium
III	**BEDS-DSE-234**	**Advanced Econometrics**	• To develop analytical skills needed to work successfully with real economic data • To understand about of simultaneous equation models • To understand about to non-stationary Time Series

			• To familiarize with Time Series Econometrics: Forecasting • To understand about panel data models
IV	**BEDS-CC-241**	**Basics of Behavioural Finance**	• To familiarize with basic aspects of behavioural finance. • To understand about building block of behavioural finance • To understand about rationality from an economics and evolutionary prospective • To familiarize with external factors and investor behaviour • To familiarize with behavioural corporate finance.
IV	**BEDS-CC-242**	**Behavioural Economics and Policy Design**	• To familiarize with basic aspects of behavioural policy design • To understand about incentives and norms for public policy • To understand about incentives and norms for public policy • To understand about nudge and policy design • To familiarize with government policy –taxation • To familiarize with behaviour and environment
IV	**BEDS-CC-243**	**Foundations Of Data Analysis Using R and Python**	• To familiarize with introduction to Data Science. • To understand about Basics of Coding in Python • To understand about Basic coding in R • To familiarize with Exploratory data analysis • To familiarize with Regression modelling
IV	**BEDS-DSE-244**	**Behavioural Economics and Public Health**	• To familiarize link between behavioural economics and public health. • To understand about health behaviour • To understand about social norms, belief and action • To familiarize with nudging individuals • To understand with deciding better health policies
IV	**BEDS-D- 225**	**Behavioural and Data Science Project**	• To develop research aptitude and skills among the students. Students produce a well-structured dissertation work meeting standard requirements of academic writing.

OUTCOME BASED EDUCATION IN MATHEMATICS

COURSES IN MATHEMATICS

UNDER GRADUATE PROGRAMME

B.Sc.

Programme Description:

- A 3 year Degree programme under Choice Based-Credit & Semester-System with Mathematics as the core course.
- The programme spanned over 6 semesters.
- Apart from the Core Course in Mathematics, there is an Open Course Programme in Mathematics for students from all other subject backgrounds except those from the Core Economics, and an Elective Course in Mathematics and complementary Mathematics programme.

CORE COURSES

SEM.	COURSE CODE	COURSE TITLE	COURSE OUTCOMES
I	**MM 1141**	**Methods of Mathematics**	• Understand the application of Mathematics in physical science. • Methods of solving maximum - minimum problems relating to day to day life.
II	**MM 1221**	**Foundations of Mathematics:**	• Understand the way in which a mathematician formally makes statements and proves or disproves it. • Applications of Mathematicians in Astronomy such as Kepler's laws. • Understand foundations of vector calculus.
III	**MM1341**	**Elementary Number Theory and Calculus I:**	• Understand Abstract Algebraic Structure. • Familiar with the facts in elementary number theory.
IV	**MM1441**	**Elementary Number Theory and Calculus II**	• Analysis of fundamental facts in elementary number theory. • Understand calculus of vector functions and multiple integrals. •
V	**MM 1541**	**Real Analysis I**	• Application of the concepts of the real number
	MM 1542	**Complex Analysis I**	• Understand Complex analysis and its applications • Applications of Complex analysis in Engineering and other sciences
	MM 1543	**Differential Equations**	• Problem solving using differential equation with regard to various physical problems
	MM 1544	**Vector Analysis**	• Understand some advanced points of vector calculus
	MM 1545	**Abstract algebra I**	• Application of the Theory of Groups and rings
	MM 1551.2	**Business Mathematics (Open Course)**	• Understand basic mathematics of finance • Understand differentiation and their applications to business and economics

VI	**MM 1641**	**Real Analysis II**	• Application of the concepts of the real number
	MM 1642	**Linear Algebra**	• Understand linear algebra and methods in it for solving practical problems
	MM1643	**Complex Analysis 11**	• Understand Complex analysis and its applications • Applications of Complex analysis in Engineering and other sciences
	MM 1644	**Abstract algebra II**	• Application of the Theory of Groups and rings
	MM 1661.1	**Graph Theory:**	• Awareness of some of the fundamental concepts in graph theory • Understand of the subject so as to use these ideas skilfully in solving the real world problems

COMPLEMENTARY COURSES FOR B.Sc. PHYSICS

SEM.	COURSE CODE	COURSE TITLE	COURSE OUTCOMES
I	**MM 1131.1**	**Calculus with applications in Physics I**	• Understand the applications of differentiation and integration to physics • Understand infinite series , calculus to vectors functions and multiple integrals
II	**MM 1231.1**	**Calculus with applications in Physics II**	• Understand the applications of differentiation and integration to physics • Understand infinite series , calculus to vectors functions and multiple integrals
III	**MM 1331.1**	**Calculus and Linear Algebra**	• Familiar with line, surface, volume integrals and Fourier series • Problem solving using differential equations and basic linear algebra
IV	**MM 1431.1**	**Complex Analysis, Special functions and probability Theory**	• Understand complex analysis and its applications, introduce special functions

			• Application of probability theory in physical sciences

COMPLEMENTARY COURSES FOR B.Sc. CHEMISTRY

SEM.	COURSE CODE	COURSE TITLE	COURSE OUTCOMES
I	**MM 1131.2**	**Calculus with applications in Chemistry – I**	• Understand the applications of differentiation and integration to Chemistry • Understand basic vector algebra complex numbers, infinite series and limits.
II	**MM 1231.2**	**Calculus with applications in Chemistry – II**	• Understand the applications of differentiation and integration to Chemistry • Understand basic vector algebra complex numbers, infinite series and limits.
III	**MM 1331.2**	**Linear Algebra, Probability theory and Numerical methods**	• Problem solving using basic linear algebra and numerical methods • Application of probability theory in Chemistry
IV	**MM 1431.2**	**Differential Equations, Vector calculus and abstract algebra**	• Problem solving using differential equations • Familiar with abstract algebra • Understand line, surface and volume integrals

COMPLEMENTARY STATISTICS for B.Sc. MATHEMATICS

SEM.	COURSE CODE	COURSE TITLE	COURSE OUTCOMES
I	ST 1131.1	**Descriptive statistics**	• Aims that Students will learn to understand the characteristics of data • Students will able to learn collect, organize and summarize the data and interpret simple graphs and compute appropriate summary statistics
II	ST 1231.1	**Probability and Random variables:**	• This course will introduce elementary ideas of probability and random variables
III	ST 1331.1	**Statistical Distribution**	• This course introduces standard probability distributions, limit theorems and sampling distributions.
IV	ST 1431.1	**Statistical Inference:**	• This course enables students to understand the methods of statistical inference.
	ST 1421.1	**Practical using Excel**	• The students will learn to use statistical tools available in Excel and have hands on training in data analysis • This course covers topics of courses I, II , III and IV • Use of Excel in statistics (charts, functions and data analysis).

B.Sc. PHYSICS

Programme Description:

- A 3 year Degree programme under Choice Based-Credit & Semester-System with Physics as the core course.
- The programme spanned over 6 semesters.
- Apart from the Core Course in Physics, there are Complementary Courses in Physics for B.Sc. Mathematics & Chemistry Programmes, an Open Course Programme in Physics for students from all other subject backgrounds except those from the Core Physics, an Elective Course in Physics, Project and Scientific research, Research Institute/Science Museum visit, and Lab experiments for Core, and Complementary Physics Programmes.

General Outcomes for the Programme:

✓ **At the end of the Programme, students will be able to:**

- Acquire a solid foundation in all aspects of Physics.
- Familiarize a broad spectrum of modern trends in Physics.
- Develop experimental, mathematical & computational skills.
- Expand the existing knowledge in basic areas of Physics acquired from the Plus- Two classes and create a logical framework in assimilating the higher levels of Physics.
- Transform themselves as graduates of the calibre sought by technologies, industries and public service as well as academic teachers and researchers of the future.
- Get opportunities and platform to acquaint the skills for gathering information from various resources and to understand its effective uses.
- Develop skills and enthusiasms to the best of their potential through an intellectually stimulating environment provided by the programme.

✓ **By the end of the First Year Degree Programme, the students should have:**

- Attained a common level in Basic Mechanics and Properties of Matter and laid a secure foundation in Mathematics for their future courses.
- Developed their experimental and data analysis skills through a wide range of experiments in the practical laboratories.

OUTCOME BASED EDUCATION IN PHYSICS

COURSES IN PHYSICS

UNDER GRADUATE PROGRAMME	POST GRADUATE PROGRAMME
B.Sc. PHYSICS	M.Sc. PHYSICS

✓ **By the end of the Second Year Degree Programme, the students should have:**

- Been introduced to powerful tools for tackling a wide range of topics in Thermodynamics, Electrodynamics, Classical Mechanics and Relativistic Mechanics.
- Become familiar with additional relevant mathematical techniques.
- Further developed their experimental skills through a series of experiments which also illustrate major themes of the lecture courses.

✓ **By the end of the Third Year Degree Programme, the students should have:**

- Covered a range of topics in almost all areas of Physics including Quantum Physics, Solid State Physics, Computational Physics, Electronics, Computer Hardware and networking etc.
- Had experience of independent work such as Projects, Seminars etc.
- Developed their understanding of Core Physics

PROGRAMME LEARNING OUTCOMES

CORE COURSES

SEM.	COURSE CODE	COURSE TITLE	COURSE OUTCOMES

I	**PY1141**	**BASIC MECHANICS & PROPERTIES OF MATTER**	Upon the completion of the course, the students will be able to: ▪ Develop knowledge and understanding of the historical development of mechanics, some implications of the principle of mechanics and the scope of mechanics. ▪ Apply knowledge of the dynamics of rigid bodies, conservation of energy, oscillations, waves and mechanical properties of matter such as elasticity, fluid dynamics and surface tension to explain natural physical processes and related technological advances. ▪ Use an understanding of elementary mathematics along with physical principles to effectively solve problems encountered in everyday life and, apply that in the advanced and further study in science. ▪ Work on the experimental design and studies on project topics such as Young's modulus for different types of wood, variation of surface tension for different detergents, viscosity of different types of ink and to arrive at knowledge of its fluidity, wide applications of Bernoulli's equation and variation of surface tension with temperature by Jaeger's method. ▪ Understand the contributions of eminent physicists- Newton, Einstein, C. V. Raman, Edison in the development of physics in its historical and cultural context. ▪ Develop knowledge of the laws of thermal conductivity and thermodynamics, and understand its implications.

II	**PY1241**	**HEAT AND THERMODYNAMICS**	▪ Develop skills in the problem solving using the concepts of heat and thermodynamics. ▪ Introduce applications of thermodynamics to heat engines such as Carnot engine, Otto engine and Diesel engine and the principle of refrigerator. ▪ Develop an appreciation of the concepts of order, disorder and entropy and an understanding of theheat as an energy.

	PY 1341	**ELECTRODYNAMICS**	▪ This course provides an advanced knowledge in understanding the principles and the dynamic as well as the static phenomena of electromagnetism. ▪ Students will be in a position to make a mathematical description of electromagnetic phenomena based on basic physical quantities through the fundamental equations of electromagnetism (Maxwell equations). ▪ Students must be able to solve electrodynamics problems using the fundamental equations through advanced mathematical steps tools like vector calculus. ▪ Students must be engaged to draw qualitative and quantitative conclusions about bound charges, alternating and transient currents, electromotive force, storage of electrostatic energy in a field, magnetic vector potential, electrostatic potential etc., by managing a number of physical concepts and laws such as Gauss's law, Ampere's circuital law, Faraday's law etc. and its applications. ▪ Study in depth the transient current response of LR, CR and LCR circuits and the alternating current response of LCR series, and parallel circuits, which are essential in designing as well as understanding the working of electronic circuits. ▪ This course equips the students with the necessary mathematical knowledge for a detailed and accurate
III			

			description of phenomena such as polarization, magnetism in materials, magnetic flux, magnetic torque, magnetic charge, electromagnetic induction, propagation of electromagnetic waves in vacuum etc., and for solving related problems.
IV	**PY 1441**	**CLASSICAL AND RELATIVISTIC MECHANICS**	▪ Students who completed this course should have deep understanding and working knowledge in the concepts of Newtonian mechanics, Lagrangian dynamics, Hamiltonian mechanics, Lorentz transformations and special theory of relativity. ▪ Students should be able to understand phenomena of length contraction, time dilation, twin paradox and mass-energy equivalence. ▪ Students can be able to apply their classical mechanical understanding to a variety of dynamical simple configurations and systems for solving its problems. ▪ Students must be in a position to equip with the necessary mathematical concepts to be able to solve relativistic problems.
V	**PY1541**	**QUANTUM MECHANICS**	Students who completed this course should: ▪ Have a deep understanding of the limitations of classical physics and the emergence, and the mathematical foundations of quantum mechanics. ▪ Be able to solve the Schrödinger equation for simple configurations such as square-well potential with infinite

		walls, square well potential with finite walls, square potential barrier and the Harmonic oscillator. ▪ Understand that quantum mechanics is a mathematical model the solutions of which yield wave functions and energies. ▪ Understand the general formalism of quantum mechanics.
PY1542	**STATISTICAL PHYSICS, RESEARCH METHODOLOGY AND DISASTER MANAGEMENT**	After the completion of this course, the students should: ▪ Have fundamental knowledge on physical statistics and be able to solve statistical mechanics problems for simple systems. ▪ Be able to perform basic experiments in physics and to perform a statistical and systematic analysis of experimental data. ▪ Be able to write the results of an experiment in the style of a scientific paper. ▪ Be aware of the research thesis writing. ▪ Have a feel of what it means to do independent research. ▪ Disaster management study will be able to equip the students a deep awareness about natural disasters and natural hazards like climate change, earthquake, tsunami, flood, radiation emergencies etc., and their effects like health emergencies, relief efforts, prevention and future development. ▪ Upon the completion of Disaster Management course, the students will be able to take actions for emergency response when disasters occur, prepare others to resolve the problems for disasters by imparting the acquired knowledge and skills

		to protect and improve.
PY1543	**ELECTRONICS**	• At the end of this course, students will be able to: • Understand the basic circuit theorems and apply them to solve circuit problems of series, parallel andcascade connections. • Be able to understand the current-voltage characteristics of a PN junction diode, Zener diode and bipolar junction transistor, their constructions using different circuit configurations and analyze its operations and working in different electronic circuits and their applications. • Know about the working of different types of power amplifiers. • Know the concepts of feedback principles and Barkhausen criterion for oscillations. • Design and analyze the RC phase shift, Hartley Oscillator, Colpitt's oscillator circuits to determine the frequency of oscillations. • Understand the fundamentals of AM and FM modulations, and demodulations. • Design and analyze the basic operations of MOSFET and UJT. • Understand the fundamentals of operational amplifiers**.**
PY1544	**ATOMIC & MOLECULAR PHYSICS**	At the end of this course, the students should: • Be familiar with the phenomena in several areas atomic and molecular physics. • Understand the interaction between atoms, molecules and electromagnetic fields. • Be able to account for the effect of nucleus on the electron structure including concepts like mass dependency, and hyperfine structure.

		• Know the effect external electric and magnetic fields on atoms. • List the properties of X-rays, and explain the fundamentals of X-ray diffraction and X-ray absorption spectroscopy. • Explain the basic principles of molecular rotational, vibrational and electronic spectroscopies. • Know the fundamental principles of NMR, ESR and Mossbauer spectroscopies and be able to outline the applications of resonance spectroscopies. • Perform quantitative calculations based on the relationship between wavelength, energy, speed of light, and the other optical and spectroscopic terms for atomic and molecular properties.
PY1551.5	**ENERGY PHYSICS (OPEN COURSE)**	• At the end of this course, the students should: • Have a good understanding of various energy systems, related energy technologies, their availability, merits, and demerits in relation to natural and human aspects of the environment and energy applications. • Have profound and specialized knowledge in solar, wind, biomass, tidal, wave and chemical energies. • Know the effective energy management, energy storage, energy crisis and possible solutions. • Be able to suggest and design energy options for the developing countries. • Understand the impact due to non-conventional energy sources like global warming. • Gain a solid foundation for developing the use of renewable

			and conventional energy systems in society.
	PY 1641	**SOLID STATE PHYSICS**	At the end of this course, the students should: • Know how to explain the fundamental features of crystalline solids, metallic conduction through free electron model, Properties of insulators and semiconductors, band theory of solids, dielectric and magnetic properties of materials. • Understand the physics underlying superconductivity and its applications. • Be familiar with the basic theoretical and conceptual models in solid state physics such as Miller indices, reciprocal lattice, Brillouin Zones, Bragg's law, Fermi surface, Hall effect, magneto resistance, AC conductivity, Bloch theorem, Kronig-Penney model, Langevin theory, Clausius Mosotti Equation, Cauchy and Sellmeir relations, Langevin-Debye equation, Plasmons, Curie's law, Weiss's theory, Hysteresis curve, London's equation and penetration depth, isotope effect, BCS theory, tunnelling and Josephson effect etc. • Acquire the capability of elementary problem solving in solid state physics, relating theoretical prediction and analyzing the results. • Gain basic knowledge of solid state physics so as to build a foundation for further study of solid state systems and their application in electronic devices and modern technologies in material sciences. • Be able to outline the relevance of
	VI		

		solid state physics in the modern society.
PY 1642	**NUCLEAR AND PARTICLE PHYSICS**	At the end of this course, the students will be able to: ▪ Understand and explain the general properties of nuclei, nuclear structure and nuclear models. ▪ Explain different forms of radioactivity and account for their occurrence. ▪ Account for the nuclear fission and fusion processes. ▪ Understand elementary nuclear particles, and their families, symmetries and conservation laws. ▪ Know and understand various elementary particle interactions and their basic features, and interrelations. ▪ Classify elementary particles according to their Baryon, Lepton, isospin, strangeness and charm numbers. ▪ Master the knowledge of particle detectors and accelerators. • Acquire the capability of elementary problem solving in
PY 1643	**CLASSICAL AND MODERN OPTICS**	At the end of this course, the students will be able to: • Develop basic knowledge of physics behind interference, diffraction, polarization and dispersion. • Understand the fundamentals of modern optics like lasers, Fiber optics and holography. • Solve problems in optics by selecting the appropriate equations and performing numerical or analytical calculations.
PY 1644	**DIGITAL ELECTRONICS AND COMPUTER**	At the end of this course, the students should: • Understand different number systems, and their mutual

	SCIENCE	conversions as well as the arithmetic operations, digital codes, logic gates, Boolean laws, D' Morgan's theorem and Karnaugh map. • Analyze, Design and implement combinational logic gate circuits. • Be able to explain Boolean expressions for different logic gate circuits and simplify various Boolean expressions for different inputs using the Boolean algebra and with Karnaugh Map. • Explain principle of operations for various arithmetic and sequential electronic circuits. • Understand the basic components, and operational concepts of computers as well as the basic concepts, and the role of memory systems in computers. • Have deep knowledge in the C++ programming language. • Develop programming skills for solving problems in Physics using C++. • Understand the fundamentals of microprocessors and microcontrollers. • Draw and describe the basic architecture of 8085 microprocessor.
PY1661.5	**COMPUTER HARDWARE & NETWORKING (ELECTIVE COURSE)**	At the end of this course, the students should: ▪ Have ideas of architecture and functions of computer and enhance their acquired knowledge on processor, motherboard, memory, chipsets, buses and add on cards, etc. ▪ Have deep understanding about the operations of computer peripherals such as keyboard, mouse, VDU, printer, scanner, SMPS, UPS etc., and the

		working of computer drivers. ▪ Have knowledge about Computer viruses and vaccines. ▪ Be familiar with the essentials of networking, protocols, wireless and mobile technologies. • Develop knowledge and skills necessary to gain employment as computer network administrator.
PY1645	**ADVANCED PHYSICS LAB 2**	Upon the completion of this course, the students should be able to: ▪ Effectively engage in advanced experiments using spectrometer, potentiometer, Carey-Foster's bridge, circular coil, Searle's vibration magnetometer etc. ▪ Critically evaluate and analyze the results of the experimental measurements. ▪ Design and practice related experiments and acquire data in order to explore physical principles in optics, electricity and magnetism, effectively communicate results, and critically evaluate related scientific studies.
PY1646	**ADVANCED PHYSICS LAB 3**	Upon the completion of this course, the students should be able to: ▪ Effectively engage in electronics experiments using PN junction diode, Zener diode, transistor and integrated circuits and execute computer programs in physical science problems. ▪ Critically evaluate and analyze the results of the experimental measurements. ▪ Design and practice related experiments and acquire data in order to explore electronic principles, effectively

		communicate results, and critically evaluate related scientific studies.
PY1647	**PROJECT**	• Students can get an introduction to research methodology. • Bring out the talents of students in experimental, theoretical or computational researches. • Students can maintain novelty in approaching any research problem through their first-hand experiences. • Adapting to new situations. • Students can develop their oral and verbal presentation skills. • Participate in decision-making process. • Students get an opportunity to communicate with experts in the project/research field so as to share, and clarify their doubts and to seek their opinions and advices. • Search for, analysis and synthesis of data and information, with the use of the necessary technology. • Motivated students can expand and develop their future research field.
	STUDY TOUR	• Students can get an opportunity to visit and to familiar with scientific institutions, and its experts as well as to identify, and understand the essential components and parts of a scientific system and its working. • Students can develop and integrate their skills in observation, reflection, reasoning, induction, deduction and creative

			thinking, analysis, concept making and problem solving on specific physical science problem. • Students will be able to analyze the scientific practices critically and suggest alternate methods for experimentation and its implementation. • Stimulate the scientific temper in students and to enhance learning initiatives. • Assess the contributions of physics to our evolving understanding of global change and sustainability while placing the development of physics in its historical and cultural context.

COMPLEMENTARY COURSES FOR B.Sc. MATHEMATICS

SEM.	COURSE CODE	COURSE TITLE	COURSE OUTCOMES
I	PY1131.1	MECHANICS AND PROPERTIES OF MATTER	• Upon the completion of the course, the students will be able to: • Apply knowledge of the dynamics of rigid bodies, conservation of energy, oscillations, waves and mechanical properties of matter such as elasticity, fluid dynamics and surface tension to explain natural physical processes and related technological advances. • Use an understanding of elementary mathematics along with physical principles to effectively solve problems encountered in everyday life and, apply that in the advanced and further study in science. • Do experiments on topics such as Young's modulus for different types of wood, variation of surface tension for different liquids,

			viscosity of different types of liquids and to arrive at knowledge of its fluidity and variation of surface tension with temperature by Jaeger's method.
	PY1231.1	**THERMAL PHYSICS AND STATISTICAL MECHANICS**	• At the end of this course, the students will be able to: • Differentiate between thermal conductivity and thermometric conductivity. • Perform Lee's disc experiment in Physics lab. • Know qualitative ideas about different radiation laws about transmission of heat. • Know what black body is, how energy is distributed in black body radiation spectrum and be able to estimate the solar constant and temperature of the sun.
II			• Acquainted with Isothermal and adiabatic processes and work done in each of these process. • Get ideas about heat engines and their efficiencies as well as the laws of thermodynamics. • Understand the concept of entropy, and disorder and have a clear understanding about the changes irreversible and irreversible cycles. • Have knowledge of calculating entropy when ice is converted into steam. • Familiarize the fundamental concepts of statistical mechanics. • Solve problems in thermal physics and statistical mechanics by selecting appropriate equations.

III	**PY1331.1**	**OPTICS, MAGNETISM AND ELECTRICITY**	• At the end of this course, the students will be able to: • Develop basic knowledge of the physics behind interference, diffraction and polarization. • Understand the principle of operation of laser and the light propagation in optical fibres. • Be able to outline the important applications of lasers and optical fibres in the modern society. • Be able to define magnetism and magnetic properties of matter, including diamagnetism, paramagnetism, ferromagnetism and antiferromagnetism, derive the relation between magnetic vectors and explain the electron theory of magnetism. • Study in depth the alternating current response of RC, LC, LR and LCR series circuits, which is essential in understanding the working of electronic circuits. • Be able to solve problems relating to optics, electricity and magnetism.
IV	**PY1431.1**	**MODERN PHYSICS AND ELECTRONICS**	• Students who completed this course should: • Have a deep understanding of models in atomic physics such as Bohr atom model and vector atom model. • Explain Bohr's correspondence principle, coupling mechanisms and Pauli's exclusion principle. • Familiar with various quantum numbers. • Understand the basic properties of nucleus. • Outline the salient features of nuclear forces. • Explain different forms of radioactivity and account for

their occurrence.

- Get an awareness about radioactive decay, decay laws, radioactive equilibrium and be able to differentiate secular and transient radioactive equilibriums.
- Develop an understanding of how to measure radioactivity.
- Engaged to solve numerical problems on decay constant, half life and mean life.
- Enhance the existing knowledge about electromagnetic spectrum.
- Explain the basic principles of various spectrometers used in specific regions of EM spectrum for UV, visible, IR, radio and microwave spectroscopies.
- Know the fundamental principles absorption and emission spectroscopies.
- Have knowledge about the limitations of classical physics and hence be aware how quantum theory emerged.
- Know the mathematical foundations of quantum mechanics.
- Explain the significance and properties of wavefunction and define probability density.
- Be able to solve the Schrödinger equation for simple configurations.
- Be able to understand the current-voltage characteristics of a P-N junction diode, Zener diode and bipolar junction transistor, their constructions using different circuit configurations and analyze its operations and working in different electronic circuits.
- Have knowledge about

		transistor biasing and amplification. • Be able to design and construct transistor amplifier, and evaluate its gain, input and output resistances, frequency response and bandwidth. • Understand different number systems, and their mutual conversions, digital codes and logic gates. • Analyze, Design and implement combinational logic gate circuits.
PY1432	**PRACTICAL**	After the completion of this course, the students should: • Be able to perform basic hands-on experiments in some areas physics about optics, electricity, magnetism, rigid body dynamics, properties of matter, heat and thermodynamics, electronics and digital electronics, and to analyze the measured results for arriving at valid conclusions so as the students develop an in depth understanding of theories what they have learned from the classrooms and other knowledge resources. • Acquire the capability for suggesting alternate experimental methods for verifying the theories.

I	**PY1131.2**	**ROTATIONAL DYNAMICS AND PROPERTIES OF MATTER**	Upon the completion of the course, the students will be able to: ▪ Apply knowledge of the dynamics of rigid bodies, oscillations, waves and properties of matter such as bending moment, elasticity, viscosity and surface tension to explain natural physical processes and related technological advances. ▪ Use an understanding of elementary mathematics along with physical principles to effectively solve problems encountered in everyday life and, apply that in the advanced and further study in science. ▪ Do hands-on-experiments in topics such as Young's modulus for different types of wood, rigidity modulus of wires, surface tension of liquids, variation of surface tension with temperature by Jaeger's method, viscosity of different types of liquids and to arrive at knowledge of its fluid.
II	**PY1231.2**	**THERMAL PHYSICS**	At the end of this course, the students should: ▪ Be able to make comparison between liquid diffusion and heat conduction. ▪ Get ideas about fundamental laws of diffusion. ▪ Understand what diffusion is and be able to estimate concentrations and coefficient of diffusivity. ▪ Differentiate between thermal conductivity and thermometric conductivity. ▪ Perform Lee's disc experiment in Physics lab. ▪ Know qualitative ideas about

			different radiation laws about transmission of heat. ▪ Know what black body is, how energy is distributed in black body radiation spectrum and be able to estimate the solar constant and temperature of the sun. ▪ Acquainted with Isothermal and adiabatic processes and work done in each of these process. ▪ Get ideas about heat engines and their efficiencies as well as the laws of thermodynamics. ▪ Understand the concept of entropy, and disorder and have a clear understanding about the changes irreversible and irreversible cycles. ▪ Have knowledge of calculating entropy when ice is converted into steam. Solve problems in thermal physics and statistical mechanics by selecting appropriate equations.
III	**PY1331.2**	**OPTICS, MAGNETISM AND ELECTRICITY**	At the end of this course, the students should: ▪ Develop basic knowledge of the physics behind interference, diffraction and polarization. ▪ Understand the principle of operation of laser and the light propagation in optical fibres. ▪ Be able to outline the important applications of lasers and optical fibres in the modern society. ▪ Be able to define magnetism and magnetic properties of matter, including diamagnetism, paramagnetism, ferromagnetism and antiferromagnetism, derive the relation between magnetic vectors and explain the electron theory of magnetism. ▪ Study in depth the alternating current response of RC, LC, LR and LCR series circuits, which is

			essential in understanding the working of electronic circuits. ▪ Be able to solve problems relating to optics, electricity and magnetism.
IV	PY1431.2	**ATOMIC PHYSICS, QUANTUM MECHANICS AND ELECTRONICS**	Students who completed this course should: ▪ Have a deep understanding of models in atomic physics such as Bohr atom model and vector atom model. ▪ Explain Bohr's correspondence principle, coupling mechanisms and Pauli's exclusion principle. ▪ Familiar with various quantum numbers. ▪ Get the knowledge of superconductivity, its underlying principles and its applications in modern world ▪ Have knowledge about the limitations of classical physics and hence be aware how quantum theory emerged. ▪ Know the mathematical foundations of quantum mechanics. ▪ Understand the properties and significance of wavefunction and define probability density. ▪ Be able to solve the Schrödinger equation for simple configurations. ▪ Be able to understand the current-voltage characteristics of a P-N junction diode, Zener diode and bipolar junction transistor, their constructions using different circuit configurations and analyze its operations and working in different electronic circuits. ▪ Have knowledge about transistor biasing and amplification. ▪ Be able to design and construct

		transistor amplifier, and evaluate its gain, input and output resistances, frequency response and bandwidth. ▪ Understand different number systems, and their mutual conversions, digital codes and logic gates. ▪ Analyze, Design and implement combinational logic gate circuits.
PY1432	**PRACTICAL**	After the completion of this course, the students should: ▪ Be able to perform basic hands-on experiments in some areas physics about optics, electricity, magnetism, rigid body dynamics, properties of matter, heat and thermodynamics, electronics and digital electronics, and to analyze the measured results for arriving at valid conclusions so as the students develop an in depth understanding of theories what they have learned from the classrooms and other knowledge resources. ▪ Acquire the capability for suggesting alternate experimental methods for verifying the theories.

M.Sc. PHYSICS

Programme Description:

- A 2-year Degree programme under Semester-System with Physics as the core course.
- The programme spanned over 4 semesters.

Programme Outcome:

- At the end of the Programme, students will be able to:
  - Acquire advanced knowledge in all aspects of Physics.
  - Develop competence, experimental, mathematical, analytical & computational skills.

- ❖ Acquaint interest in any of the specific areas of Physics such as Space Physics, Nano and Material Science, Nuclear and Particle Physics, and Theoretical Physics

PROGRAMME LEARNING OUTCOMES

COURSES			
SEM.	**COURSE CODE**	**COURSE TITLE**	**COURSE OUTCOMES**
I	**PH 211**	**Classical Mechanics**	• Demonstrate the ability to analyse and solve introductory problems in Physics. • Demonstrate an advanced level knowledge and understanding of the laws of classical mechanics to include representing these laws in mathematical expressions with appropriate units for physical quantities.
	PH 212	**Mathematical Physics**	• Generate skill to solve mathematical problems in the physical world. • Develop skill to apply mathematics to physical problems.
	PH 213	**Basic Electronics**	• Understand the basic signals and systems. • Design bandpass, lowpass, and highpass filter • Basic knowledge of electronic instrumentation • Basic formulation of optical fibres. • Knowledge of principles of digital electronics and logic systems. • Ability to solve introductory dc and ac circuits, design, construct, and analyze dc and ac circuits.
	PH 251	**General Physics Practicals**	• Develop observational, analytical and evaluation skills in mechanical and optical properties of materials.
	PH 252	**Electronics & Computer Science Practicals**	• Develop observational, analytical and evaluation skills in electronics

	PH 211	**Modern Optics and Electromagnetic Theory**	• Knowledge of Electromagnetic field theory to able to design emission, propagation and reception of electro-magnetic wave systems • Ability to identify, formulate and solve fields and electromagnetic waves propagation problems in a multi-disciplinary frame individually or as a member of a group. • Ability to acquire the knowledge of Non-linear optics and linear optics.
II	**PH 212**	**Thermodynamics, Statistical Physics and Basic Quantum Mechanics**	• Ability to pinpoint the historical aspects of development of quantum mechanics and explain the differences between classical and quantum mechanics • Understanding the basic principles of wave mechanic, solve the Schrodinger equation for simple configurations and the effect of symmetries in quantum mechanics. • Knowledge and understanding of the concept that quantum states live in a vector space
	PH 213	**Computer Science and Numerical Techniques**	• Understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems. • Analyse and evaluate the accuracy of common numerical methods. • Implement numerical methods in c++. • Demonstrate the basic working of 8085 μ p. • Master an understanding of scripting and the contributions of scripting languages and python.
	PH 251	**General Physics Practicals**	• Get the students the basics of advanced experiments. • Develop the skill of independent thinking and solving

	PH 252	**Electronics & Computer Science Practicals**	• Design and construction of electronic circuits. • Develop skill to solve the problems in electronic circuits.
	PH231	**Advanced Quantum Mechanics**	• Working knowledge of the Quantum Mechanics postulate on the evolution of physical systems. • Understand the path integral representation of quantum mechanics • Appreciate the need for quantum field theory.
	PH232	**Advanced Spectroscopy**	• Understand general tools of spectroscopy • Detailed understanding of Molecular, rotational, IR, Electronic, Raman • Distinguish ESR, NMR, Mossbauer, Photo electron and Photo acoustic spectroscopy
III	**PH233E**	**Advanced Electronics-I**	• Knowledge of optical fiber modes, configurations and its signal degradation factor, optical sources, • detectors and their use in the optical communication system. • Knowledge of digital transmission and its associated parameters on system performance. • Basic understanding of necessary for transmitting and receiving information • Understand different types of modulation and demodulation • Ability to solve analog and digital modulation problems. • Understand fundamentals of mobile and wireless communications
	PH 261	**Advanced Physics Practicals**	• Develop observational, analytical and evaluation skills in electrical and magnetic properties of materials.
	PH 262	**Advanced Electronics Practicals**	• Skill in performing advanced experiments using op-amps, ICs and microprocessors

	PH241	**Condensed Matter Physics**	• Knowledge of elate crystal structure and degree of ordering to atom binding and packing • Ability to classify condensed matter upon its degree of order • Know about thermal properties in solids in particular heat capacity, • Ability to classify condensed matter upon its electrical and transport properties, • Ability to apply the obtained concepts to challenges in condensed matter physics.
	PH242	**Nuclear and Particle Physics**	• Understand Nuclear forces, nuclear models and nuclear reactions • Know the details of Nuclear fission and fusion, Nuclear detectors, particle accelerator and Elementary particle physics
IV	**PH243E**	**Advanced Electronics-II**	• Understand the architecture of microprocessor 8086 and programming using 8086 • Understand the interfacing devices of microprocessor 8086 and advanced microprocessors • Knowledge representation in AI-problem solving in AI • Understand Fuzzy logic and expert systems • Understand the concepts of Neural networks • Knowledge of RADAR and satellite communication system
	PH 261	**Advanced Physics Practicals**	• Develop observational, analytical and evaluation skills in electrical and magnetic properties of materials.
	PH 262	**Advanced Electronics Practicals**	• Skill in performing advanced experiments using op-amps, ICs and microprocessors
	PH201	**Project**	• Get a chance to work in the advanced fields.

		• Develop the skill to solve practical issues. • Develop the skill of team work • Develop skill to write a paper / dissertations.
PH202	**Viva-Voce**	• Evaluate students' awareness about the basic physics. • Evaluate students' awareness about the present needs of society for the existence/ development.