# SLC(University of Delhi)

## Shyam Lal College

# Programme Specific Outcomes and Course Outcomes

# B.Sc. (Physical Sciences)

## Programme Specific Outcomes:

| Programme | Programme Specific Outcomes |
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| **B.Sc. Physical Sciences (Discipline Physics)** | **PSO-1:** Motivate students to develop a deep interest in Physics, and to gain a broad and balanced knowledge and understanding of physical concepts, principles and theories of Physics.<br><br>**PSO-2:** Provide opportunities to students to learn, design and perform experiments in lab, gain an understanding of laboratory methods, analysis of observational data and report writing, and acquire a deeper understanding of concepts, principles and theories learned in the classroom through laboratory demonstration, and computational problems and modelling.<br><br>**PSO-3:** Develop the ability in students to apply the knowledge and skills they have acquired to get to the solutions of specific theoretical and applied problems in Physics.<br><br>**PSO-4:** To prepare students for pursuing the interdisciplinary and multidisciplinary higher education and/or research in interdisciplinary and multidisciplinary areas, as Physics is among the most important branches of science necessary for interdisciplinary and multidisciplinary research.<br><br>**PSO-5:** To prepare students for developing new industrial technologies and theoretical tools for applications in diverse branches of the economic life of the country, as Physics is one of the branches of science which contribute directly to technological development; and it has the most advanced theoretical structure to make quantitative assessments and predictions.<br><br>**PSO-6:** Provide students with the knowledge and skill base that would enable them to undertake further studies in Physics and related areas, or in interdisciplinary/multidisciplinary areas, or join and be successful in diverse professional streams including entrepreneurship. |
| **B.Sc. Physical Sciences (Discipline Electronics)** | **PSO-1:** Motivate students to develop a deep interest in applied Physics and Electronics, and to gain a broad and balanced knowledge and understanding of physical concepts, principles and theories of Electronics.<br><br>**PSO-2:** Provide opportunities to students to learn, design and perform experiments in lab, gain an understanding of laboratory methods, design and analysis of electronic circuits and report writing, and acquire a deeper understanding of concepts, principles and theories learned in the classroom through laboratory demonstration, and computational problems and modelling. |

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| | **PSO-3:** Develop the ability in students to apply the knowledge and skills they have acquired to get to the solutions of specific theoretical and applied problems in Electronics.<br><br>**PSO-4:** Prepare students for pursuing the interdisciplinary and multidisciplinary higher education and/or research in interdisciplinary and multidisciplinary areas, as Electronics is among the most important branches of applied science necessary for interdisciplinary and multidisciplinary research.<br><br>**PSO-5:** Prepare students for developing new industrial technologies and theoretical tools for applications in diverse branches of the corporate and economic life of the country, as Electronics is one of the branches of applied science which contribute directly to technological development.<br><br>**PSO-6:** Provide students with the knowledge and skill base that would enable them to undertake further studies in Electronics and related areas, or in interdisciplinary/multidisciplinary areas, or join and be successful in diverse professional streams including entrepreneurship and startups. |
| **B.Sc. Physical Sciences (Discipline Computer Science)** | **PSO-1:** Develop theoretical foundations in computer science.<br><br>**PSO-2:** Develop expertise in programming skills using high level programming languages.<br><br>**PSO-3:** Develop skills to design, implement and document the solutions for computational problems.<br><br>**PSO-4:** Develop soft skills to work effectively in a team to solve a problem.<br><br>**PSO-5:** Develop the ability to use state of the art technologies.<br><br>**PSO-6:** Effectively utilizing their knowledge of computing principles and mathematical theory to develop sustainable solutions to current and future computing problems.<br>**PSO-7:** Inculcating the understanding of the needs of society and the importance of societal obligations.<br><br>**PSO-8:** Apply fundamental principles and methods of Computer Science to a wide range of applications<br><br>**PSO-9:** Exhibiting their computing expertise within the computing community through corporate leadership, entrepreneurship, and/or advanced graduate study<br><br>**PSO-10:** Developing and implementing solution based systems and/or |

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| | processes that address issues and/or improve existing systems within in a computing based industry. |
| **B.Sc. Physical Sciences (Discipline Chemistry)** | **PSO-1:** An integral part of chemistry curriculum is problem solving. The student will be equipped to solve problems of numerical, synthetic and analytical nature that are best approached with critical thinking.<br><br>**PSO-2:** The student will be able to draw logical conclusions based on a group of observations, facts and rules.<br><br>**PSO-3:** The student is inquisitive about processes and phenomena happening during experiments in laboratories and seeks answers through the research path.<br><br>**PSO-4:** Students are aware of the importance of working with safety and consciousness in laboratory and actively seeks information about health and environmental safety of chemicals that are used in the laboratories and follows protocols for their safe disposal. |

## Course Outcomes: B.Sc. Physical Sciences (Discipline Electronics)

## Semester 1:

| Course Name | Learning Outcomes |
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| **CC-1B: Network Analysis and Analog Electronics** | **CO1:** To understand the concept of voltage and current sources, Network theorems, Mesh and Node Analysis.<br><br>**CO2:** To develop an understanding of the basic operation and characteristics of different type of diodes and familiarity with its working and applications.<br><br>**CO3:** Become familiar with Half-wave, Full-wave center tapped and bridge rectifiers. To be able to calculate ripple factor and efficiency.<br><br>**CO4:** To be able to recognize and explain the characteristics of a PNP or NPN transistor.<br><br>**CO5:** Become familiar with the load-line analysis of the BJT configurations and understand the hybrid model (h- parameters) of the BJT transistors.<br><br>**CO6:** To be able to perform small signal analysis of Amplifier and understand its classification. |

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| | **CO7:** To be able to perform analysis of two stage R-C coupled Amplifier.<br><br>**CO8:** To understand the concept of positive and negative feedback along with applications of each type of feedback and the working of Oscillators.<br><br>**CO9:** To become familiar with construction, working and characteristics of JFET and UJT. |

## Semester 2:

| Course Name | Learning Outcomes |
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| **CC-2B: Linear and Digital Integrated Circuits** | **CO1:** To understand Op- Amp basics and its various applications.<br><br>**CO2:** To become familiar with number systems and codes, Logic Gates, Boolean Algebra Theorems.<br><br>**CO3:** To understand the minimization techniques for designing a simplified logic circuit.<br><br>**CO4:** To design a half Adder, Full Adder, Half-Subtractor, Full-Subtractor.<br><br>**CO5:** To understand the working of Data processing circuits Multiplexers, Demultiplexers, Decoders, Encoders.<br><br>**CO6:** To become familiar with the working of flip-flop circuits, its working and applications. |

## Semester 3:

| Course Name | Learning Outcomes |
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| **CC-3B : Communication Electronics** | **CO1: T**he concepts of electronics in communication, introduction to the principle, performance and applications of communication systems.<br><br>**CO2: V**arious means and modes of communication, electromagnetic communication spectrum with an idea of frequency allocation for radio communication system in India.<br><br>**CO3: A**n insight on the use of different modulation and demodulation techniques used in analog communication. |

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| | **CO4: A**nalyze different parameters of analog communication techniques.<br><br>**CO5:** Learn the generation and detection of a signal through pulse and digital modulation techniques and multiplexing.<br><br>**CO6:** In-depth understanding of different concepts used in a satellite communication system, Mobile radio propagation, cellular system design and understand mobile technologies like GSM and CDMA, mobile communication generations 2G, 3G, and 4G with their characteristics and limitations. |
| **SEC: Computational Physics Skills** | **CO1:** Use computers for solving problems in Physics.<br><br>**CO2:** Prepare algorithm and flowchart for solving a problem.<br><br>**CO3:** Use Linux commands on terminal • Use an unformatted editor to write sources codes.<br><br>**CO4:** Learn "Scientific Word Processing", in particular, using LaTeX for preparing articles, papers etc. which include mathematical equations, picture and tables.<br><br>**CO5:** Learn the basic commands of Gnuplot. |
| **SEC: Electrical Circuits and Network Skills** | **CO1:** Demonstrate good comprehension of basic principles of electricity including ideas about voltage, current and resistance.<br><br>**CO2:** Develop the capacity to analyze and evaluate schematics of power efficient electrical circuits while demonstrating insight into tracking of interconnections within elements while identifying current flow and voltage drop.<br><br>**CO3:** Gain knowledge about generators, transformers and electric motors. The knowledge would include to interfacing aspects and consumer defined control of speed and power.<br><br>**CO4:** Acquire capacity to work theoretically and practically with solid-state devices.<br><br>**CO5:** Delve into practical aspects related to electrical wiring like various types of conductors and cables, wiring-Star and delta connections, voltage drop and losses.<br><br>**CO6:** Measure current, voltage, power in DC and AC circuits acquire proficiency in fabrication of regulated power supply. |

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| | **CO7:** Develop capacity to identify and suggest types and sizes of solid and stranded cables, conduit lengths, cable trays, splices, crimps, terminal blocks and solder. |
| **SEC: Renewable Energy and Energy Harvesting** | **CO1:** Understand the need of energy conversion and the various methods of energy storage<br><br>**CO2:** A good understanding of various renewable energy systems, and its components.<br><br>**CO3:** Knowledge about renewable energy technologies, different storage technologies, distribution grid, smart grid including sensors, regulation and their control.<br><br>**CO4:** Design the model for sending the wind energy or solar energy plant.<br><br>**CO5:** The students will gain hand on experience of: (i) different kinds of alternative energy sources, (ii) conversion of vibration into voltage using piezoelectric materials, (iii) conversion of thermal energy into voltage using thermoelectric modules. |
| **SEC: Engineering Design and Prototyping/Technical Drawing** | **CO1:** Understanding the concept of a sectional view – visualizing a space after being cut by a plane. How The student will be able to draw and learn proper techniques for drawing an aligned sections.<br><br>**CO2:** Understanding the use of spatial visualization by constructing an orthographic multi view drawing.<br><br>**CO3:** Drawing simple curves like ellipse, cycloid and spiral, Orthographic projections of points, lines and of solids like cylinders, cones, prisms and pyramids etc.<br><br>**CO4:** Using Computer Aided Design (CAD) software and AutoCAD techniques. |
| **SEC: Applied Optics** | **CO1:** Understand basic lasing mechanism qualitatively, types of lasers, characteristics of laser light and its application in developing LED, Holography.<br><br>**CO2:** Gain concepts of Fourier optics and Fourier transform spectroscopy.<br><br>**CO3:** Understand basic principle and theory of Holography.<br><br>**CO4:** Grasp the idea of total internal reflection and learn the characteristics of optical fibres. |
| **SEC: Weather Forecasting** | **CO1:** Acquire basic knowledge of the elements of the atmosphere, its composition at various heights, variation of pressure and |

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| | temperature with height.<br><br>**CO2:** To learn basic techniques to measure temperature and its relation with cyclones and anticyclones.<br><br>**CO3:** Knowledge of simple techniques to measure wind speed and its directions, humidity and rainfall.<br><br>**CO4:** Understanding of absorption, emission and scattering of radiations in atmosphere; Radiation laws.<br><br>**CO5:** Knowledge of global wind systems, jet streams, local thunderstorms, tropical cyclones,<br>tornadoes and hurricanes.<br><br>**CO6:** Knowledge of climate and its classification. Understanding various causes of climate change like global warming, air pollution, aerosols, ozone depletion, acid rain.<br><br>**CO7:** Develop skills needed for weather forecasting, mathematical simulations, weather forecasting methods, types of weather forecasting, role of satellite observations in weather forecasting, weather maps etc. Uncertainties in predicting weather based on statistical analysis.<br><br>**CO8:** Develop ability to do weather forecasts using input data.<br><br>**CO9:** In the laboratory course, students should be able to learn: Principle of the working of a weather Station, Study of Synoptic charts and weather reports, Processing and analysis of weather data, Reading of Pressure charts, Surface charts, Wind charts and their analysis. |
| **SEC: Introduction to Physical Computing** | **CO1:** Understand the evolution of the CPU from microprocessor to microcontroller and embedded computers from a historical perspective.<br><br>**CO2:** Operate basic electronic components and analog and digital electronics building blocks including power supply and batteries.<br><br>**CO3:** Use basic laboratory equipment for measurement and instrumentation.<br><br>**CO4:** Understand the Arduino ecosystem and to write simple Arduino programs (sketches)<br><br>**CO5:** Understand sensor characteristics and how to select a suitable |

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| | sensor for various applications<br><br>**CO6:** Read digital and analog data and produce digital and analog outputs from an embedded computer.<br><br>**CO7:** Understand how to interface an embedded computer to the physical environment<br><br>**CO8:** Visualize the needs of a stand alone embedded computer and implement a simple system using Arduino. |
| **SEC: Numerical Analysis** | **CO1:** approximate single and multi-variable function by Taylor's Theorem.<br><br>**CO2:** Solve first order differential equations and apply it to physics problems.<br><br>**CO3:** solve linear second order homogeneous and non-homogeneous differential equations with constant coefficients.<br><br>**CO4:** Calculate partial derivatives of function of several variables<br><br>**CO5:** Understand the concept of gradient of scalar field and divergence and curl of vector fields. perform line, surface and volume integration<br><br>**CO6:** Use Green's, Stokes' and Gauss's Theorems to compute integrals |

## Semester 4:

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| **CC-4B: Microprocessor and Microcontroller** | **CO1:** Designing and developing embedded systems.<br><br>**CO2:** Major components that constitute an embedded system.<br><br>**CO3:** The architecture of a 8085 Microprocessor.<br><br>**CO4: A**ssembly language programming essentials<br><br>**CO5: A** microcontroller, microcomputer embedded system.<br><br>**CO6:** The architecture of a 8051 microcontroller and its concepts like I/O operations, interrupts, programming of timers and counters. |

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| | **CO7:** Interfacing of 8051 microcontroller with peripherals<br><br>**CO8:** Implementing small programs to solve well-defined problems on an embedded platform. |
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## Semester 5:

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| **DSE-1B: Semiconductor Devices Fabrication** | **CO1:** Learn to distinguish between single crystal, polycrystalline and amorphous materials based on their structural morphology and learn about the growth of single crystals of silicon, using Czocharalski technique, on which a present day electronics and IT revolution is based.<br><br>**CO2:** Students will understand about the various techniques of thin film growth and processes.<br><br>**CO3:** Gain knowledge about characteristics of semiconductor devices (p-n junction diode, MOS, MOSFET, TUNNEL diode)<br><br>**CO4:** Understanding of characteristics of Volatile and Non Volatile memory element and their classifications.<br><br>**CO5:** Appreciate the various VLSI fabrication technologies and learn to design the basic fabrication process of R, C, P- N Junction diode, BJT, JFET, MESFET, MOS, NMOS, PMOS and CMOS technology.<br><br>**CO6:** Gain basic knowledge on overview of MEMS (MicroElectro-Mechanical System) |

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| | **CO7:** MEMS based transducers. |
| **DSE-1B : Electronic Instrumentation** | **CO1:** Basic principles of the measurement and errors in measurement, specifications of basic Measurement instruments and their significance with hands on mode.<br><br>**CO2:** Principles of voltage measurement, advantages of electronic voltmeter over conventional multimeter in terms of sensitivity etc.<br><br>**CO3:** Measurement of impedance using bridges, Power supply, Filters, IC regulators and Load and line regulation.<br><br>**CO4:** Specifications of CRO and their significance, the use of CRO and DSO for the measurement of voltage (dc and ac), frequency and time period.<br><br>**CO5:** Multivibrators, working circuits of Astable and monostable multivibrators.<br><br>**CO6:** Phase Locked Loop (PLL), Voltage controlled oscillators and lock-In amplifier.<br><br>**CO7:** Explanation and specifications of Signal and pulse Generators<br><br>**CO8:** The Interfacing techniques, Audrino microcontroller & interfacing software, Understanding and usage of Transducers. |
| **DSE-1B: Digital Signal Processing** | **CO1:** Students will learn basic discrete-time signal and system types, convolution sum, impulse and frequency response concepts for linear time-invariant (LTI) systems.<br><br>**CO2:** The student will be in position to understand use of different transforms and analyze the discrete time signals and systems. They will learn to analyze a digital system using ztransforms and discrete time Fourier transforms, region of convergence concepts, their properties and perform simple transform calculations.<br><br>**CO3:** The student will realize the use of LTI filters for filtering different real world signals. The concept of transfer Function and difference-Equation System will be introduced. Also, they will learn to solve Difference Equations.<br><br>**CO4:** Students will develop an ability to analyze DSP systems like linear-phase, FIR, IIR, Allpass, averaging and notch Filter etc.<br><br>**CO5:** Students will be able to understand the discrete Fourier transform (DFT) and realize its implementation using FFT |

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| | techniques.<br><br>**CO6:** Students will be able to learn the realization of digital filters, their structures, along with their advantages and disadvantages. They will be able to design and understand different types of digital filters such as finite & infinite impulse response filters for various applications. |
| **SEC: Computational Physics Skills** | **CO1:** Use computers for solving problems in Physics.<br><br>**CO2:** Prepare algorithm and flowchart for solving a problem.<br><br>**CO3:** Use Linux commands on terminal • Use an unformatted editor to write sources codes.<br><br>**CO4:** Learn "Scientific Word Processing", in particular, using LaTeX for preparing articles, papers etc. which include mathematical equations, picture and tables.<br><br>**CO5:** Learn the basic commands of Gnuplot. |
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## Semester 6:

| Course Name | Learning Outcomes |
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| **DSE-2B: Verilog and FPGA based system Design** | **CO1:** Understand the steps and processes for design of logic circuits and systems.<br><br>**CO2:** Be able to differentiate between combinational and sequential circuits.<br><br>**CO3:** Be able to design various types of state machines.<br><br>**CO4:** Be able to partition a complex logic system into elements of data-path and control path.<br><br>**CO5:** Understand various types of programmable logic building blocks such as CPLDs and FPGAs and their tradeoffs.<br><br>**CO6:** Be able to write synthesizable Verilog code.<br>**CO7:** Be able to write a Verilog test bench to test various Verilog code modules.<br><br>**CO8:** Be able to design, program and test logic systems on a programmable logic device (CPLD or FPGA) using Verilog. |

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| **DSE-2B: Photonic devices and Power Electronics** | **CO1:** Develop understanding of application of fundamental laws of physics in such optoelectronics areas as telecommunications and power electronics for automation in industries.<br><br>**CO2:** Acquire essential laboratory skills in designing experiments, assembling standard optical tools for optical experimentation and power electronics and analyzing acquired data.<br><br>**CO3:** Identify the critical areas in application levels and derive typical alternative solutions, select suitable power converters to control Electrical Motors and other industry grade apparatus.<br><br>**CO4:** Develop understanding to compare performance and basic operation of various power semiconductor devices, passive components and various switching circuits.<br><br>**CO5:** Develop understanding of Basic circuit of power rectifiers and inverters. |
| **DSE-2B: Antenna Theory and wireless Network** | **CO1:** Identify basic antenna parameter (Radiating wire Structures).<br><br>**CO2:** Determine directions of maximum signal radiations and the nulls in the radiation patterns.<br><br>**CO3:** Design array antenna systems from specifications.<br><br>**CO4:** Identify the characteristics of radio-wave propagation.<br><br>**CO5:** Identify Wireless Networks 4G and LTE, and 5G.<br><br>**CO6:** Design Cellular Systems. |
| **DSE-2B: Dissertation** | **CO1:** Exposure to research methodology<br><br>**CO2:** Picking up skills relevant to dissertation project, such as experimental skills in the subject, computational skills, etc.<br><br>**CO3:** Development of creative ability and intellectual initiative<br><br>**CO4:** Developing the ability for scientific writing<br><br>**CO5:** Becoming conversant with ethical practices in acknowledging other sources, avoiding plagiarism, etc. |
| **SEC: Computational Physics Skills** | **CO1:** Use computers for solving problems in Physics.<br><br>**CO2:** Prepare algorithm and flowchart for solving a problem.<br><br>**CO3:** Use Linux commands on terminal • Use an unformatted |

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| | editor to write sources codes.<br><br>**CO4:** Learn "Scientific Word Processing", in particular, using LaTeX for preparing articles, papers etc. which include mathematical equations, picture and tables.<br><br>**CO5:** Learn the basic commands of Gnuplot. |
| **SEC: Electrical Circuits and Network Skills** | **CO1:** Demonstrate good comprehension of basic principles of electricity including ideas about voltage, current and resistance.<br><br>**CO2:** Develop the capacity to analyze and evaluate schematics of power efficient electrical circuits while demonstrating insight into tracking of interconnections within elements while identifying current flow and voltage drop.<br><br>**CO3:** Gain knowledge about generators, transformers and electric motors. The knowledge would include to interfacing aspects and consumer defined control of speed and power.<br><br>**CO4:** Acquire capacity to work theoretically and practically with solid-state devices.<br><br>**CO5:** Delve into practical aspects related to electrical wiring like various types of conductors and cables, wiring-Star and delta connections, voltage drop and losses.<br><br>**CO6:** Measure current, voltage, power in DC and AC circuits acquire proficiency in fabrication of regulated power supply.<br><br>**CO7:** Develop capacity to identify and suggest types and sizes of solid and stranded cables, conduit lengths, cable trays, splices, crimps, terminal blocks and solder. |
| **SEC: Renewable Energy and Energy Harvesting** | **CO1:** Understand the need of energy conversion and the various methods of energy storage<br><br>**CO2:** A good understanding of various renewable energy systems, and its components.<br><br>**CO3:** Knowledge about renewable energy technologies, different storage technologies, distribution grid, smart grid including sensors, regulation and their control.<br><br>**CO4:** Design the model for sending the wind energy or solar energy plant.<br><br>**CO5:** The students will gain hand on experience of: (i) different |

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| | kinds of alternative energy sources, (ii) conversion of vibration into voltage using piezoelectric materials, (iii) conversion of thermal energy into voltage using thermoelectric modules. |
| **SEC: Engineering Design and Prototyping/Technical Drawing** | **CO1:** Understanding the concept of a sectional view – visualizing a space after being cut by a plane. How The student will be able to draw and learn proper techniques for drawing an aligned sections.<br><br>**CO2:** Understanding the use of spatial visualization by constructing an orthographic multi view drawing.<br><br>**CO3:** Drawing simple curves like ellipse, cycloid and spiral, Orthographic projections of points, lines and of solids like cylinders, cones, prisms and pyramids etc.<br><br>**CO4:** Using Computer Aided Design (CAD) software and AutoCAD techniques. |
| **SEC: Applied Optics** | **CO1:** Understand basic lasing mechanism qualitatively, types of lasers, characteristics of laser light and its application in developing LED, Holography.<br><br>**CO2:** Gain concepts of Fourier optics and Fourier transform spectroscopy.<br><br>**CO3:** Understand basic principle and theory of Holography.<br><br>**CO4:** Grasp the idea of total internal reflection and learn the characteristics of optical fibres. |
| **SEC: Weather Forecasting** | **CO1:** Acquire basic knowledge of the elements of the atmosphere, its composition at various heights, variation of pressure and temperature with height.<br><br>**CO2:** To learn basic techniques to measure temperature and its relation with cyclones and anticyclones.<br><br>**CO3:** Knowledge of simple techniques to measure wind speed and its directions, humidity and rainfall.<br><br>**CO4:** Understanding of absorption, emission and scattering of radiations in atmosphere; Radiation laws.<br><br>**CO5:** Knowledge of global wind systems, jet streams, local thunderstorms, tropical cyclones, tornadoes and hurricanes.<br><br>**CO6:** Knowledge of climate and its classification. Understanding various causes of climate change like global warming, air pollution, aerosols, ozone depletion, acid rain. |

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| | **CO7:** Develop skills needed for weather forecasting, mathematical simulations, weather forecasting methods, types of weather forecasting, role of satellite observations in weather forecasting, weather maps etc. Uncertainties in predicting weather based on statistical analysis.<br><br>**CO8:** Develop ability to do weather forecasts using input data.<br><br>**CO9:** In the laboratory course, students should be able to learn: Principle of the working of a weather Station, Study of Synoptic charts and weather reports, Processing and analysis of weather data, Reading of Pressure charts, Surface charts, Wind charts and their analysis. |
| **SEC: Introduction to Physical Computing** | **CO1:** Understand the evolution of the CPU from microprocessor to microcontroller and embedded computers from a historical perspective.<br><br>**CO2:** Operate basic electronic components and analog and digital electronics building blocks including power supply and batteries.<br><br>**CO3:** Use basic laboratory equipment for measurement and instrumentation.<br><br>**CO4:** Understand the Arduino ecosystem and to write simple Arduino programs (sketches)<br><br>**CO5:** Understand sensor characteristics and how to select a suitable sensor for various applications<br><br>**CO6:** Read digital and analog data and produce digital and analog outputs from an embedded computer.<br><br>**CO7:** Understand how to interface an embedded computer to the physical environment<br><br>**CO8:** Visualize the needs of a stand alone embedded computer and implement a simple system using Arduino. |
| **SEC: Numerical Analysis** | **CO1:** approximate single and multi-variable function by Taylor's Theorem.<br><br>**CO2:** Solve first order differential equations and apply it to physics problems.<br><br>**CO3:** solve linear second order homogeneous and non-homogeneous differential equations with constant coefficients. |

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| | **CO4:** Calculate partial derivatives of function of several variables<br><br>**CO5:** Understand the concept of gradient of scalar field and divergence and curl of vector fields. perform line, surface and volume integration<br><br>**CO6:** Use Green's, Stokes' and Gauss's Theorems to compute integrals |

## Course Outcomes: B.Sc. Physical Sciences (Discipline Computer Science)

## Semester 1:

| Course Name | Learning Outcomes |
|---|---|
| **Problem Solving using Computers** | **CO1:** Describe the components of a computer and the notion of an algorithm.<br><br>**CO2:** Apply suitable programming constructs and data structures to solve a problem.<br><br>**CO3:** Develop, document, and debug modular python programs.<br><br>**CO4:** Use of classes and objects in application programs.<br><br>**CO5:** Use of files for I/O operations. |
| **Generic Elective: Programming using Python** | **CO1:** Describe the components of a computer and notion of an algorithm.<br><br>**CO2:** Apply suitable programming constructs and built-in data structures to solve a problem.<br><br>**CO3:** Develop, document, and debug modular python programs.<br><br>**CO4:** Use classes and objects in application programs and visualize data. |

## Semester 2:

| Course Name | Learning Outcomes |
|---|---|
| **Database Management Systems** | **CO1:** Use database management system to manage data.<br><br>**CO2:** Create entity relationship diagrams for modeling real-life situations and design the database schema. |

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| | **CO3:** Use the concept of functional dependencies to remove data anomalies and arrive at normalized database design.<br><br>**CO4:** Write queries using relational algebra and SQL. |
| **Generic Elective: Database Management system** | **CO1:** Describe the features of database management systems.<br><br>**CO2:** Differentiate between database systems and file systems.<br><br>**CO3:** Model an application's data requirements using conceptual modelling tools like ER diagrams and design database schemas based on the conceptual model.<br><br>**CO4:** Write queries in relational algebra / SQL.<br><br>**CO5:** Normalize a given database schema |

## Semester 3:

| Course Name | Learning Outcomes |
|---|---|
| **Operating Systems** | **CO1:** Understand the rationale behind the current design and implementation decisions in<br>modern Operating Systems by considering the historic evolution.<br><br>**CO2:** Identify modules of the operating systems and learn about important functions performed by operating system as resource manager.<br><br>**CO3:** Use the OS in a more efficient manner. |
| **Generic Elective : Computer Networks** | **CO1:** State the use of computer networks and different network topologies.<br><br>**CO2:** Distinguish between LAN, MAN, WAN, and between Intranet, Extranet and Internet.<br><br>**CO3:** Compare OSI and TCP/IP architectures<br><br>**CO4:** Enumerate different transmission media and describe the use of each of them. 5. Design web pages using HTML. |

## Semester 4:

| Course Name | Learning Outcomes |
|---|---|
| **Computer System Architecture** | **CO1:** Design combinational circuits using basic building blocks. Simplify these circuits using Boolean Algebra and Karnaugh maps. |

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| | **CO2:** Differentiate between combinational circuits and sequential circuits.<br><br>**CO3:** Represent data in binary form, convert numeric data between different number systems and perform arithmetic operations in binary.<br><br>**CO4:** Determine various stages of instruction cycle, various instruction formats and instruction **CO5:** Describe interrupts and their handling.<br><br>**CO6:** Explain how CPU communicates with memory and I/O devices. |
| **Generic Elective :Information Security and Cyber Laws** | **CO1:** Learn, structure, mechanics and evolution of various crime threats<br><br>**CO2:** Learn to protect information systems from external attacks by developing skills in enterprise security, wireless security and computer forensics.<br><br>**CO3:** Analyse the risks involved while sharing their information in cyber space and numerous related solutions like sending protected and digitally signed documents<br><br>**CO4:** Insights of ethical hacking and usage of password cracking tools<br><br>**CO5:** Get an overview of different ciphers used for encryption and decryption. |

## Semester 5:

| Course Name | Learning Outcomes |
|---|---|
| **Programming in JAVA** | **CO1:** Develop and execute Java programs using iteration and selection.<br><br>**CO2:** Create classes and their objects.<br><br>**CO3:** Implement OOPS concepts to solve problems using JAVA |

## Semester 6:

| Course Name | Learning Outcomes |
|---|---|
| **Internet Technologies** | **CO1:** Develop the web page using HTML<br><br>**CO2:** Gain insights in web designing using CSS<br><br>**CO3:** Implement the dynamic web designing using Java script and JSP.<br><br>**CO4:** Gain proficiency in fetching of data from database using JDBC. |

## Course Outcomes: B.Sc. Physical Sciences (Discipline Mathematics)

## Semester 1:

| Course Name | Learning Outcomes |
|---|---|
| **Calculus and Matrices** | **CO1:**Define and use fundamental concepts of calculus including limits, continuity and differentiability.<br><br>**CO2:**Find eigenvalues and corresponding eigenvectors for a square matrix, and check for its diagonalizability |
| **GE-1: Calculus** | **CO1:** Visualize three dimensional figures and calculating their volumes.<br><br>**CO2:** Draw the graph of functions in polar coordinates and level curves of functions of several variables.<br><br>**CO3:** Understand Limits, continuity and partial derivatives of functions of several variables. |

## Semester 2:

| Course Name | Learning Outcomes |
|---|---|
| **Calculus and Geometry** | **CO1:** Sketch curves in a plane using its mathematical properties in the different coordinate systems of reference. |

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| | **CO2:** Compute area of surfaces of revolution and the volume of solids by integrating over crosssectional areas.<br><br>**CO3:** Be well versed with conics and quadric surfaces so that they should able to relate the shape of real life objects with the curves/conics. |
| **GE-2: Linear Algebra** | **CO1:** Visualize the space n in terms of vectors and the interrelation of vectors with matrices, and their application to computer graphics.<br><br>**CO2:** Learn about vector spaces, linear transformations, transition matrix and similarity.<br><br>**CO3:** Find approximate solution of inconsistent system of linear equations. |

## Semester 3:

| Course Name | Learning Outcomes |
|---|---|
| **Abstract Algebra** | **CO1:** Recognize the mathematical objects that are groups, and classify them as abelian, cyclic and permutation groups etc;<br><br>**CO2:** Explain the significance of the notion of cosets, normal subgroups, and of factor groups;<br><br>**CO3:** Understand the fundamental concepts of Rings, Fields, Subrings, Integral domains, Vector spaces over a field, and linear transformations. |
| **SEC-1: Computer Algebra Systems** | **CO1:** as a calculator;<br><br>**CO2:** for plotting functions;<br><br>**CO3:** for various applications of algebra, calculus and matrices. |
| **GE-3: Linear Programming and Game Theory** | **CO1:** The optimal solution for linear optimization problems subject to certain constraints.<br><br>**CO2:** The dual to a production problem with profits to be maximized to keep total cost down.<br><br>**CO3:** The transportation and Hungarian algorithm specially designed to solve the transportation and assignment problems, respectively. |

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| | **CO4:** The strategies for two-person, zero-sum game are obtained by solving two dual linear programming problems. |

## Semester 4:

| Course Name | Learning Outcomes |
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| **Real Analysis** | **CO1:** Familiar with the concept of sequences, series and recognize convergent, divergent, bounded, Cauchy and monotone sequences.<br><br>**CO2:** Test the convergence and divergence of series using the ratio test, Leibnitz test.<br><br>**CO3:** Understand and apply the basics of Riemann integration. |
| **SEC-2: Mathematical Typesetting System: LaTeX** | **CO1:** Create and typeset a LaTeX document<br><br>**CO2:** Typeset a mathematical document<br><br>**CO3:** Draw pictures in LaTeX, and create beamer presentations. |
| **GE-4: Numerical Methods (with Practicals)** | **CO1:** Find the consequences of finite precision and the inherent limits of numerical methods.<br><br>**CO2:** Appropriate numerical methods to solve algebraic and transcendental equations.<br><br>**CO3:** How to solve first order initial value problems of ODE's numerically using Euler methods. |

## Semester 5:

| Course Name | Learning Outcomes |
|---|---|
| **Differential Equations** | **CO1:** Solve the exact, linear and Bernoulli equations and find orthogonal trajectories.<br><br>**CO2:** Apply the method of variation of parameters to solve linear differential equations.<br><br>**CO3:** Formulate and solve various types of partial differential equations of first and second order. |
| **SEC-3: Transportation and Network Flow Problems** | **CO1:** Transportation, Assignment and Traveling salesperson problems.<br><br>**CO2:** Network models and various network flow problems. |

## Semester 6:

| Course Name | Learning Outcomes |
|---|---|
| **Numerical Methods** | **CO1:** Find the consequences of finite precision and the inherent limits of numerical methods.<br><br>**CO2:** Appropriate numerical methods to solve algebraic and transcendental equations.<br><br>**CO3:** How to solve first order initial value problems of ODE's numerically using Euler methods. |
| **SEC-4: Statistical Software: R** | **CO1:** Use R as a calculator<br><br>**CO2:** Read and import data in R.<br><br>**CO3:** Explore and describe data in R and plot various graphs in R. |

## Course Outcomes: B.Sc. Physical Sciences (Discipline Chemistry)

## Semester 1:

| Course Name | Learning Outcomes |
|---|---|
| **Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons** | **CO1:** Solve the conceptual questions using the knowledge gained by studying the quantum mechanical model of the atom, quantum numbers, electronic configuration, radial and angular distribution curves, shapes of s, p, and d orbitals, and periodicity in atomic radii, ionic radii, ionization energy and electron affinity of elements.<br><br>**CO2:** Draw the plausible structures and geometries of molecules using radius ratio rules, VSEPR theory and MO diagrams (homo- & hetero-nuclear diatomic molecules).<br><br>**CO3:** Understand and explain the differential behavior of organic compounds based on fundamental concepts learnt.<br><br>**CO4:** Formulate the mechanism of organic reactions by recalling |

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| | and correlating the fundamental properties of the reactants involved.<br><br>**CO5:** Learn and identify many organic reaction mechanisms including free radical substitution, electrophilic addition and electrophilic aromatic substitution. |

## Semester 2:

| Course Name | Learning Outcomes |
|---|---|
| **Chemical Energetics, Equilibria and Functional Group Organic Chemistry-I** | **CO1:** Understand the laws of thermodynamics, thermochemistry and equilibria.<br><br>**CO2:** Understand concept of pH and its effect on the various physical and chemical properties of the compounds.<br><br>**CO3:** Use the concepts learnt to predict feasibility of chemical reactions and to study the behaviour of reactions in equilibrium.<br><br>**CO4:** Understand the fundamentals of functional group chemistry through the study of methods of preparation, properties and chemical reactions with underlying mechanism.<br><br>**CO5:** Use concepts learnt to understand stereochemistry of a reaction and predict the reaction outcome<br><br>**CO6:** Design newer synthetic routes for various organic compounds. |

## Semester 3:

| Course Name | Learning Outcomes |
|---|---|
| **Solutions, Phase Equilibrium, Conductance, Electrochemistry and Functional Group Organic Chemistry-II** | **CO1:** Explain the concepts of different types of binary solutions-miscible, partially miscible and immiscible along with their applications.<br><br>**CO2:** Explain the thermodynamic aspects of equilibria between phases and draw phase diagrams of simple one component and two component systems. |

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| | **CO3:** Explain the factors that affect conductance, migration of ions and application of conductance measurement.<br><br>**CO4:** Understand different types of galvanic cells, their Nernst equations, measurement of emf, calculations of thermodynamic properties and other parameters from the emf measurements.<br><br>**CO5:** Understand and demonstrate how the structure of biomolecules determines their chemical properties, reactivity and biological uses.<br><br>**CO6:** Design newer synthetic routes for various organic compounds. |
| **SEC-1: IT Skills For Chemists** | **CO1:** Become familiar with the use of computers<br><br>**CO2:** Use software for tabulating data, plotting graphs and charts, carry out statistical analysis of the data.<br><br>**CO3:** Solve chemistry problems and simulate graphs.<br><br>**CO4:** Prepare documents that will incorporate chemical structure, chemical equations, mathematical expressions from chemistry. |
| **SEC-2: Basic Analytical Chemistry** | **CO1:**Handle analytical data<br><br>**CO2:**Determine composition and pH of soil, which can be useful in agriculture<br><br>**CO3:**Do quantitative analysis of metal ions in water<br><br>**CO4:**Separate mixtures using separation techniques<br><br>**CO5:**Estimate macro nutrients using Flame photometry |
| **SEC-3: Chemical Technology and Society** | **CO1:**Understand the use of basic chemistry to chemical engineering<br><br>**CO2:**Learn and use various chemical technology used in industries<br><br>**CO3:**Develop scientific solutions for societal needs |
| **SEC-4: Chemoinformatics** | **CO1:** Have a comprehensive understanding of drug discovery process and techniques including structure-activity relationship, quantitative structure activity relationship and the use of chemoinformatics in this, including molecular modelling and docking studies.<br><br>**CO2:** Appreciate role of modern computation techniques in the |

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| | drug discovery process and perform their own modelling studies. |
| **SEC-5: Business Skills for Chemists** | **CO1:** Learn basics skills of of business and project management.<br><br>**CO2:** Understand the process of product development and business planning that includes environmental compliancy.<br><br>**CO3:** Learn the process by which technical innovations are conceived and converted into successful business ventures.<br><br>**CO4:** Understand the intellectual property rights and patents which drive business viability and commercialization of innovation.<br><br>**CO5:** Relate to the importance of chemistry in daily life, along with the employment and business opportunities. They will effectively use the skills to contribute towards the well-being of the society and derive commercial value. |
| **SEC-6: Intellectual Property Rights** | **CO1:** Learn theoretical concepts of evolution of Intellectual Property Laws, and to differentiate between the different kinds of IP.<br><br>**CO2:** Know the existing legal framework relating to IP in India.<br><br>**CO3:** Comprehend the value of IP and its importance in their respective domains.<br><br>**CO4:** This course may motivate the students to make their career in multifaceted field of intellectual property rights. |
| **SEC-7: Analytical Clinical Biochemistry** | **CO1:** Understand and establish how the structure of biomolecules determines their reactivity and biological uses.<br><br>**CO2:** Understand the basic principles of drug-receptor interaction and structure activity relation (SAR).<br><br>**CO3:** Gain an insight into concept of heredity through biological processes like replication, transcription and translation.<br><br>**CO4:** Demonstrate an understanding of the biochemistry of diseases.<br><br>**CO5:** Understand the application of chemistry in biological systems. |
| **SEC-8: Green Methods in Chemistry** | **CO1:** Get idea of toxicology, environmental law, energy and the environment<br><br>**CO2:** Think to design and develop materials and processes that reduce the use and generation of hazardous substances in industry. |

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| | **CO3:** Think of chemical methods for recovering metals from used electronics materials.<br><br>**CO4:** Get ideas of innovative approaches to environmental and societal challenges.<br><br>**CO5:** Know how chemicals can have an adverse/potentially damaging effect on human and vegetation.<br><br>**CO6:** Critically analyse the existing traditional chemical pathways and processes and creatively think about bringing environmentally benign reformations in these protocols.<br><br>**CO7:** Convert biomass into valuable chemicals through green technologies. |
| **SEC-9: Pharmaceutical Chemistry** | **CO1:** Gain insight into retro-synthesis approach in relation to drug design and drug discovery.<br><br>**CO2:** Learn synthetic pathways of major drug classes.<br><br>**CO3:** Understand the fermentation process and production of ethanol, citric acids, antibiotics and some classes of vitamins. |
| **SEC-10: Chemistry of Cosmetics and Perfumes** | **CO1:** Learn basic of cosmetics, various cosmetic formulation, ingredients and their roles in cosmetic products.<br><br>**CO2:** Learn the use of safe, economic and body-friendly cosmetics<br><br>**CO3:** Prepare new innovative formulations. |
| **SEC-11: Pesticide Chemistry** | **CO1:** Students will be able to learn about the basic role of pesticide in everyday life, various ingredients and their role in controlling the pest.<br><br>**CO2:** Students can also educate the farmers/gardeners to choose the appropriate pesticides for their crop production. |
| **SEC-12: Fuel Chemistry** | **CO1:** The students will learn the chemistry that underpins petroleum fuel technology, will understand the refining processes used to produce fuels and lubricants and will know how differences in chemical composition affect properties of fuels and their usage in different applications.<br><br>**CO2:** The course will also cover origin of petroleum, crude oil, composition, different refining processes employed industrially to obtain different fractions of petroleum. Further, course will cover |

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| | various alternative and renewable fuels like Biofuels (Different generations), Gaseous Fuels (e.g. CNG, LNG, CBG, Hydrogen etc.).<br><br>**CO3:** The course will also cover fuel product specifications, various test methods used to qualify different types of fuels as well characterization methods.<br><br>**CO4:** Review of energy scenario (Global & India), Energy sources (renewable and non-renewable). Types of Crude Oils, Composition and Properties. Crude oil assay |

## Semester 4:

| Course Name | Learning Outcomes |
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| **Chemistry of s- and p-Block Elements, States of Matter and Chemical Kinetics** | **CO1:** Understand the chemistry and applications of s- and p-block elements.<br><br>**CO2:** Derive ideal gas law from kinetic theory of gases and explain why the real gases deviate from ideal behaviour.<br><br>**CO3:** Explain Maxwell-Boltzmann distribution, critical constants and viscosity of gases.<br><br>**CO4:** Explain the properties of liquids especially surface tension and viscosity.<br><br>**CO5:** Explain symmetry elements, crystal structure specially NaCl, KCl and CsCl<br><br>**CO6:** Define rate of reactions and the factors that affect the rates of reaction.<br><br>**CO7:** Understand the concept of rate laws e.g., order, molecularity, half-life and their determination<br><br>**CO8:** Learn about various theories of reaction rates and how these account for experimental observations. |

## Semester 5/6:

| Course Name | Learning Outcomes |
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| **DSE-1: Applications of Computers in Chemistry** | **CO1:** Have knowledge of most commonly used commands and library functions used in QBASIC programming.<br>**CO2:** Develop algorithm to solve problems and write corresponding programs in BASIC for performing calculations involved in laboratory experiments and research work.<br><br>**CO3:** Use various spreadsheet software to perform theoretical calculations and plot graphs |
| **DSE-2: Analytical Methods in Chemistry** | **CO1:** Perform experiment with accuracy and precision.<br><br>**CO2:** Develop methods of analysis for different samples independently.<br><br>**CO3:** Test contaminated water samples.<br><br>**CO4:** Understand basic principle of instrument like Flame Photometer, UV-vis spectrophotometer.<br><br>**CO5:** Learn separation of analytes by chromatography.<br><br>**CO6:** Apply knowledge of geometrical isomers and keto-enol tautomers to analysis.<br><br>**CO7:** Determine composition of soil.<br><br>**CO8:** Estimate macronutrients using Flame photometry. |
| **DSE-3: Molecular Modelling and Drug Design** | **CO1:** Understand theoretical background of computational techniques and selective application to various molecular systems.<br><br>**CO2:** Learn Energy minimization methods through use of different force fields.<br><br>**CO3:** Learn ESP Plots by suitable soft wares, electron rich and electron deficient sites,<br><br>**CO4:** Compare computational and experimental results and explain deviations.<br><br>**CO5:** Carry out Molecular dynamics (MD) and Monte Carlo (MC) simulations on several molecules and polymers.<br><br>**CO6:** Learn QSAR properties and their role in molecular modelling, cheminformatics and drug discovery.<br><br>**CO8:** Perform Optimization of geometry parameters of a molecule |

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| | (such as shape, bond length and bond angle) through use of software like Chem Sketch and Argus Lab in interesting hands-on exercises. |
| **DSE-4: Novel Inorganic Solids** | **CO1:** Understand the mechanism of solid-state synthesis.<br><br>**CO2:** Explain about the different characterization techniques and their principle.<br><br>**CO3:** Understand the concept of nanomaterials, their synthesis and properties.<br><br>**CO4:** Explain the mechanism of growth of self-assembled nanostructures.<br><br>**CO5:** Appreciate the existence of bioinorganic nanomaterials.<br><br>**CO6:** Explain the importance of composites, conducting polymers and their applications.<br><br>**CO7:** Understand the usage of solid materials in various instruments, batteries, etc. which would help them to appreciate the real life importance of these materials |
| **DSE-5: Polymer Chemistry** | **CO1:** Know about history of polymeric materials and their classification<br><br>**CO2:** Learn about different mechanisms of polymerization and polymerization techniques<br><br>**CO3:** Evauate kinetic chain length of polymers based on their mechanism • Differentiate between polymers and copolymers<br><br>**CO4:** Learn about different methods of finding out average molecular weight of polymers<br><br>**CO5:** Differentiate between glass transition temperature (Tg) and crystalline melting point (Tm)<br><br>**CO6:** Determine Tg and Tm<br><br>**CO7:** Know about solid and solution properties of polymers<br><br>**CO8:** Learn properties and applications of various useful polymers in our daily life. This paper will give glimpse of polymer industry to the student and help them to choose their career in the field of polymer chemistry |
| **DSE-6: Research** | **CO1:** Learn how to identify research problems. |

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| **Methodology For Chemistry** | **CO2:** Evaluate local resources and need for addressing the research problem<br>**CO3:** Find out local solution.<br><br>**CO4:** Know how to communicate the research findings. |
| **DSE-7: Green Chemistry** | **CO1:** Understand the twelve principles of green chemistry and will build the basic understanding of toxicity,hazard and risk of chemical substances.<br><br>**CO2:** Understand stoichiometric calculations and relate them to green chemistry metrics.They will learn about atom economy and how it is different from percentage yield.<br><br>**CO3:** Learn to design safer chemical ,products and processes that are less toxic,than current alternatives. Hence,they will understand the meaning of inherently safer design for accident prevention and the principle "what you don't have can't harm you"<br><br>**CO4:** Understand benefits of use of catalyst and bio catalyst ,use of renewable feed stock which helps in energy efficiency and protection of the environment, renewable energy sources, importance led reactions in various green solvents.<br><br>**CO5:** Appreciate the use of green chemistry in problem solving skills, critical thinking and valuable skills to innovate and find out solution to environmental problems. Thus the students are able to realise that chemistry can be used to solve rather than cause environmental problems.<br><br>**CO6:** Green chemistry is a way to boost profits, increase productivity and ensure sustainability with absolute zero waste. Success stories and real world cases also motivate them to practice green chemistry.These days customers are demanding to know about a product: Is it green? Does it contribute to global warming? Was it made from non depletable resources? Students have many career opportunities as " green" is the path to success. |
| **DSE-8: Industrial Chemicals and Environment** | **CO1:** The different toxic gases and their toxicity hazards<br><br>**CO2:** Safe design systems for large scale production of industrial gases.<br><br>**CO3:** Manufacturing processes, handling and storage of inorganic chemicals.<br><br>**CO4:** Hazardous effects of the inorganic chemicals on human |

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| | beings and vegetation.<br><br>**CO5:** The requirement of ultra-pure metals for the semiconducting technologies<br><br>**CO6:** Composition of air, various air pollutants, effects and control measures of air pollutants.<br><br>**CO7:** Different sources of water, water quality parameters, impacts of water pollution, water treatment.<br><br>**CO8:** Different industrial effluents and their treatment methods.<br><br>**CO9:** Different sources of energy.<br><br>**CO11:**Generation of nuclear waste and its disposal.<br><br>**CO12:**Use of biocatalyst in chemical industries. |
| **DSE-9: Inorganic Materials of Industrial Importance** | **CO1:** Learn the composition and applications of the different kinds of glass.<br><br>**CO2:** Understand glazing of ceramics and the factors affecting their porosity.<br><br>**CO3:** Give the composition of cement and discuss the mechanism of setting of cement.<br><br>**CO4:** Explain the suitability of fertilizers for different kinds of crops and soil.<br><br>**CO5:** Explain the process of formulation of paints and the basic principle behind the protection offered by the surface coatings.<br><br>**CO6:** Explain the principle, working and applications of different batteries.<br><br>**CO7:** List and explain the properties of engineering materials for mechanical construction used in day to day life.<br><br>**CO8:** Explain the synthesis and properties of nano-dimensional materials, various semiconductor and superconductor oxides. |
| **DSE-10: Instrumental Methods of Chemical Analysis** | **CO1:** Handle analytical data<br><br>**CO2:** Understand basic components of IR, FTIR, UV-Visible and Mass spectrometer. |

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| | **CO3:** Interpret of IR, FTIR, UV-visible spectra and their applications.<br><br>**CO4:** Understand the use of single and double beam instruments.<br><br>**CO5:** Learn separations techniques like Chromatography.<br><br>**CO6:** Learn elemental analysis, NMR spectroscopy, Electroanalytical Methods, Radiochemical Methods, X-ray analysis and electron spectroscopy. |
| **DSE-11: Chemistry of d-Block Elements, Quantum Chemistry and Spectroscopy** | **CO1:** Understand chemistry of d and f block elements, Latimer diagrams, properties of coordination compounds and VBT and CFT for bonding in coordination compounds<br><br>**CO2:** Understand basic principles of quantum mechanics: operators, eigen values, averages, probability distributions.<br><br>**CO3:** Understand and use basic concepts of microwave, IR and UV-VIS spectroscopy for interpretation of spectra.<br><br>**CO4:** Explain Lambert-Beer's law, quantum efficiency and photochemical processes. |
| **DSE-12: Organometallics, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV, IR Spectroscopy** | **CO1:** Understand the chemistry and applications of 3d elements including their oxidation states and important properties of the familiar compounds potassium dichromate, potassium permanganate and potassium ferrocyanide<br><br>**CO2:** Use IR data to explain the extent of back bonding in carbonyl complexes<br>**CO3:** Get a general idea of toxicity of metal ions through the study of Hg2+ and Cd2+ in the physiological system<br><br>**CO4:** Understand the fundamentals of functional group chemistry, polynuclear hydrocarbons and heterocyclic compounds through the study of methods of preparation, properties and chemical reactions with underlying mechanism.<br><br>**CO5:** Gain insight into the basic fundamental principles of IR and UV-Vis spectroscopic techniques.<br><br>**CO6:** Use basic theoretical principles underlying UV-visible and IR spectroscopy as a tool for functional group identification in organic molecules. |
| **DSE-13: Molecules of Life** | **CO1:** Learn and demonstrate how the structure of biomolecules determines their chemical properties, reactivity and biological uses. |

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| | **CO2:** Gain an insight into mechanism of enzyme action and inhibition.<br><br>**CO3:** Understand the basic principles of drug-receptor interaction and SAR.<br><br>**CO4:** Understand biological processes like replication, transcription and translation.<br><br>**CO5:** Demonstrate an understanding of metabolic pathways, their inter-relationship, regulation and energy production from biochemical processes. |
| **DSE-14: Nanoscale Materials and Their Applications** | **CO1:** Understand the concept of nanodimensions.<br><br>**CO2:** Know the various methods of preparation of nanomaterials.<br><br>**CO3:** Know the different characterization techniques used for the analysis of nanomaterials and understand the basic principle behind these techniques. Page 65 of 96 B.Sc. Physical Science<br><br>**CO4:** Understand the optical and conducting properties of nanostructures.<br><br>**CO5:** Appreciate the real life applications of nanomaterials. |
| **DSE-15: Dissertation** | **CO1:** Do survey, study and cite published literature on a particular area of interest<br><br>**CO2:** Correlate the experimental observations with theoretical understanding.<br><br>**CO3:**Interpret results, write a report and submit to the supervisor.<br><br>**CO4:**Use laboratory resources judiciously.<br><br>**CO5:**Work in a team under the supervision of a teacher.<br><br>**CO6:**Develop scientific writing skills. |