REVA UNIVERSITY
Bengaluru, India

# School of Applied Sciences

## B. Sc., (Physics, Chemistry, Mathematics)

## HANDBOOK

## 2019-22

Rukmini Knowledge Park,
Kattigenahalli, Yelahanka, Bangalore - 560 064
Phone No: +91-080-66226622, Fax: 080-28478539

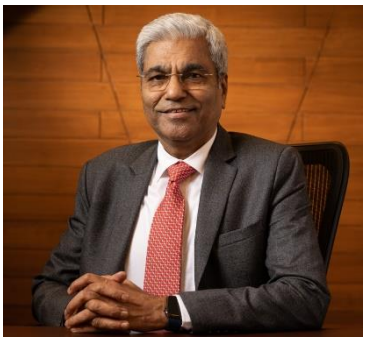
Rukmini Educational
Charitable Trust

www.reva.edu.in

# Chancellor's Message

*"Education is the most powerful weapon which you can use to change the world."*

- Nelson Mandela.



There was a time when survival depended on just the realization of physiological needs. We are indeed privileged to exist in a time when 'intellectual gratification' has become indispensable. Information is easily attainable for the soul that is curious enough to go look for it. Technological boons enable information availability anywhere anytime. The difference, however, lies between those who look for information and those who look for knowledge.

It is deemed virtuous to serve seekers of knowledge and as educators it is in the ethos at REVA University to empower every learner who chooses to enter our portals. Driven by our founding philosophy of 'Knowledge is Power', we believe in building a community of perpetual learners by enabling them to look beyond their abilities and achieve what they assumed impossible.

India has always been beheld as a brewing pot of unbelievable talent, acute intellect and immense potential. All it takes to turn those qualities into power is a spark of opportunity. Being at a University is an exciting and rewarding experience with opportunities to nurture abilities, challenge cognizance and gain competence.

For any University, the structure of excellence lies in the transitional abilities of its faculty and its facility. I'm always in awe of the efforts that our academic board puts in to develop the team of subject matter experts at REVA. My faculty colleagues understand our core vision of empowering our future generation to be ethically, morally and intellectually elite. They practice the art of teaching with a student-centered and transformational approach. The excellent infrastructure at the University, both educational and extra-curricular, magnificently demonstrates the importance of ambience in facilitating focused learning for our students.

A famous British politician and author from the 19$^{th}$ century - Benjamin Disraeli, once said 'A University should be a place of light, of liberty and of learning'. Centuries later this dictum still inspires me and I believe, it takes team-work to build successful institutions. I welcome you to REVA University to join hands in laying the foundation of your future with values, wisdom and knowledge.

**Dr. P. Shyama Raju**
The Founder and Hon'ble Chancellor, REVA University

# Vice-Chancellor's Message

The last two decades have seen a remarkable growth in higher education in India and across the globe. The move towards inter-disciplinary studies and interactive learning have opened up several options as well as created multiple challenges. India is at a juncture where a huge population of young crowd is opting for higher education. With the tremendous growth of privatization of education in India, the major focus is on creating a platform for quality in knowledge enhancement and bridging the gap between academia and industry.

A strong believer and practitioner of the dictum "Knowledge is Power", REVA University has been on the path of delivering quality education by developing the young human resources on the foundation of ethical and moral values, while boosting their leadership qualities, research culture and innovative skills. Built on a sprawling 45 acres of green campus, this 'temple of learning' has excellent and state-of-the-art infrastructure facilities conducive to higher teaching-learning environment and research. The main objective of the University is to provide higher education of global standards and hence, all the programs are designed to meet international standards. Highly experienced and qualified faculty members, continuously engaged in the maintenance and enhancement of student-centric learning environment through innovative pedagogy, form the backbone of the University.

All the programs offered by REVA University follow the Choice Based Credit System (CBCS) with Outcome Based Approach. The flexibility in the curriculum has been designed with industry-specific goals in mind and the educator enjoys complete freedom to appropriate the syllabus by incorporating the latest knowledge and stimulating the creative minds of the students. Bench marked with the course of studies of various institutions of repute, our curriculum is extremely contemporary and is a culmination of efforts of great think-tanks - a large number of faculty members, experts from industries and research level organizations. The evaluation mechanism employs continuous assessment with grade point averages. We believe sincerely that it will meet the aspirations of all stakeholders – students, parents and the employers of the graduates and postgraduates of REVA University.

At REVA University, research, consultancy and innovation are regarded as our pillars of success. Most of the faculty members of the University are involved in research by attracting funded projects from various research level organizations like DST, VGST, DBT, DRDO, AICTE and

industries. The outcome of the research is passed on to students through live projects from industries. The entrepreneurial zeal of the students is encouraged and nurtured through EDPs and EACs.

REVA University has entered into collaboration with many prominent industries to bridge the gap between industry and University. Regular visits to industries and mandatory internship with industries have helped our students. REVA University has entered into collaboration with many prominent industries to bridge the gap between industry and University. Regular visits to industries and mandatory internship with industries have helped our students become skilled with relevant to industry requirements. Structured training programs on soft-skills and preparatory training for competitive exams are offered here to make students more employable. 100% placement of eligible students speaks the effectiveness of these programs. The entrepreneurship development activities and establishment of "Technology Incubation Centers" in the University extend full support to the budding entrepreneurs to nurture their ideas and establish an enterprise.

With firm faith in the saying, "Intelligence plus character –that is the goal of education" (Martin Luther King, Jr.), I strongly believe REVA University is marching ahead in the right direction, providing a holistic education to the future generation and playing a positive role in nation building. We reiterate our endeavor to provide premium quality education accessible to all and an environment for the growth of over-all personality development leading to generating "GLOBAL PROFESSIONALS".

Welcome to the portals of REVA University!

**Dr. S Y Kulkarni**
Vice-Chancellor, REVA University

# Director's Message

Higher education across the globe is opening doors of its academic disciplines to the real-world experiences. The disciplinary legitimacy is under critical review. Trans-border mobility and practice learning are being fore-grounded as guiding principles. Interactive learning, bridging disciplines and facilitating learners to gain different competencies through judicious management of time is viewed as one of the greatest and fascinating priorities and challenges today.

Indian economy is experiencing an upward growth right from the beginning of 21st century necessitating well qualified science graduates to work as scientists, teachers, algorithm developers, computer programmers, professionals and often administrators. At present more than 400 million youth are below 18 years of age and government is committed to increase the GER to 30% by 2020, further necessitating a greater number of teachers and professors to work in schools and colleges. Research has also been given equal importance. Pivate sector and Corporates are also looking for smart science graduates in a big way. The B.Sc. (PCM) degree program of REVA University is designed to prepare physists, chemists, mathematiciens, scientists, teachers, professionals & administrators who are motivated, enthusiastic & creative thinkers to meet the challenges of growing economy as well as to fulfill the growing aspirations of the youth.

The program has been developed with an emphasis on knowledge assimilation, application, national and international job market and its social relevance. The curriculum caters to and has relevance to local, regional, national and global developmental needs. The outcome-based curriculum designed and followed imbibes required theoretical concepts and practical skills in the domain. By undergoing this program, you will develop critical, analytical thinking and problem-solving abilities for a smooth transition from academic to real-life work environment. The L: T: P structure of teaching and learning under Choice Based Credit System (CBCS) and Continuous Assessment Grading Pattern (CAGP) would certainly help our students learn and build competencies needed in this knowledge-based society. Maximum number of courses are integrated with cross cutting issues with relevant to professional ethics, gender, human values, environmental and sustainability.

This handy document containing brief information about B.Sc. (PCM) program, scheme of instruction and detailed course content will serve as a guiding path to you to move forward in a right direction.

I am sure you will enjoythe curriculum, teaching and learning environment, the vast infrastructure and the experienced teacher's involvement and guidance. We will strive to provide all needed comfort andcongenial environment for your studies. I wish you and all students' pleasant stay in REVA and grand success in your career.

**Dr. Beena G**
Director
School of Applied Sciences

# CONTENTS

# RUKMINI EDUCATIONAL CHARITABLE TRUST

It was the dream of late Smt. Rukmini Shyama Raju to impart education to millions of underprivileged children as she knew the importance of education in the contemporary society. The dream of Smt. Rukmini Shyama Raju came true with the establishment of Rukmini Educational Charitable Trust (RECT), in the year 2002. Rukmini Educational Charitable Trust (RECT) is a Public Charitable Trust, set up in 2002 with the objective of promoting, establishing and conducting academic activities in the fields of Arts, Architecture, Commerce, Education, Engineering, Environmental Science, Legal Studies, Management and Science & Technology, among others. In furtherance of these objectives, the Trust has set up the REVA Group of Educational Institutions comprising of REVA Institute of Technology & Management (RITM), REVA Institute of Science and Management (RISM), REVA Institute of Management Studies (RIMS), REVA Institute of Education (RIE), REVA First Grade College (RFGC), REVA Independent PU College at Kattigenahalli, Ganganagar and Sanjaynagar and now REVA University. Through these institutions, the Trust seeks to fulfill its vision of providing world class education and create abundant opportunities for the youth of this nation to excel in the areas of Arts, Architecture, Commerce, Education, Engineering, Environmental Science, Legal Studies, Management and Science & Technology.

Every great human enterprise is powered by the vision of one or more extraordinary individuals and is sustained by the people who derive their motivation from the founders. The Chairman of the Trust is Dr. P. Shyama Raju, a developer and builder of repute, a captain of the industry in his own right and the Chairman and Managing Director of the DivyaSree Group of companies. The idea of creating these top notched educational institutions was born of the philanthropic instincts of Dr. P. Shyama Raju to do public good, quite in keeping with his support to other socially relevant charities such as maintaining the Richmond Road Park, building and donating a police station, gifting assets to organizations providing accident and trauma care, to name a few.

The Rukmini Educational Charitable Trust drives with the main aim to help students who are in pursuit of quality education for life. REVA is today a family of ten institutions providing education from PU to Post Graduation and Research leading to PhD degrees. REVA has well qualified experienced teaching faculty of whom majority are doctorates. The faculty is supported by committed administrative and technical staff. Over 11,000 students' study various courses across REVA's three campuses equipped with exemplary state-of-the-art infrastructure and conducive environment for the knowledge driven community.

# ABOUT REVA UNIVERSITY

REVA University has been established under the REVA University Act, 2012 of Government of Karnataka and notified in Karnataka State Gazette dated 7th February, 2013. The University is empowered by UGC to award degrees any branch of knowledge under Sec.22 of the UGC Act. The University is a Member of Association of Indian Universities, New Delhi. The main objective of the University is to prepare students with knowledge, wisdom and patriotism to face the global challenges and become the top leaders of the country and the globe in different fields.

REVA University located in between Kempegowda International Airport and Bangalore city, has a sprawling green campus spread over 45 acres of land and equipped with state-of-the-art infrastructure that provide conducive environment for higher learning and research. The REVA campus has well equipped laboratories, custom-built teaching facilities, fully air-conditioned library and central computer centre, the well-planned sports facility with cricket ground, running track & variety of indoor and outdoor sports activities, facilities for cultural programs. The unique feature of REVA campus is the largest residential facility for students, faculty members and supportive staff.

The University is presently offering 23 Post Graduate Degree programs, 20 Degree and PG Degree programs in various branches of studies and has 15000+ students studying in various branches of knowledge at graduate and post graduate level and 410 Scholars pursuing research leading to PhD in 18 disciplines. It has 800+ well qualified, experienced and committed faculty members of whom majority are doctorates in their respective areas and most of them are guiding students pursuing research leading to PhD.

The programs being offered by the REVA University are well planned and designed after detailed study with emphasis with knowledge assimilation, applications, global job market and their social relevance. Highly qualified, experienced faculty and scholars from reputed universities / institutions, experts from industries and business sectors have contributed in preparing the scheme of instruction and detailed curricula for this program. Greater emphasis on practice in respective areas and skill development to suit to respective job environment has been given while designing the curricula. The Choice Based Credit System and Continuous Assessment Graded Pattern (CBCS – CAGP) of education has been introduced in all programs to facilitate students to opt for subjects of their choice in addition to the core subjects of the study and prepare them with needed skills. The system also allows students to move forward under the fast track for those who have the capabilities to surpass others. These programs are taught by well experienced qualified faculty supported by the experts from industries, business sectors and such other organizations. REVA

University has also initiated many supportive measures such as bridge courses, special coaching, remedial classes, etc., for slow learners so as to give them the needed input and build in them confidence and courage to move forward and accomplish success in their career. The University has also entered into MOUs with many industries, business firms and other institutions seeking their help in imparting quality education through practice, internship and also assisting students' placements.

REVA University recognizing the fact that research, development and innovation are the important functions of any university has established an independent Research and Innovation division headed by a senior professor as Dean of Research and Innovation. This division facilitates all faculty members and research scholars to undertake innovative research projects in engineering, science & technology and other areas of study. The interdisciplinary-multidisciplinary research is given the top most priority. The division continuously liaisons between various funding agencies, R&D Institutions, Industries and faculty members of REVA University to facilitate undertaking innovative projects. It encourages student research projects by forming different research groups under the guidance of senior faculty members. Some of the core areas of research wherein our young faculty members are working include Data Mining, Cloud Computing, Image Processing, Network Security, VLSI and Embedded Systems, Wireless Censor Networks, Computer Networks, IOT, MEMS, Nano- Electronics, Wireless Communications, Bio-fuels, Nano-technology for coatings, Composites, Vibration Energies, Electric Vehicles, Multilevel Inverter Application, Battery Management System, LED Lightings, Renewable Energy Sources and Active Filter, Innovative Concrete Reinforcement, Electro Chemical Synthesis, Energy Conversion Devices, Nano-structural Materials, Photo-electrochemical Hydrogen generation, Pesticide Residue Analysis, Nano materials, Photonics, Nano Tribology, Fuel Mechanics, Operation Research, Graph theory, Strategic Leadership and Innovative Entrepreneurship, Functional Development Management, Resource Management and Sustainable Development, Cyber Security, General Studies, Feminism, Computer Assisted Language Teaching, Culture Studies etc.

The REVA University has also given utmost importance to develop the much required skills through variety of training programs, industrial practice, case studies and such other activities that induce the said skills among all students. A full-fledged Career Development and Placement (CDC) department with world class infrastructure, headed by a dynamic experienced Professor & Dean, and supported by well experienced Trainers, Counselors and Placement Officers. The University also has University-Industry Interaction and Skill Development Centre headed by a Senior Professor & Director facilitating skill related training to REVA students and other unemployed students. The University has been recognized as a Centre of Skill Development and Training by NSDC (National Skill Development Corporation) under Pradhan Mantri Kaushal Vikas Yojana.

The Centre conducts several add-on courses in challenging areas of development. It is always active in facilitating student's variety of Skill Development Training programs.

The University has collaborations with Industries, universities abroad, research institutions, corporate training organizations, and Government agencies such as Florida International University, Okalahoma State University, Western Connecticut University, University of Alabama, Huntsville, Oracle India Ltd, Texas Instruments, Nokia University Relations, $EMC^2$, VMware, SAP, Apollo etc, to facilitate student exchange and teacher–scholar exchange programs and conduct training programs. These collaborations with foreignuniversities also facilitates students to study some of the programs partly in REVA University and partly in foreign university, viz, M.S in Computer Science one year in REVA University and the next year in the University of Alabama, Huntsville, USA.

The University has also given greater importance to quality in education, research, administration and all activities of the university. Therefore, it has established an independent Internal Quality division headed by a senior professor as Dean of Internal Quality. The division works on planning, designing and developing different quality tools, implementing them and monitoring the implementation of these quality tools. It concentrates on training entire faculty to adopt the new tools and implement their use. The division further works on introducing various examination and administrative reforms.

To motivate the youth and transform them to become innovative entrepreneurs, successful leaders of tomorrow and committed citizens of the country, REVA organizes interaction between students and successful industrialists, entrepreneurs, scientists and such others from time to time. As a part of this exercise great personalities such as Bharat Ratna Prof. C. N. R. Rao, a renowned Scientist, Dr. N R Narayana Murthy, Founder and Chairman and Mentor of Infosys, Dr. K Kasturirangan, Former Chairman ISRO, Member of Planning Commission, Government of India, Dr. Balaram, Former Director I.I.Sc., and noted Scientist, Dr. V S Ramamurthy, Former Secretary, DST, Government of India, Dr. V K Aatre, noted Scientist and former head of the DRDO and Scientific Advisor to the Ministry of Defence Dr. Sathish Reddy, Scientific Advisor, Ministry of Defence, New Delhi and many others have accepted our invitation and blessed our students and faculty members by their inspiring addresses and interaction.

As a part of our effort in motivating and inspiring youth of today, REVA University also has instituted awards and prizes to recognize the services of teachers, researchers, scientists, entrepreneurs, social workers and such others who have contributed richly for the development of the society and progress of the country. One of such awards instituted by REVA University is **'Life Time Achievement Award'** to be awarded to successful personalities who have made mark

in their field of work. This award is presented on occasion of the **"Founders' Day Celebration"** of REVA University on 6th January of every year in presence of dignitaries, faculty members and students gathering. The first "REVA Life Time Achievement Award" for the year 2015 has been awarded to Shri. Kiran Kumar, Chairman ISRO, followed by Shri. Shekhar Gupta, renowned Journalist for the year 2016, Dr K J Yesudas, renowned play back singer for the year 2017. REVA also introduced "**REVA Award of Excellence"** in the year 2017 and the first Awardee of this prestigious award is Shri Ramesh Aravind, Actor, Producer, Director, Screen Writer and Speaker.

REVA organizes various cultural programs to promote culture, tradition, ethical and moral values to our students. During such cultural events the students are given opportunities to unfold their hidden talents and motivate them to contribute innovative ideas for the progress of the society. One of such cultural events is REVAMP conducted every year. The event not only gives opportunities to students of REVA but also students of other Universities and Colleges. During three days of this mega event students participate in debates, Quizzes, Group discussion, Seminars, exhibitions and variety of cultural events. Another important event is Shubha Vidaaya, - Graduation Day for the final year students of all the programs, wherein, the outgoing students are felicitated and are addressed by eminent personalities to take their future career in a right spirit, to be the good citizens and dedicate themselves to serve the society and make a mark in their respective spheres of activities. During this occasion, the students who have achieved top ranks and wonmedals and prizes in academic, cultural and sports activities are also recognized by distributing awards and prizes. The founders have also instituted medals and prizes for sports achievers every year. The physical education department conducts regular yoga classes everyday to students, faculty members, administrative staff and their family members and organizes yoga camps for villagers around.

Recognizing the fast growth of the university and its quality in imparting higher education, the BERG (Business Excellence and Research Group), Singapore has awarded BERG Education Award 2015 to REVA University under Private Universities category. The University has also been honored with many more such honors and recognitions.

# VISION

REVA University aspires to become an innovative university by developing excellent human resources with leadership qualities, ethical and moral values, research culture and innovative skills through higher education of global standards

## MISSON

- To create excellent infrastructure facilities and state-of-the-art laboratories and incubation centers
- To provide student-centric learning environment through innovative pedagogy and education reforms
- To encourage research and entrepreneurship through collaborations and extension activities
- To promote industry-institute partnerships and share knowledge for innovation and development
- To organize society development programs for knowledge enhancement in thrust areas
- To enhance leadership qualities among the youth and enrich personality traits, promote patriotism and moral values.

## OBJECTIVES

- Creation, preservation and dissemination of knowledge and attainment of excellence in different disciplines.
- Smooth transition from teacher - centric focus to learner - centric processes and activities.
- Performing all the functions of interest to its major constituents like faculty, staff, students and the society to reach leadership position.
- Developing a sense of ethics in the University and Community, making it conscious of its obligations to the society and the nation.
- Accepting the challenges of globalization to offer high quality education and other services in a competitive manner.

# ABOUT SCHOOL OF APPLIED SCIENCES

The School of Applied Sciences offers graduate and post graduate programs in Biotechnology, Biochemistry, Chemistry, Physics and Mathematics which are incredibly fascinating. It aims to attract talented youth and train them to acquire knowledge and skills useful to industrial sectors, research laboratories, and educational institutions. The School presently offers B.Sc. degree programs in Bio-Chemistry, Bio-Technology, Chemistry, Physics, Mathematics and B Sc with various combinations viz, Biotechnology, Biochemistry and Genetics, Physics Chemistry and Mathematics, Mathematics , Physics and Statistics, Mathematics Statistics and Computer Science, and Bioinformatics, Biology Mathematics & Computer Science and also Post Graduate Diploma in Clinical Research Management, Post Graduate Diploma in Functional Geneomics & Bioinformatics. The School also facilitates research leading to PhD in Biotechnology, Biochemistry, Physics, Chemistry, Mathematics and related areas of study.

The School of Applied Sciences is shouldered by well qualified, experienced and highly committed faculty. The state-of-the-art infrastructure digital classrooms, well equipped laboratories, conference rooms and the serene academic atmosphere at REVA University will enhance the transfer as well as creation of knowledge. The school provides an interactive, collaborative peer tutoring environment that encourages students to break down complex problems and develop strategies for finding solutions across a variety of situations and disciplines. The school aims to develop a learning community of critical thinkers who serves as models of innovative problems solving in the university environment to enrich their academic and professional careers.

## Vision

To nurture intellect, creativity, character and professionalism among students and impart contemporary knowledge in various branches of Chemical, Biological, Physical and Mathematical Sciences that are socially relevant and transform them to become global citizens.

### Mission

To achieve excellence in studies and research through pedagogy and support interface between industry and academia

# BOS MEMBERS

REVA UNIVERSITY

Ref: RU/BOS-CHEM/2018-19/01 Date: 25.05.2018

**NOTIFICATION**

Under the direction of the Hon'ble Chancellor and as per the provisions REVA University Statutes relating to Formation of the Boards of Studies, their powers and functions, 2013 the Board of Studies in Chemistry (UG) comprising of following members is constituted.

| Sl. No. | Name of Members | Designation |
|---|---|---|
| 1. | **Dr. N.Ramesh**<br>Dean, Science & Technology and Training, Placement and Planning, REVA University<br>Ph: +91-9880514718, E-mail:dean.tpp@reva.edu.in | Chairperson |
| 2. | **Dr. G. S. Suresh**<br>Associate Professor<br>NMKRV College for Woman, Jayanagara, Bangalore<br>Ph: 080-22443695, E-mail:sureshssmrv@yahoo.co.in | External Member |
| 3. | **Dr. Ramakrishna Reddy K**<br>Associate Professor, Department of Chemistry<br>Govt. Science College (Autonomous), Bangalore<br>Ph:+91-9886730374, E-mail: rkrchem@gmail.com | External Member |
| 4. | **Dr. Madhusudana Reddy M B**<br>Associate Professor, School of Chemical Science<br>Reva University<br>Ph:+91-9480224757, E-mail: madhusudana@reva.edu.in | Internal Member |
| 5. | **Dr. Lakshmi B**<br>Associate Professor<br>School of Chemical Science, Reva University<br>Ph:+91-9902632762, E-mail: lakshmib@reva.edu.in | Internal Member |

The tenure of office of members of the Board of Studies in Chemistry (UG) shall be for a period of three years or until further orders.

**REGISTRAR**

REVA UNIVERSITY
Rukmini Knowledge Park, Yelahanka
Post, Bengaluru-560064
+91-80-6622 6622
+91-80-2847 8539
www.reva.edu.in

REGD OFFICE
DivyaSree Chambers, A Wing
#11, O'Shaugnessy Road
Bengaluru - 560025
+91-80-2221 3344
+91-80-2222 8840

Rukmini Educational Charitable Trust
A Unit of Divyashree

# B. Sc – PCM (Physics, Chemistry, Mathematics)

**Programme Overview**

Physics and Chemistry are parts of physical sciences belong to the group of natural science. Natural science is concerned with description, prediction and understanding of natural phenomenon based on empirical evidence from observation and experimentation. Mathematics helps in developing empirical relations among various parameters for better understanding of the Phenomenon. Since centuries, study of physics, chemistry and mathematics in universities has become a practice because of their importance for understanding nature and life on the Universe.

The School of Applied Sciences at REVA UNIVERSITY has designed to offer B.Sc. in Physics, Chemistry and Mathematics as an undergraduate degree programme to create motivated, enthusiastic, thinking and creative graduates to fill the roles as teachers, professors, scientists, professionals and administrators.

Indian economy is experiencing an upward growth right from the beginning of 21$^{st}$ century except for a short stint during the mid of present decade necessitating well qualified science graduates to work as teachers, professors, scientists, professionals and often administrators. At present more than 400 million youth are below 18 years of age and government is committed to increase the GER to 30% by 2020, further necessitating a greater number of teachers and professors to work in schools and colleges. The proposed B.Sc. (PCM) programme designed will act as a foundation and first degree to prepare teachers, professors, scientists, professionals and administrators to meet the challenges of growing economy as well as to meet the growing aspirations of the youth.

The B.Sc. (PCM) programme at the School of Applied Sciences, has been developed by the members of the faculty based on interactions with various universities, research establishments and industries in India and abroad.

The curriculum is outcome based and it imbibes required theoretical concepts and practical skills in the domain. By undergoing this programme, students develop critical, analytical thinking and problem-solving abilities for a smooth transition from academic to real-life work environment. In addition, students are trained in communication skills and interdisciplinary topics to enhance their scope. The above-mentioned features of the programme, advanced teaching and learning resources, and experience of the faculty members with their strong connections with industry and research organizations makes this programme unique.

## Program Educational Objectives (PEO's)

The programme educational objectives of the **B Sc (P.C.M)** course is to prepare graduates to

| | |
|---|---|
| PEO-1 | Demonstrate problem solving skills in physics, chemistry and mathematics by communicating effectively either leading a team or as a team member. |
| PEO-2 | Express oral and written interpersonal skills in order to understand, learn and advance their careers through research developments and seeking higher education. |
| PEO-3 | Understand the professional, ethical and social responsibilities through lifelong learning skills |

## Program Outcomes (POs)

1. Demonstrate the knowledge in the areas of physics, chemistry and mathematics
2. Apply the fundamentals of physics, chemistry and mathematics to formulate, solve and interpret complex problems.
3. Comprehend, analyze, model and solve complex problems in the areas of physics, chemistry and mathematics.
4. Recognize the need to expertise in the areas of physics, chemistry and mathematics by self-upgradation through lifelong learning.
5. Communicate with clarity and coherence, both written and verbally.
6. Exhibit professional and ethical responsibility.
7. Encourage collaborative learning through group activities and hands-on learning.
8. Use latest computer techniques and tools to carry out scientific investigations and develop new solutions and solve problems related to environment and society.

## Programme Specific Outcomes (PSOs)

**After successful completion of the programme, the graduates shall be able to**

1. Acquire a strong conceptual foundation in the area of physics, chemistry and mathematics using latest software tools and technologies, along with analytical and managerial skills to arrive at cost effective and optimum solutions.
2. Implant the capacity to apply theoretical concepts to design and develop solutions.

## Eligibility for B.Sc (PCM) program

Pass in PUC/10+2 examination with Physics, Mathematics and Chemistry as compulsory subjects and obtained minimum 45% marks (40% in case of candidate belonging to SC/ST category) in the above subjects taken together of any Board recognized by the respective State Government /Central Government/Union Territories or any other qualification recognized as equivalent thereto.

# REVA University Regulations for Choice Based Credit System (CBCS) and Continuous Assessment Grading Pattern (CAGP) for Engineering Graduate Degree Programs, 2019

(Framed as per the provisions under Section 35 (ii), Section 7 (x) and Section 8 (xvi) & (xxi) of the REVA University Act, 2012)

**1. Title and Commencement:**

1.1 These Regulations shall be called the **"REVA University Regulations for Choice Based Credit System (CBCS) and Continuous Assessment Grading Pattern (CAGP) for Post Graduate Degree Programs- 2019"**

1.2 These Regulations shall come into force from the date of assent of the Chancellor.

**2. The Programs:**

The following programs and all Graduate Degree programs to be instituted and introduced in REVA University in coming years shall follow these regulations.

**B.Sc in:**

Physics Chemistry and Mathematics

Biotechnology, Biochemistry and Genetics

Mathematics, Physics and Statistics

Mathematics Statistics and Computer Science

Bioinformatics, Biology Mathematics & Computer Science

Medical Laboratory Technology

**3. Definitions:**

**Course:** Every course offered will have three components associated with the teaching-learning process of the course, namely:

(i) L= Lecture (ii) T= Tutorial (iii) P=Practice; where:

**L** stands for **Lecture** session consisting of classroom instruction.

**T** stands for **Tutorial** session consisting participatory discussion/selfstudy/desk work/brief seminar presentations by students and such other novel methods that make a student to absorb and assimilate more effectively the contents delivered in the Lecture classes.

**P** stands for **Practice** session and it consists of Hands on Experience/Laboratory Experiments/Field Studies/Case Studies that equip students to acquire the much-required skill component.

## 4. Courses of study and Credits

4.1. The study of various subjects in B.Sc., degree program is grouped under various courses. Each of these course carries credits which are based on the number of hours of teaching and learning.

4.1.1. In terms of credits, every **one-hour session of L amounts to 1 credit per Semester.** In terms of credits, every **one-hour session of L amounts to 1 credit per Semester** and a minimum of **two-hour session of T or P amounts to 1 credit per Semester** over a period of one Semester of 16 weeks for teaching-learning process.

4.1.2. **The total duration of a semester is 20 weeks inclusive of semester-end examination.**

4.1.3. **A course shall have either or all the four components.** That means a course may have only lecture component, or only practical component or combination of any two or all the three components.

4.1.4. **The concerned BoS will assign Credit Pattern for every course based on the requirement. However, generally, courses can be assigned with 1-4 Credits depending on the size of the course.**

4.1.5. Different **Courses of Study** are labelled and defined as follows:

**Core Course:**

A course which should compulsorily be studied by a candidate as a core-requirement is termed as a Core course. The CORE courses of Study are of THREE types, viz – (i) Foundation Course (ii) Hard Core Course, and (iiI) Soft Core Course.

**a. Foundation Course (FC)**

Foundation Courses are four courses including language study which are mandatory in nature prescribed by the University and should be completed successfully as part of Graduate Degree Program irrespective of the branch of study.

**b. Hard Core Course (HC):**

The **Hard-Core Course** is a Core Course in the main branch of study and related branch(es) of study, if any that the candidates have to complete compulsorily.

**c. Soft Core Course (SC):**

A Core course may be a **Soft Core** if there is a choice or an option for the candidate to choose a course from a pool of courses from the main branch of study or from a sister/related branch of study which supports the main branch of study.

**d. Open Elective Course:** An elective course chosen generally from other discipline / subject, with an intention to seek exposure to the basics of subjects other than the main discipline the student is studying is called an O**pen Elective Course.**

**e. Project Work / Dissertation:**

Project work / Dissertation work is a special course involving application of knowledge in solving / analysing /exploring a real-life situation / difficult problem. A project work carrying **FOUR or SIX** credits is called **Minor Project** work / **Dissertation.** A project work of **EIGHT, TEN, TWELVE or SIXTEEN** credits is called **Major Project** work / **Dissertation**. **A Project work may be a hard core or a Soft Core as decided by the BoS / concerned.**

**5. Eligibility for Admission:**

Pass in PUC/10+2 examination with Physics, Mathematics and Chemistry as compulsory subjects with minimum 45% marks (40% in case of candidate belonging to SC/ST category) in the above subjects taken together of any Board recognized by the respective State Government /Central Government/Union Territories or any other qualification recognized as equivalent thereto.

**6. Scheme, Duration and Medium of Instructions:**

**6.1** The Three-Year degree program is of 6 semesters (3 years) duration. A candidate can avail a maximum of 12 semesters (6 years) as per double duration norm, in one stretch to complete the ThreeYear Degree, including blank semesters, if any. Whenever a candidate opts fo blank semester, he/she has to study the prevailing courses offered by the School when he/she resumes his/her studies.

**6.2** The medium of instruction shall be English.

**7. Credits and Credit Distribution**

**7.1** A candidate has to earn 144 credits for successful completion of Three-Year Degree with a distribution of credits for different courses as given in Table - 1 given below:

**Table-1**

**Credits and Credit Distribution for ThreeYear degree programs**

| Course Type | Credits for Three Year Degree (6 semesters) |
|---|---|
| Hard Core Course | A minimum of 76 but not exceeding 100 |
| Soft Core Course | A minimum of 12 but not exceeding 24 |
| Foundation Courses | A minimum of 04 but not exceeding 16 |
| Core Courses (languages) | A minimum of 14 but not exceeding 24 |
| Open Elective Course | A minimum of 04 |
| RULO | A minimum of 2 but not exceeding 12 |
| **Total** | **144** |

**7.2** The concerned BOS based on the credits distribution pattern given above shall prescribe the credits to various types of courses and shall assign title to every course including project work, practical work, field work, self-study elective, as **Foundation Course (FC), Hard Core (HC) or Soft Core (SC) or Open Elective (OE)**.

**7.3** Every course including project work, practical work, field work, self-study elective should be entitled as Foundation Course (FC), Hard Core (HC) or Soft Core (SC) or Open Elective (OE) by the BoS concerned.

However, following shall be the

RULO (REVA Unique Learning Offerings) courses with credits mentioned against them, common to all branches of study. However, the BOS of respective program/ discipline shall decide about the total credits for RULO courses.

| **RULO Courses** | | |
|---|---|---|
| **Sl. No.** | **Course Title** | **Number of Credits** |
| 1 | Sports, Yoga, Music, Dance, Theatre | 2 |
| 2 | MOOC / Swayam/ Coursera/Internship | 4 |
| 3 | Soft Skill Training | 4 |
| 4 | Skill Development Course | 2 |
| | **Total** | **12** |

**7.4**. The concerned BOS shall specify the desired Program Objectives, Program Educational Objectives, Program Specific Outcomes and Course Outcomes while preparing the curriculum of a particular program.

**7.5**. A candidate can enrol for a maximum of 30 credits and a minimum of 20 credits per Semester. However, he/she may not successfully earn a maximum of 30 credits per semester. This maximum of 30 credits does not include the credits of courses carried forward by a candidate.

**7.6.** Only such full time candidates who register for a minimum prescribed number of credits in each semester from I semester to VI semester and complete successfully 144 credits in 6 successive semesters shall be considered for declaration of Ranks, Medals, Prizes and are eligible to apply for Student Fellowship, Scholarship, Free ships, and such other rewards / advantages which could be applicable for all full time students and for hostel facilities.

**8. Add-on Proficiency Certification / Diploma:**

**8.1 Add- on Proficiency Certification:**

To acquire Add on Proficiency Certification a candidate can opt to complete a minimum of 4 extra credits either in the same discipline /subject or in different discipline / subject in excess to 144 credits for the Three-Year Graduate degree programs.

**8.2 Add on Proficiency Diploma:**

To acquire Add on Proficiency Diploma, a candidate can opt to complete a minimum of 18 extra credits either in the same discipline /subject or in different discipline / subject in excess to 144 credits for the Three-Year Graduate degree programs.

The Add on Proficiency Certification / Diploma so issued to the candidate contains the courses studied and grades earned.

**9. Assessment and Evaluation**

**a)** Each course is assessed for a total weight of 100%. Out of the total 100% weight; 50% weight is for Continuous Internal Assessment (CIA or IA) and the remaining 50% for the Semester End Examination (SEE). This is applicable for theory, laboratory, workshop, studio and any such courses

b) Out of 50% weight earmarked for Internal Assessment (IA)- 15% for test-1, 15% for test-2 and 20% for Assignments and this is applicable for theory-based courses

c) The tests and assignments are conducted as per the semester academic calendar provided by the University

**The details as given in the table**

| Component | Description | Conduction | Weight Percentage |
|---|---|---|---|
| C1 | Test-1: IA1 | 6th week from the starting date of semester | 15 |
| | Test-2: IA2 | 12th week from the starting date of semester | 15 |
| C2 | 1 Assignment 1 | 7th week | 10 |
| | 2 Assignment 2 | 13th week | 10 |
| C3 | SEE including practical | between 17th Week-20th Week | 50 |
| **Results to be Announced** | | | **By the end of 21st week** |

**Note**: IA or CIA includes C1 and C2

Each test must be conducted for a duration of 60 minutes, setting the test question paper for a maximum of 30 marks. The final examination must be conducted for a duration of 3 hours and the question paper must be set for a maximum of 100 marks.

d) Students are required to complete courses like technical skills, placement related courses, Open electives and any such value addition or specialized courses through online platforms like SWAYAM/NPTEL/Any other reputed online education aggregator. Students are required to choose the courses on the advice of their course coordinator/Director and required to submit the course completion certificate along with percentage of marks/grade scored in the assessment conducted by the online education aggregator. If the online education aggregator has issued a certificate along with the grade or marks scored to students, such courses will be considered for SGPA calculations, in case the aggregator has issued only a certificate and not marks scored, then such courses will be graded through an examination by concerned School, in case, if grading is not possible, students will be given a pass grade and award the credit and the credits will not be considered for SGPA calculations. The Online/MOOCs courses will not have continuous internal assessment component

Such of those students who would like to discontinue with the open elective course that they have already registered for earning required credits can do so, however, they need to complete the required credits by choosing an alternative open elective course.

**Setting question paper and evaluation of answer scripts.**

i. For SEE, three sets of question papers shall be set for each theory course out of which two sets

will be by the internal examiners and one set will be by an external examiner. In subsequent years by carrying forward the unused question papers, an overall three sets of question papers should be managed and depending on the consumption of question papers either internal or external examiner be called for setting the question paper to maintain an overall tally of 3 papers with the conditioned mentioned earlier. The internal examiner who sets the question paper should have been course tutor

ii. The Chairman of BoE shall get the question papers set by internal and external examiners.

iii. The Board of Examiners shall scrutinize and approve the question papers and scheme of valuation. It is the responsibility of the BoE to see that all questions contained in the question paper are within the prescribed syllabus of the concerned course.

iv. There shall be single valuation for all theory papers by internal examiners. However, there shall be moderation by the external examiner who has the subject background. In case no external examiner with subject background is available, a senior faculty member within the discipline shall be appointed as moderator.

v. The SEE examination for Practical work / Field work / Project work/Internship will be conducted jointly by internal and external examiners as detailed below: However, the BoE on its discretion can also permit two internal examiners.

vi. If a course is fully of (L=0):T:(P=0) type or a course is partly P type i.e, (L=3): (T=0) (P=1), then the examination for SEE component will be as decided by the BoS concerned.

**10. Evaluation of Practical's and Minor Project / Major Project / Dissertation**

**10.3.1.** A practical examination shall be assessed on the basis of:

**a)** Knowledge of relevant processes;

**b)** Skills and operations involved;

**c)** Results / products including calculation and reporting.

**10.3.2.** In case a course is fully of P type (L=0: T=0: P=4), the performance of a candidate shall be assessed for a maximum of 100 marks as explained below:

a) Continuous Internal assessment (CIA) = 50 marks

b) Semester end practical examination (SEE) = 50 marks

The 25 marks for continuous assessment shall further be allocated as under (IA or CIA):

| | | |
|---|---|---|
| i | Conduction of regular practical throughout the semester | 20 marks |
| ii | Maintenance of lab records/industry reports | 15 marks |
| iii | Laboratory test and viva | 15 marks |
| | Total | 50 marks |

The 50 marks meant for Semester End Examination, shall be allocated as under:

| | | |
|---|---|---|
| i | Conduction of semester end practical examination | 30 marks |
| ii | Write up about the experiment / practical conducted | 10 marks |
| iii | Viva Voce | 10 marks |
| | Total | 50 marks |

**10.3.3.** The SEE for Practical work will be conducted jointly by internal and external examiners. However, if external examiner does not turn up, then both the examiners will be internal examiners.

**10.3.4.** In case a course is partly P type i.e, (L=3): (T=0) (P=1), then the examination for SEE component will be as decided by the BoS concerned.

**10.3.5.** The duration for semester-end practical examination shall be decided by the concerned School Board.

**10.4. Evaluation of Minor Project / Major Project / Dissertation:**

Right from the initial stage of defining the problem, the candidate has to submit the progress reports periodically and also present his/her progress in the form of seminars in addition to the regular discussion with the supervisor. At the end of the semester, the candidate has to submit final report of the project / dissertation, as the case may be, for final evaluation. The components of evaluation are as follows:

| | | | |
|---|---|---|---|
| 1 | First Dissertation presentation describing the problem definition | Should be done a semester before the project semester | Weightage: 0% |
| 2 | Dissertation Progress presentation-1 | $7^{th}$ week from the start date of project semester | Weightage: 25% |
| 3 | Dissertation progress presentation-2 | $14^{th}$ Week from the start date of project semester | Weightage -25% |
| 4 | Final project Viva and Dissertation Submission | $17^{th}$ -$20^{th}$ Week of project Semester | Weightage: 30% for Dissertation<br>Weightage: 20% for Final Viva Voce |

**11. Provision for Appeal**

If a candidate is not satisfied with the evaluation of C1, C2 components, he/she can approach the grievance cell with the written submission together with all facts, the assignments, test papers etc, which were evaluated. He/she can do so before the commencement of semester-end examination. The grievance cell is empowered to revise the marks if the case is genuine and is also empowered to levy penalty as prescribed by the university on the candidate if his/her

submission is found to be baseless and unduly motivated. This cell may recommend taking disciplinary/corrective action on an evaluator if he/she is found guilty. The decision taken by the grievance cell is final.

For every program there will be one grievance cell. The composition of the grievance cell is as follows: -

- The Registrar (Evaluation) - Ex-officio Chairman / Convener
- One Senior Faculty Member (other than those concerned with the evaluation of the course concerned) drawn from the school / department/discipline and/or from the sister schools / departments/sister disciplines – Member.
- One Senior Faculty Members / Subject Experts drawn from outside the University school / department – Member.

**12. Eligibility to Appear Semester End Examination (SEE)**

**12.1** Only those students who fulfil a minimum of 75% attendance in aggregate of all the courses including practical courses / field visits etc, as part of the course(s), as provided in the succeeding sections, shall be eligible to appear for SEE examination.

**12.2 Requirements** to Pass a Course

Students are required to score a total minimum of 40% (Continuous Internal assessment and SEE) in each course offered by the University/ Department for a pass (other than online courses) with a minimum of 25% (12) marks in final examination

**13. Requirements to Pass the Semester**

To pass the semester, a candidate has to secure minimum of 40% marks in each subject / course of the study prescribed in that semester.

**13.1 Provision to Carry Forward the Failed Subjects / Courses:**

A student who has failed in a given number of courses in odd and even semesters of first year shall move to third semester of second and final year of the study. However, he / she shall have to clear all courses of all semesters within the double duration, i. e., within sixyears of admission of the first semester failing which the student has to re-register to the entire program.

**13.2 Provision to Withdraw Course:**

A candidate can withdraw any course within ten days from the date of notification of final results. Whenever a candidate withdraws a course, he/she has to register for the same course in case it is hard core course, the same course or an alternate course if it is Soft Core Course or Open Elective Course.

A DROPPED course is automatically considered as a course withdrawn.

**13.3. Re-Registration and Re-Admission:**

**a)** In case a candidate's class attendance in aggregate of all courses in a semester is less than 75% or as stipulated by the University, such a candidate is considered as dropped the semester and is not allowed to appear for end semester examination (C3) and he / she shall have to seek re-admission to that semester during subsequent semester / year within a stipulated period.

**b)** In such case where in a candidate drops all the courses in a semester due to personal reasons, it is considered that the candidate has dropped the semester and he / she shall seek re-admission to such dropped semester.

**14. Attendance Requirement:**

**14.1** All students must attend every lecture, tutorial and practical classes.

**14.2** In case a student is on approved leave of absence (e g:- representing the university in sports, games or athletics, placement activities, NCC, NSS activities and such others) and / or any other such contingencies like medical emergencies, the attendance requirement shall be minimum of 75% of the classes taught.

**a)** Any student with less than 75% of attendance in aggregate of all the courses including practical courses / field visits etc, during a semester shall not be permitted to appear to the end semester (C4) examination and such student shall seek re-admission as provided in 7.8.4.

**b)** Teachers offering the courses will place the above details in the School Board meeting during the last week of the semester, before the commencement of C3, and subsequently a notification pertaining to the above will be brought out by the Director of the School before the commencement of C3 examination. A copy of this notification shall also be sent to the office of the Registrar & Registrar (Evaluation).

**15. Absence during Mid Semester Examination:**

In case a student has been absent from a mid-semester (C1,C2) examination due to the illness or other contingencies he / she may give a request along with necessary supporting documents and certification from the concerned class teacher / authorized personnel to the concerned Head of the School, for make-up examination. The Head of the School may consider such request depending on the merit of the case and after consultation with course instructor and class teacher, and arrange to conduct a special test for such candidate(s) well in advance before the C3 examination of that respective semester. Under no circumstances C1,C2 test shall be held after C3 examination.

**16. Grade Card and Grade Point**

**16.1. Provisional Grade Card**: The tentative / provisional grade card will be issued by the Registrar (Evaluation) at the end of every semester indicating the courses completed successfully. The

provisional grade card provides **Semester Grade Point Average** (SGPA).

**16.2. Final Grade Card:** Upon successful completion of M.Sc., Degree a Final Grade card consisting of grades of all courses successfully completed by the candidate will be issued by the Registrar (Evaluation).

**16.3. The Grade and the Grade Point:** The Grade and the Grade Point earned by the candidate in the subject will be as given below.

| Marks P | Grade G | Grade Point (GP=V x G) | Letter Grade |
|---|---|---|---|
| 90 >100 | 10 | v*10 | **O** |
| 80 > 90 | 9 | v*9 | **$A^+$** |
| 70 > 80 | 8 | v*8 | **A** |
| 60 > 70 | 7 | v*7 | **$B^+$** |
| 55 > 60 | 6 | v*6 | **B** |
| 50 > 55 | 5.5 | V*5.5 | **$C^+$** |
| 40 > 50 | 5 | v*5 | **P** |
| 0-40 | 0 | v*0 | **F** |
| ABSENT | | | **AB** |

**O** - Outstanding; **A**-Excellent; **B**-Very Good; **C**-Good; **D**-Fair; **E**-Satisfactory; **F** - Fail

Here, P is the percentage of marks (P=[C1+C2+C3]) secured by a candidate in a course which is **rounded to nearest integer**. V is the credit value of course. G is the grade and GP is the grade point.

**16.3.1. Computation of SGPA and CGPA**

The Following procedure to compute the Semester Grade Point Average (SGPA)

The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student in a given semester, i.e:

**SGPA (Si) = $\sum$(Ci x Gi) / $\sum$Ci** where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

**Illustration for Computation of SGPA and CGPA**

**Illustration No. 1**

| Course | Credit | Grade Letter | Grade Point | Credit Point (Credit x Grade) |
|---|---|---|---|---|
| Course 1 | 4 | $A^+$ | 9 | 4X9=36 |
| Course 2 | 4 | A | 8 | 4X8=32 |
| Course 3 | 3 | $B^+$ | 7 | 3X7=21 |
| Course 4 | 3 | O | 10 | 3X10=30 |
| Course 5 | 3 | P | 5 | 3X5=15 |
| Course 6 | 3 | B | 6 | 3X6=18 |
| Course 7 | 2 | O | 10 | 2X10=20 |
| Course 8 | 2 | A | 8 | 2X8=16 |
| | 24 | | | 188 |

Thus, **SGPA = 188 ÷ 24 = 7.83**

**Illustration No. 2**

| Course | Credit | Grade letter | Grade Point | Credit Point (Credit x Grade point) |
|---|---|---|---|---|
| Course 1 | 4 | A | 8 | 4X8=32 |
| Course 2 | 4 | B+ | 7 | 4X7=28 |
| Course 3 | 3 | A+ | 9 | 3X9=27 |
| Course 4 | 3 | B+ | 7 | 3X7=21 |
| Course 5 | 3 | B | 6 | 3X6=18 |
| Course 6 | 3 | P | 5 | 3X5=15 |
| Course 7 | 2 | B+ | 7 | 2X7=21 |
| Course 8 | 2 | O | 10 | 2X10=20 |
| | 24 | | | 175 |

Thus, **SGPA = 175 ÷ 24 = 7.29**

**Illustration No.3**

| Course | Credit | Grade Letter | Grade Point | Credit Point (Credit x Grade point) |
|---|---|---|---|---|
| Course 1 | 4 | O | 10 | 4 x 10 = 40 |
| Course 2 | 4 | A+ | 9 | 4 x 9 = 36 |
| Course 3 | 3 | B+ | 7 | 3 x 7 = 21 |
| Course 4 | 3 | B | 6 | 3 x 6 = 18 |
| Course 5 | 3 | A+ | 9 | 3 x 9 = 27 |
| Course 6 | 3 | B+ | 7 | 3 x 7 = 21 |
| Course 7 | 2 | A+ | 9 | 2 x 9 = 18 |
| Course 8 | 2 | A+ | 9 | 2 x 9 = 18 |
| | 24 | | | 199 |

Thus**, SGPA = 199 ÷ 24 = 8.29**

**Cumulative Grade Point Average (CGPA):**

Overall Cumulative Grade Point Average (CGPA) of a candidate after successful completion of the required number of credits (96) for Two year Post Graduate degree program is calculated taking into account all the courses undergone by a student over all the semesters of a program i. e.,

$$CGPA = \sum(Ci \times Si) / \sum Ci$$

Where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

**Illustration: No.1**

CGPA after Final Semester

| Semester (ith) | No. of Credits (Ci) | SGPA (Si) | Credits x SGPA (Ci X Si) |
|---|---|---|---|
| 1 | 24 | 6.83 | 24 x 6.83 = 163.92 |
| 2 | 24 | 7.71 | 24 x 7.71 = 185.04 |
| 3 | 24 | 8.68 | 24 x 8.68 = 208.32 |
| 4 | 24 | 9.20 | 24 x 9.20 = 220.80 |
| Cumulative | 96 | | 778.08 |

Thus, CGPA = 24x6.83+24x7.13+24x8.68+24x9.20 = 8.11

96

**16.3.2. CONVERSION OF GRADES INTO PERCENTAGE:**

Conversion formula for the conversion of CGPA into Percentage is:

Percentage of marks scored = CGPA Earned x 10

Illustration: CGPA Earned 8.10 x 10=81.0

**16.3.3. Classification of Results**

The final grade point (FGP) to be awarded to the student is based on CGPA secured by the candidate and is given as follows.

| **CGPA** | **Grade (Numerical Index)** | **Letter Grade** | **Performance** | **FGP** |
|---|---|---|---|---|
| | **G** | | | **Qualitative Index** |
| 9 >= CGPA 10 | 10 | O | Outstanding | Distinction |
| 8 >= CGPA < 9 | 9 | A+ | Excellent | |
| 7 >= CGPA < 8 | 8 | A | Very Good | First Class |
| 6 >= CGPA < 7 | 7 | B+ | Good | |
| 5.5> = CGPA < 6 | 6 | B | Above average | Second Class |
| > 5 CGPA < 5.5 | 5.5 | C | Average | |
| > 4 CGPA <5 | 5 | P | Pass | Satisfactory |

**Overall percentage=10*CGPA**

**17. Challenge Valuation**

**a)** A student who desires to apply for challenge valuation shall obtain a photo copy of the answer script by paying the prescribed fee within 10 days after the announcement of the results. He / She can challenge the grade awarded to him/her by surrendering the grade card and by submitting an application along with the prescribed fee to the Registrar (Evaluation) within 10 days after the announcement of the results. This challenge valuation is only for SEE

The answer scripts for which challenge valuation is sought for shall be evaluated by the external examiner who has not involved in the first evaluation. The higher of two marks from first valuation and challenge valuation shall be the final.

**b)** With regard to any specific case of ambiguity and unsolved problem, the decision of the Vice-Chancellor shall be final.

**Mapping of PEOs with Respect to POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|
| **PE01** | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **PE02** | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **PE03** | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **PE04** | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |

**Attainment of CO (Course Outcome)**

| CO Attainment | Value |
|---|---|
| 0.4 - 0.6 | 1 |
| 0.6 - 0.75 | 2 |
| > 0.75 | 3 |

## Mapping of Course Outcomes with programme Outcomes

| Course Code | POs/COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC1030 | CO1 | 3 | 3 | 3 | 3 | 2 | | 1 | 3 | 3 | 3 |
| | CO2 | 3 | 3 | 3 | 3 | 2 | | 3 | 3 | 3 | 3 |
| | CO3 | 3 | 3 | 3 | 2 | 2 | | 2 | 3 | 3 | 3 |
| | CO4 | 3 | 3 | 3 | 2 | 2 | | | | 2 | 3 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC1040 | CO1 | 3 | 3 | 2 | 1 | | | 1 | 1 | 2 | 3 |
| | CO2 | 3 | 2 | 2 | 1 | | | 1 | 2 | 3 | 3 |
| | CO3 | 2 | 3 | 2 | 2 | | 1 | | 2 | 3 | 2 |
| | CO4 | 3 | 3 | 2 | 1 | | | | | 3 | 3 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC1050 | CO1 | 3 | 2 | 2 | | | | | | 2 | 3 |
| | CO2 | 3 | 2 | 2 | | | | | | 2 | 3 |
| | CO3 | 3 | 2 | 2 | | | | | | 3 | 3 |
| | CO4 | 3 | 2 | 1 | 1 | | | | | 2 | 3 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC1070 | CO1 | 3 | 2 | 2 | | 1 | | | | 3 | 3 |
| | CO2 | 3 | 2 | 2 | | 1 | | | | 3 | 3 |
| | CO3 | 2 | 2 | 2 | | 1 | | | | 3 | 2 |
| | CO4 | 3 | 2 | 2 | | 1 | | | | 2 | 3 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC1080 | CO1 | 2 | | | 3 | | 2 | 2 | 2 | 2 | 2 |
| | CO2 | 3 | 2 | | 3 | | 2 | 1 | 3 | 3 | 3 |
| | CO3 | 3 | 3 | 3 | 3 | | | 2 | 2 | 3 | 2 |
| | CO4 | 3 | 3 | 2 | 2 | | 2 | 2 | 3 | 3 | 2 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC1090 | CO1 | 3 | 2 | 2 | | 1 | | | | 3 | 3 |
| | CO2 | 3 | 2 | 2 | | 1 | | | | 3 | 3 |
| | CO3 | 2 | 2 | 2 | | 1 | | | | 2 | 3 |
| | CO4 | 3 | 2 | 2 | | 1 | | | | 3 | 2 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC2030 | CO1 | 3 | 2 | 2 | 3 | | | | | 3 | 2 |
| | CO2 | 2 | 2 | 2 | 2 | | | | | 3 | 3 |
| | CO3 | 3 | 2 | 2 | 3 | | | | | 3 | 3 |
| | CO4 | 3 | 2 | 2 | 2 | | | | | 3 | 2 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC2040 | CO1 | 3 | 3 | 2 | 3 | | | 2 | 1 | 2 | 2 |
| | CO2 | 3 | 3 | 3 | 2 | | | 1 | 2 | 2 | 3 |
| | CO3 | 3 | 2 | 2 | 2 | | | 2 | 1 | 2 | 3 |
| | CO4 | 3 | 2 | 1 | 2 | | | 2 | 3 | 3 | 3 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC2050 | CO1 | 3 | 2 | 2 | | | | | | 3 | 2 |
| | CO2 | 2 | 2 | 2 | | | | | | 3 | 3 |
| | CO3 | 3 | 2 | 2 | | | | | | 3 | 3 |
| | CO4 | 3 | 2 | 2 | | | | | | 3 | 2 |

| Course Code | POs/COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC2080 | CO1 | 3 | 2 | 2 | | 1 | | | | 3 | 3 |
| | CO2 | 3 | 2 | 2 | 1 | 1 | | | | 3 | 3 |
| | CO3 | 2 | 2 | 2 | 2 | 2 | | | | 3 | 3 |
| | CO4 | 3 | 2 | 2 | | 1 | | | | 3 | 3 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC2090 | CO1 | 2 | 2 | 3 | 2 | 1 | | 2 | 2 | 1 | 3 |
| | CO2 | 3 | 3 | 3 | 3 | 1 | | 2 | 3 | 2 | 2 |
| | CO3 | 3 | 2 | 2 | 3 | | | 2 | 2 | 3 | 2 |
| | CO4 | 2 | 3 | 2 | 2 | 1 | | 2 | 3 | 2 | 2 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC2X10 | CO1 | 3 | 2 | 2 | | 1 | | | | 3 | 3 |
| | CO2 | 3 | 2 | 2 | 1 | 1 | | | | 3 | 3 |
| | CO3 | 2 | 2 | 2 | 1 | 1 | | | | 3 | 3 |
| | CO4 | 3 | 2 | 2 | | 1 | | | | 3 | 3 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC3030 | CO1 | 3 | 3 | 3 | 3 | | | 1 | 2 | 3 | 3 |
| | CO2 | 3 | 3 | 3 | 3 | | | 2 | 2 | 3 | 3 |
| | CO3 | 3 | 2 | 2 | 2 | | | 2 | 2 | 3 | 3 |
| | CO4 | 3 | 3 | 2 | 2 | | | 2 | 2 | 3 | 3 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC3040 | CO1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| | CO2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| | CO3 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| | CO4 | 2 | 1 | 1 | 2 | 1 | 2 | 2 | 1 | 1 | 2 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC3050 | CO1 | 3 | 3 | 3 | 3 | | | 1 | 2 | 3 | 3 |
| | CO2 | 3 | 3 | 3 | 3 | | | 1 | 2 | 3 | 3 |
| | CO3 | 3 | 2 | 2 | 2 | | | 2 | 2 | 3 | 3 |
| | CO4 | 3 | 2 | 2 | 2 | | | 2 | 2 | 3 | 3 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC3090 | CO1 | 3 | 3 | 3 | 3 | | | | 3 | 3 | 1 |
| | CO2 | 3 | 3 | 2 | 1 | | | | 1 | 2 | 2 |
| | CO3 | 3 | 3 | 2 | 2 | | | 1 | 3 | 2 | 1 |
| | CO4 | 3 | 3 | 3 | 1 | | | | 3 | 3 | 3 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC3X10 | CO1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 |
| | CO2 | 2 | 2 | 1 | 1 | 1 | 2 | 1 | 2 | 2 | 2 |
| | CO3 | 1 | 2 | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| | CO4 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 1 | 2 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC3X20 | CO1 | 3 | 2 | 2 | 1 | | | 1 | 1 | 3 | 2 |
| | CO2 | 3 | 2 | 2 | 1 | | | 1 | 1 | 3 | 3 |
| | CO3 | 3 | 2 | 2 | 1 | | | 1 | 1 | 3 | 2 |
| | CO4 | 3 | 2 | 2 | 1 | | | 1 | 1 | 2 | 3 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC4030 | CO1 | 3 | 2 | 1 | 1 | | | 1 | 3 | 3 | 2 |
| | CO2 | 3 | 2 | 3 | 2 | | | | 2 | 3 | 2 |
| | CO3 | 3 | 3 | 3 | 3 | | | 2 | 3 | 3 | 3 |
| | CO4 | 3 | 2 | 2 | 2 | | | 2 | 2 | 3 | 2 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC4040 | CO1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 |
| | CO2 | 2 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 2 |
| | CO3 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 1 |
| | CO4 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 2 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC4050 | CO1 | 3 | 3 | 3 | 3 | | | 1 | 3 | 3 | 3 |
| | CO2 | 3 | 2 | 1 | 2 | | | 1 | 2 | 3 | 3 |
| | CO3 | 3 | 2 | 2 | 2 | | | 1 | 2 | 3 | 3 |
| | CO4 | 3 | 3 | 3 | 3 | | | 1 | 3 | 3 | 3 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC4070 | CO1 | 3 | 2 | 1 | 1 | | | 1 | 3 | 3 | 2 |
| | CO2 | 3 | 2 | 3 | 2 | | | | 2 | 3 | 2 |
| | CO3 | 3 | 3 | 3 | 3 | | | 2 | 3 | 3 | 3 |
| | CO4 | 3 | 2 | 2 | 2 | | | 2 | 2 | 3 | 2 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC4080 | CO1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 |
| | CO2 | 2 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 2 |
| | CO3 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 1 |
| | CO4 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 2 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC4090 | CO1 | 3 | 2 | 2 | 1 | | | 1 | 1 | 3 | 2 |
| | CO2 | 3 | 2 | 2 | 1 | | | 1 | 1 | 3 | 3 |
| | CO3 | 3 | 2 | 2 | 1 | | | 1 | 1 | 3 | 2 |
| | CO4 | 3 | 2 | 2 | 1 | | | 1 | 1 | 2 | 2 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC5010 | CO1 | 3 | 3 | 2 | 3 | 2 | | | | 2 | 1 |
| | CO2 | 3 | 3 | 2 | 3 | 2 | | | | 3 | 3 |
| | CO3 | 3 | 3 | 1 | 3 | 2 | | | | 3 | 2 |
| | CO4 | 3 | 3 | 2 | 3 | 2 | | | | 3 | 3 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC5020 | CO1 | 2 | 1 | 1 | 1 | | | 1 | 2 | 1 | 2 |
| | CO2 | 3 | 2 | 2 | 1 | | | 1 | 2 | 2 | 2 |
| | CO3 | 2 | 1 | 1 | | | | | | | 2 |
| | CO4 | 2 | 1 | 1 | 1 | | | 1 | 1 | 2 | 2 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC5030 | CO1 | 3 | 3 | 2 | 3 | 2 | | | | 2 | 1 |
| | CO2 | 3 | 3 | 2 | 3 | 2 | | | | 3 | 3 |
| | CO3 | 3 | 3 | 1 | 3 | 2 | | | | 3 | 2 |
| | CO4 | 3 | 3 | 2 | 3 | 2 | | | | 3 | 3 |

| Course Code | POs/COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC5040 | CO1 | 3 | 3 | 2 | 3 | 2 | | | | 3 | 3 |
| | CO2 | 3 | 3 | 2 | 3 | 2 | | | | 3 | 3 |
| | CO3 | 3 | 3 | 2 | 3 | 2 | | | | 3 | 2 |
| | CO4 | 3 | 2 | 1 | 2 | 2 | | | | 3 | 3 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC5090 | CO1 | 3 | 3 | 3 | 2 | 2 | | 2 | 2 | 2 | 3 |
| | CO2 | 3 | 3 | 3 | 2 | 2 | | 2 | 2 | 3 | 3 |
| | CO3 | 2 | 2 | 1 | 3 | 2 | | 2 | 3 | 3 | 2 |
| | CO4 | | | | | | | | | | |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC5X10 | CO1 | 3 | 3 | 3 | 2 | 2 | | 2 | 2 | 2 | 3 |
| | CO2 | 3 | 3 | 3 | 2 | 2 | | 2 | 2 | 3 | 3 |
| | CO3 | 2 | 2 | 1 | 3 | 2 | | 2 | 3 | 3 | 2 |
| | CO4 | | | | | | | | | | |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC5X20 | CO1 | 1 | 2 | 2 | 1 | | | 2 | | 3 | 1 |
| | CO2 | 1 | 2 | 1 | 3 | | | 3 | | 3 | 1 |
| | CO3 | 1 | 2 | 2 | 2 | | | 2 | | 3 | 1 |
| | CO4 | 1 | 1 | 2 | 1 | | | 2 | 2 | 3 | 1 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC5X30 | CO1 | 1 | 2 | 2 | 3 | | | 2 | | 3 | 1 |
| | CO2 | 1 | 2 | 2 | 3 | | | 3 | | 3 | 1 |
| | CO3 | 1 | 2 | 1 | 2 | | | 3 | 2 | 3 | 1 |
| | CO4 | 1 | 3 | 3 | 2 | | | 2 | 3 | 3 | 1 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC6010 | CO1 | 3 | 3 | 2 | 2 | 1 | | | | 3 | 3 |
| | CO2 | 3 | 3 | 2 | 1 | 1 | | | | 3 | 3 |
| | CO3 | 3 | 3 | 2 | 1 | 1 | | | | 3 | 2 |
| | CO4 | 3 | 2 | 2 | | 1 | | | | 3 | 2 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC6020 | CO1 | 2 | 2 | 2 | 1 | | 1 | | 1 | | 1 |
| | CO2 | 3 | 2 | 1 | 1 | | | | 2 | 1 | 1 |
| | CO3 | 2 | 1 | 2 | 2 | | 1 | | 1 | 2 | 1 |
| | CO4 | 2 | 3 | 1 | 2 | | 1 | 1 | 1 | 1 | |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC6030 | CO1 | 3 | 3 | 2 | 3 | | | | | 3 | 2 |
| | CO2 | 3 | 3 | 3 | 3 | | | | | 3 | 3 |
| | CO3 | 3 | 2 | 3 | 2 | | | | | 3 | 2 |
| | CO4 | 3 | 2 | 3 | 3 | | | | | 3 | 3 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC6090 | CO1 | 3 | 2 | 2 | | 1 | | | | 3 | 3 |
| | CO2 | 3 | 2 | 2 | 1 | 1 | | | | 3 | 3 |
| | CO3 | 2 | 2 | 2 | 1 | 1 | | | | 3 | 3 |
| | CO4 | 2 | 2 | 2 | 1 | 1 | | | | 2 | 2 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC6X10 | CO1 | 3 | 3 | 3 | 3 | | | 2 | 2 | 3 | 2 |
| | CO2 | 3 | 3 | 2 | 3 | | | 2 | 2 | 3 | 1 |
| | CO3 | 3 | 3 | 2 | 3 | | | 2 | 2 | 3 | 2 |
| | CO4 | 2 | 2 | 3 | 3 | | | 2 | 2 | 3 | 3 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC6X20 | CO1 | 3 | 2 | 2 | 2 | | | | | 3 | 3 |
| | CO2 | 3 | 2 | 3 | 2 | | | | | 2 | 2 |
| | CO3 | 3 | 3 | 2 | 3 | | | | | 3 | 3 |
| | CO4 | 3 | 2 | 2 | 2 | | | | | 3 | 3 |
| **Course Code** | **POs/COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B19PC6X30 | CO1 | 3 | 3 | 2 | 2 | | | | | 2 | 3 |
| | CO2 | 3 | 2 | 2 | 3 | | | | | 3 | 2 |
| | CO3 | 3 | 2 | 3 | 2 | | | | | 3 | 2 |
| | CO4 | 3 | 3 | 2 | 2 | | | | | 3 | 3 |

# B. Sc – PCM
# (Physics, Chemistry, Mathematics)
## Scheme of Instruction and Detailed Syllabus
### (Effective from the Academic Year 2019-22)

**Scheme of Instruction** **Duration: 6 Semesters (3 Years)**

| Sl. No | Course Code | Title of the Course | CC/FC/ HC/SC | Credit Pattern | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | Total | Hours |
| **FIRST SEMESTER** | | | | | | | | |
| 1 | B19PC1011 | Language – II: Kannada | CC | 2 | 1 | 0 | 3 | 4 |
| 2 | B19PC1012 | Language – II: Hindi | CC | | | | | |
| 3 | B19PC1013 | Language – II: Additional English | CC | | | | | |
| 4 | B19PC1020 | Functional English - I | CC | 2 | 1 | 0 | 3 | 4 |
| 5 | B19PC1030 | Mechanics and Fluid Dynamics | HC | 2 | 1 | 0 | 3 | 4 |
| 6 | B19PC1040 | Chemistry-I | HC | 2 | 1 | 0 | 3 | 4 |
| 7 | B19PC1050 | Mathematics - I | HC | 2 | 1 | 0 | 3 | 4 |
| 8 | B19PC1060 | Constitution of India and Professional Ethics | FC | 2 | 0 | 0 | 2 | 2 |
| | | **Practicals** | | | | | | |
| 7 | B19PC1070 | Physics Lab-I | HC | 0 | 0 | 2 | 2 | 3 |
| 8 | B19PC1080 | Chemistry Lab-I | HC | 0 | 0 | 2 | 2 | 3 |
| 9 | B19PC1090 | Mathematics Lab-I | HC | 0 | 0 | 2 | 2 | 3 |
| **Total Credits** | | | | **12** | **05** | **06** | **23** | **31** |
| **SECOND SEMESTER** | | | | | | | | |
| 1 | B19PC2011 | Language – II: Kannada | CC | 2 | 1 | 0 | 3 | 4 |
| 2 | B19PC2012 | Language – II: Hindi | CC | | | | | |
| 3 | B19PC2013 | Language – II: Additional English | CC | | | | | |
| 4 | B19PC2020 | Functional English - II | CC | 2 | 1 | 0 | 3 | 4 |
| 5 | B19PC2030 | Heat and Thermodynamics | HC | 2 | 1 | 0 | 3 | 4 |
| 6 | B19PC2040 | Chemistry-II | HC | 2 | 1 | 0 | 3 | 4 |
| 7 | B19PC2050 | Mathematics - II | HC | 2 | 1 | 0 | 3 | 4 |
| 8 | B19PC2060 | Environmental Studies | FC | 2 | 0 | 0 | 2 | 2 |
| 9 | B19PC2070 | Sports/Yoga/Music/Dance/Theatre | RULO | 2 | 0 | 0 | 2 | 2 |
| | | **Practicals** | | | | | | |
| 8 | B19PC2080 | Physics Lab-II | HC | 0 | 0 | 2 | 2 | 3 |
| 9 | B19PC2090 | Chemistry Practical-II | HC | 0 | 0 | 2 | 2 | 3 |
| 10 | B19PC2X10 | Mathematics - II Lab | HC | 0 | 0 | 2 | 2 | 3 |
| **Total Credits** | | | | **14** | **05** | **06** | **25** | **33** |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **THIRD SEMESTER** | | | | | | | | |
| 1 | B19PC3011 | Language – II: Kannada | CC | 2 | 1 | 0 | 3 | 4 |
| 2 | B19PC3012 | Language – II: Hindi | CC | | | | | |
| 3 | B19PC3013 | Language – II: Additional English | CC | | | | | |
| 4 | B19PC3020 | Communicative English - I | CC | 2 | 1 | 0 | 3 | 4 |
| 5 | B19PC3030 | Waves, Acoustics and Optics | HC | 2 | 1 | 0 | 3 | 4 |
| 6 | B19PC3040 | Chemistry-III | HC | 2 | 1 | 0 | 3 | 4 |
| 7 | B19PC3050 | Mathematics – III | HC | 2 | 1 | 0 | 3 | 4 |
| 8 | B19PC3060 | Physics in everyday life | OE | 4 | 0 | 0 | 4 | 4 |
| 9 | B19PC3070 | Chemistry in daily Life | OE | | | | | |
| 10 | B19PC3080 | Classical Optimization | OE | | | | | |
| | | **Practicals** | | | | | | |
| 12 | B19PC3090 | Physics Lab –III | HC | 0 | 0 | 2 | 2 | 3 |
| 13 | B19PC3X10 | Chemistry Practical-III | HC | 0 | 0 | 2 | 2 | 3 |
| 14 | B19PC3X20 | Mathematics - III Lab | HC | 0 | 0 | 2 | 2 | 3 |
| **Total Credits** | | | | **14** | **05** | **06** | **25** | **33** |
| **FOURTH SEMESTER** | | | | | | | | |
| 1 | B19PC4011 | Language – II: K / H / AE | CC | 2 | 1 | 0 | 3 | 4 |
| 2 | B19PC4012 | Language – II: K / H / AE | CC | 2 | 1 | 0 | 3 | 4 |
| 3 | B19PC4013 | Language – II: K / H / AE | CC | 2 | 1 | 0 | 3 | 4 |
| 4 | B19PC4020 | Communicative English - II | CC | 2 | 1 | 0 | 3 | 4 |
| 5 | B19PC4030 | Electricity and Magnetism | HC | 2 | 1 | 0 | 3 | 4 |
| 6 | B19PC4040 | Chemistry-IV | HC | 2 | 1 | 0 | 3 | 4 |
| 7 | B19PC4050 | Mathematics – IV | HC | 2 | 1 | 0 | 3 | 4 |
| 8 | B19PC4060 | Soft Skill Training | RULO | 1 | 1 | 0 | 2 | 3 |
| | | **Practicals** | | | | | | |
| 9 | B19PC4070 | Physics Lab –IV | HC | 0 | 0 | 2 | 2 | 3 |
| 10 | B19PC4080 | Chemistry Practical-IV | HC | 0 | 0 | 2 | 2 | 3 |
| 11 | B19PC4090 | Mathematics - IV Lab | HC | 0 | 0 | 2 | 2 | 3 |
| | | **Total Credits** | | **11** | **06** | **06** | **23** | **32** |
| **FIFTH SEMESTER** | | | | | | | | |
| 1 | B19PC5010 | Quantum Mechanics | HC | 1 | 1 | 0 | 2 | 3 |
| 2 | B19PC5020 | Chemistry-V | HC | 1 | 1 | 0 | 2 | 3 |
| 3 | B19PC5030 | Mathematics – V | HC | 1 | 1 | 0 | 2 | 3 |
| 4 | B19PC5040 | Mathematics – VI | HC | 1 | 1 | 0 | 2 | 3 |
| 5 | B19PC5051 | Renewable Energy Resource | SC | 2 | 0 | 0 | 2 | 2 |
| | B19PC5052 | Solid State Physics | | | | | | |
| | B19PC5053 | Semiconductor Physics | | | | | | |
| 6 | B19PC5061 | Hetero Cyclic Chemistry & Chemistry of Natural Products | SC | 2 | 0 | 0 | 2 | 2 |
| | B19PC5062 | Polymer Chemistry | | | | | | |
| | B19PC5063 | Industrial Chemistry | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 7 | B19PC5071 | Complex Analysis | SC | 2 | 0 | 0 | 2 | 2 |
| | B19PC5072 | Fluid Dynamics | | | | | | |
| | B19PC5073 | Number Theory | | | | | | |
| 8 | B19PC5080 | Soft Skill Training | RULO | 1 | 1 | 0 | 2 | 3 |
| | | **Practicals** | | | | | | |
| 9 | B19PC5090 | Physics Lab – V | HC | 0 | 0 | 2 | 2 | 3 |
| 10 | B19PC5X10 | Physics Lab –VI | HC | 0 | 0 | 2 | 2 | 3 |
| 11 | B19PC5X20 | Chemistry –V | HC | 0 | 0 | 2 | 2 | 3 |
| 12 | B19PC5X30 | Chemistry – VI | HC | 0 | 0 | 2 | 2 | 3 |
| | | **Total Credits** | | **12** | **05** | **08** | **24** | **33** |
| | **SIXTH SEMESTER** | | | | | | | |
| 1 | B19PC6010 | Nuclear Physics | HC | 1 | 1 | 0 | 2 | 3 |
| 2 | B19PC6020 | Chemistry-VI | HC | 1 | 1 | 0 | 2 | 3 |
| 3 | B19PC6030 | Numerical methods | HC | 1 | 1 | 0 | 2 | 3 |
| 4 | B19PC6041 | Physics of Clouds | SC | 2 | 0 | 0 | 2 | 2 |
| | B19PC6042 | Astro Physics | | | | | | |
| | B19PC6043 | Digital Electronics and Communication | | | | | | |
| 5 | B19PC6051 | Electro Analytical Chemistry | SC | 2 | 0 | 0 | 2 | 2 |
| | B19PC6052 | Chemistry of Bio Molecules | | | | | | |
| | B19PC6053 | Solid State Chemistry | | | | | | |
| 6 | B19PC6061 | Fuzzy Mathematics | SC | 2 | 0 | 0 | 2 | 2 |
| | B19PC6062 | Topology | | | | | | |
| | B19PC6063 | Discrete Mathematics and Graph Theory | | | | | | |
| 7 | B19PC6070 | MOOC / Swayam / Internship | RULO | 0 | 0 | 2 | 2 | 3 |
| 8 | B19PC6080 | Soft Skill Training | RULO | 1 | 1 | 0 | 2 | 3 |
| | | **Practicals** | | | | | | |
| 9 | B19PC6090 | Physics Lab – VII | HC | 0 | 0 | 2 | 2 | 3 |
| 10 | B19PC6X10 | Mathematics - V Lab | HC | 0 | 0 | 2 | 2 | 3 |
| 11 | B19PC6X20 | Numerical Methods Lab | HC | 0 | 0 | 2 | 2 | 3 |
| 12 | B19PC6X30 | Project | HC | 0 | 0 | 2 | 2 | 3 |
| | | **Total Credits** | | **10** | **4** | **10** | **24** | **33** |
| | | **Total Credits of all Semesters** | | | | | **144** | **195** |

## Semester-wise Summary of Credit Distribution

| Semester | L | T | P | Total | Total Hours |
|---|---|---|---|---|---|
| I | 12 | 5 | 6 | 23 | **31** |
| II | 14 | 5 | 6 | 25 | **33** |
| III | 14 | 5 | 6 | 25 | **33** |
| IV | 11 | 6 | 6 | 23 | **32** |
| V | 10 | 4 | 10 | 24 | **33** |
| VI | 10 | 4 | 10 | 24 | **33** |
| **Total Credits** | **711** | **299** | **444** | **144** | **195** |

# B. Sc – Physics, Chemistry, Mathematics (PCM)
# Detailed Syllabus

**(effective from Academic Year 2019)**

**FIRST SEMESTER**

| B19PC1011 | Language-II: Kannada | L | T | P | C |
|---|---|---|---|---|---|
| Duration:14 Wks | | 2 | 1 | 0 | 3 |

**Prerequisites:**

- PÀ£ÀßqÀ ¨sÁµÉAiÀÄ §UÉUÉ ¥ÁæxÀ«ÄPÀ w¼ÀÄªÀ½PÉ CUÀvÀå.
- ¨sÁµÉAiÀÄ£ÀÄß NzÀ®Ä ªÀÄvÀÄÛ §gÉAiÀÄ®Ä w½¢gÀ¨ÉÃPÀÄ.
- ¥ÀzÀ« ¥ÀÆªÀð ²PÀëtzÀ°è PÀ£ÀßqÀ ¨sÁµÉAiÀÄ£ÀÄß N¢gÀ¨ÉÃPÀÄ.

**Course Objectives:**

**£Á®Ä¸É«Ä¸ÀÖgïUÀ¼À°è ¸ÀªÀÄUÀæ PÀ£ÀßqÀ ¸Á»vÀåªÀ£ÀÄß ¥ÀjZÀ¬Ä¸ÀÄªÀ GzÉÝÃ±ÀªÀ£ÀÄß ºÉÆA¢zÉ. CzÀgÀAvÉ ªÉÆzÀ®£ÉAiÀÄ ¸É«Ä¸ÀÖgï£À°è d£À¥ÀzÀ, ¥ÁæaÃ£À, ªÀÄzsÀåPÁ°Ã£À PÁªÀåUÀ¼ÀÄ, ºÉÆ¸ÀUÀ£ÀßqÀzÀ ¸ÀtÚPÀxÉUÀ¼ÀÄ ºÁUÀÄ £ÁlPÀ ¸Á»vÀåªÀ£ÀÄß ¥ÀoÀåªÀ£ÁßV DAiÉÄÌ ªÀiÁrPÉÆAqÀÄ, «zÁåyðUÀ¼À°è ¸Á»vÀåzÀ §UÉÎ ¸ÀzÀ©ügÀÄaAiÀÄ£ÀÄß ªÀÄÆr¸À¯ÁUÀÄvÀÛzÉ. ¸ÁA¸ÀÌøwPÀ w¼ÀÄªÀ½PÉAiÀÄ eÉÆvÉUÉ ªÀåQÛvÀé «PÀ¸À£ÀzÀ PÀqÉUÉ UÀªÀÄ£À ¤ÃqÀ¯ÁUÀÄvÀÛzÉ.**

1. ¨sÁµÉ, ¸Á»vÀå, EwºÁ¸À ªÀÄvÀÄÛ ¸ÀA¸ÀÌøwUÀ¼À£ÀÄß PÀ£ÀßqÀ, PÀ£ÁðlPÀPÉÌ ¸ÀA§A¢ü¹zÀAvÉ ¥ÀjZÀ¬Ä¸À¯ÁUÀÄvÀÛzÉ.
2. «zÁåyðUÀ¼À ¸ÀªÀðvÉÆÃªÀÄÄR ¨É¼ÀªÀtÂUÉUÉ C£ÀÄªÁUÀÄªÀAvÉ ºÁUÀÆ CªÀgÀ°è ªÀiÁ£ÀªÀ ¸ÀA§AzsÀUÀ¼À §UÉÎ UËgÀªÀ, ¸ÀªÀiÁ£ÀvÉ ªÀÄÆr¹, ¨É¼É¸ÀÄªÀ ¤nÖ£À°è ¥ÀoÀåUÀ¼À DAiÉÄÌAiÀiÁVzÉ.
3. CªÀgÀ°è ¸ÀÈd£À²Ã®vÉ, ±ÀÄzÀÞ ¨sÁµÉ, GvÀÛªÀÄ «ªÀÄ±Áð UÀÄt, ¤gÀUÀð¼À ¸ÀA¨sÁµÀuÉ, ¨sÁµÀt PÀ¯É ºÁUÀÆ §gÀºÀ PË±À®åUÀ¼À£ÀÄß ¨É¼É¸ÀÄªÀÅzÀÄ UÀÄjAiÀiÁVzÉ
4. ¸ÀàzsÁðvÀäPÀ ¥ÀjÃPÉëUÀ½UÉ C£ÀÄPÀÆ®ªÁUÀÄªÀAvÀºÀ «µÀAiÀÄUÀ¼À£ÀÄß UÀªÀÄ£ÀzÀ°èèlÄÖPÉÆAqÀÄ ¸ÀÆPÀÛ ¥ÀoÀåUÀ¼À£ÀÄß DAiÉÄÌ ªÀiÁrPÉÆ¼Àî¯ÁVzÉ.

**Course Outcomes:**

**d£À¥ÀzÀ, ¥ÁæaÃ£À, ªÀÄzsÀåPÁ°Ã£À PÁªÀåUÀ¼ÀÄ, ºÉÆ¸ÀUÀ£ÀßqÀzÀ ¸ÀtÚPÀxÉUÀ¼ÀÄ ºÁUÀÄ £ÁlPÀ ¸Á»vÀå PÀ°PÉAiÀÄ ªÀÄÆ®PÀ PÁ®zÀ ¹ÜvÀåAvÀgÀUÀ¼À£ÀÄß CzÀgÀ M¼À£ÉÆÃlUÀ¼À£ÀÄß ¨É¼É¸ÀÄvÀÛzÉ.**

1. ¸ÁªÀiÁfPÀ, gÁdQÃAiÀÄ, zsÁ«ÄðPÀ, ¸ÁA¸ÀÌøwPÀ ºÁUÀÆ °AUÀ¸ÀA§A¢ü «ZÁgÀUÀ¼ÉqÉ UÀªÀÄ£ÀºÀj¸ÀÄªÀÅzÀgÉÆA¢UÉ «zÁåyðUÀ¼À°è ZÀZÁð ªÀÄ£ÉÆÃ¨sÁªÀªÀÅ ¨É¼ÉAiÀÄÄvÀÛzÉ.
2. fÃªÀ£ÀzÀ°è §gÀÄªÀ C©ü¥ÁæAiÀÄ ¨ÉÃzsÀUÀ¼ÀÄ, ¸ÀªÀÄ¸ÉåUÀ¼À£ÀÄß DzsÀĤPÀ ¸ÀAzÀ¨sÀðzÀ°è ªÀiÁ£À«ÃAiÀÄvÉAiÉÆA¢UÉ ¤ªÀð»¸ÀÄªÀAvÉ ¥ÉæÃgÉÃ¦¸ÀÄvÀÛzÉ.
3. ¸ÁªÀiÁfPÀ CjªÀÅ ªÀÄÆr¸ÀÄvÀÛzÉ
4. GvÀÛªÀÄ ¸ÀAªÀºÀ£À PÀ¯ÉAiÀÄ£ÀÄß ¨É¼É¸ÀÄªÀ GzÉÝÃ±ÀªÀ£ÀÄß FqÉÃj¸ÀÄvÀÛzÉ.

## Mapping of Course Outcomes with programme Outcomes

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC1011 | CO1 | | | | | 2 | 3 | | | | |
| | CO2 | | | | | 2 | 3 | | | | |
| | CO3 | | | | | | 3 | | | | |
| | CO4 | | | | | | | 3 | 2 | | |

**Unit-I:** **12 Hrs**

1. ¸ÀvÀåªÀAvÉ ºÀqÉzÀªÀé - d£À¥ÀzÀ VÃvÉ
2. £É®¸ÀÄUÉ ¤£Àß ªÀPÀëzÉÆ¼É - ¥ÀA¥À
3. PÀÄqÀÄ ZÀ¥À¼É d¥ÀzÀ ªÀÄtÂAiÀÄA - £ÁUÀªÀªÀÄð
4. avÀæªÀÄ¥ÁvÉæ gÀªÀÄvÉ £Áj - d£Àß

**Unit-II:** **12 Hrs**

1. C©ÞAiÀÄÄªÉÆªÉÄð PÁ®ªÀ±À¢A ªÀÄgÁåzÉAiÀÄA zÁAlzÉÃ.... - £ÁUÀZÀAzÀæ
2. ªÀZÀ£ÀUÀ¼ÀÄ - CPÀÌªÀÄºÁzÉÃ«
3. ªÀZÀ£ÀUÀ¼ÀÄ - §¸ÀªÀtÚ
4. UÀÄAqÀAiÀÄå£À gÀUÀ¼É - ºÀjºÀgÀ

**Unit-III:** **12 Hrs**

1. zÀÄµÀÖ§Ä¢ÞAiÀÄÄA zsÀªÀÄð§Ä¢ÞAiÀÄÄA - zÀÄUÀð¹AºÀ
2. PÀ¯ÁärAiÀÄ PÉÆÃt - ªÀiÁ¹Û
3. AiÀiÁgÀÆ CjAiÀÄzÀ «ÃgÀ - PÀÄªÉA¥ÀÄ
4. ¸ÀªÀÄ¸ÉåAiÀÄ ªÀÄUÀÄ - wæªÉÃtÂ

**Unit-IV:** **12 Hrs**

1. mÉÆ¼ÀÄîUÀnÖ - n.¦. PÉÊ¯Á¸ÀA

**¥ÀgÁªÀÄ±Àð£À UÀæAxÀUÀ¼ÀÄ:**


1. ªÀÄÄUÀ½ gÀA.²æÃ., PÀ£ÀßqÀ ¸Á»vÀå ZÀjvÉæ, ¥ÀæPÁ±ÀPÀgÀÄ VÃvÁ §ÄPï ºË¸ï, ªÉÄÊ¸ÀÆgÀÄ. 2014
2. ¸ÀAUÀæºÀ. £ÁUÉÃUËqÀ JZï.J¯ï., ZÁjwæPÀ d£À¥ÀzÀ PÀxÀ£À PÁªÀåUÀ¼ÀÄ, ¥ÀæPÁ±ÀPÀgÀÄ PÀ£ÁðlPÀ eÁ£À¥ÀzÀ ¥ÀjµÀvÀÄÛ, ¨ÉAUÀ¼ÀÆgÀÄ. 2008
3. ¹ÃªÀiÁwÃvÀ PÀ£ÀßqÀ ¸Á»vÀå ZÀjvÉæ ¸ÀA¥ÀÄl 1,2,3,4,5 ªÀÄvÀÄÛ 6, PÀÄªÉA¥ÀÄ PÀ£ÀßqÀ CzsÀåAiÀÄ£À ¸ÀA¸ÉÜ, ªÉÄÊ¸ÀÆgÀÄ «±Àé«zÁå¤®AiÀÄ, ªÉÄÊ¸ÀÆgÀÄ. 2014
4. ¸ÀAUÀæºÀ. £ÁUÉÃUËqÀ JZï.J¯ï., PÀ£ÀßqÀ d£À¥ÀzÀ PÀxÀ£À PÁªÀåUÀ¼ÀÄ, ¥ÀæPÁ±ÀPÀgÀÄ PÀ£ÁðlPÀ eÁ£À¥ÀzÀ ¥ÀjµÀvÀÄÛ, ¨ÉAUÀ¼ÀÆgÀÄ. 2007
5. ºÀA¥À £ÁUÀgÁdAiÀÄå, ¸ÁAUÀvÀå PÀ«UÀ¼ÀÄ, ¥ÀæPÁ±ÀPÀgÀÄ ¸Àé¥Àß §ÄPï ºË¸ï, ¨ÉAUÀ¼ÀÆgÀÄ. 2010
6. £ÁgÁAiÀÄt ¦.«, ZÀA¥ÀÆ PÀ«UÀ¼ÀÄ, ¥ÀæPÁ±ÀPÀgÀÄ ¸Àé¥Àß §ÄPï ºË¸ï, ¨ÉAUÀ¼ÀÆgÀÄ. 2010
7. PÁ¼ÉÃUËqÀ £ÁUÀªÁgÀ, wæ¥À¢, gÀUÀ¼É ªÀÄvÀÄÛ eÁ£À¥ÀzÀ ¸Á»vÀå, ¥ÀæPÁ±ÀPÀgÀÄ ¸Àé¥Àß §ÄPï ºË¸ï, ¨ÉAUÀ¼ÀÆgÀÄ. 2010

8. ¸ÀA. ¨É£ÀUÀ¯ï gÁªÀÅ gÁªï ªÀÄvÀÄÜ ¥Á£ÀåA ¸ÀÄAzÀgÁ ±Á¹ÜçÃ, ¥ÁAgÁt £Á³ÀÄ ZÀÆqÁªÀÅtÃ, ¥ÀæPÁ±ÀPÀgÀÄ ¥Àæ¸ÁgÁAUÀ, ªÉÄÊ¸ÀÆgÀÄ «±Àé«zÁå¤®AiÀÄ. 2010
9. qÁ. azÁ£ÀAzÀ ªÀÄÆwð, ªÀZÀ£À ¸Á»vÀå, ¥ÀæPÁ±ÀPÀgÀÄ ¸Àé¥Àß §ÄPï ºË¸ï, ¨ÉAUÀ¼ÀÆgÀÄ. 2013
10. ¸ÀA. §¸À³ÀgÁdÄ J¯ï. ¸À³ÀðdÕ£À ªÀZÀ£ÀUÀ¼ÀÄ, ¥ÀæPÁ±ÀPÀgÀÄ VÃvÁ §ÄPï ºË¸ï, ªÉÄÊ¸ÀÆgÀÄ. 2012
11. ¸ÀA. §¸À³ÀgÁdÄ J¯ï. CPÀÌ£À ªÀZÀ£ÀUÀ¼ÀÄ, ¥ÀæPÁ±ÀPÀgÀÄ VÃvÁ §ÄPï ºË¸ï, ªÉÄÊ¸ÀÆgÀÄ. 1997
12. ¸ÀA ªÀÄgÀÄ¼À¹zÀÝ¥Àà PÉ, £ÁUÀgÁd Q.gÀA. ªÀZÀ£À PÀ³ÀÄäl, ¥ÀæPÁ±ÀPÀgÀÄ ¸Àé¥Àß §ÄPï ºË¸ï, ¨ÉAUÀ¼ÀÆgÀÄ. 2016
13. £ÀgÀ¹AºÁZÁgï. r.J¯ï., ¥ÀA¥À ¨sÁgÀvÀ ¢Ã¦PÉ, ¥ÀæPÁ±ÀPÀgÀÄ r.«.PÉ ªÀÄÆwð ¥ÀæPÁ±À£À, ªÉÄÊ¸ÀÆgÀÄ. 2012
14. gÀAeÁ£ï zÀUÁð, ±ÀgÀtgÀ ¸À³ÀÄUÀæ PÁæAw, ¥ÀæPÁ±ÀPÀgÀÄ. ¯ÉÆÃ»AiÀiÁ ¥ÀæPÁ±À£À, §¼Áîj. 2015
15. zÉÃ±À¥ÁAqÉ J¸ï.J¯ï. ¨ÉÃAzÉæ ±ÀjÃ¥sÀgÀ PÁ³ÁåAiÀiÁ£À, ¥ÀæPÁ±ÀPÀgÀÄ zÉÃ¹ ¥ÀÄ¸ÀÛPÀ, ¨ÉAUÀ¼ÀÆgÀÄ. 2013
16. ¸ÀA. ©.J¸ï. PÉÃ±À³ÀgÁ³ï. PÉÊ¯Á¸ÀA PÀ£ÀßqÀ £ÁlPÀUÀ¼ÀÄ, ¥ÀæPÁ±ÀPÀgÀÄ CAQvÀ ¥ÀÄ¸ÀÛPÀ, ¨ÉAUÀ¼ÀÆgÀÄ. 2005
17. ±Á³ÀÄgÁAiÀÄ vÀ.¸ÀÄ., PÀ£ÀßqÀ ¸Á»vÀå ZÀjvÉæ, ¥ÀæPÁ±ÀPÀgÀÄ vÀ¼ÀÄQ£À ªÉAPÀtÚAiÀÄå ¸ÁägÀPÀ UÀæAxÀ³ÀiÁ¯É, ªÉÄÊ¸ÀÆgÀÄ -2014
18. ²³ÀgÀÄzÀæ¥Àà f.J¸ï. PÀ£ÀßqÀ ¸Á»vÀå ¸À«ÄÃPÉë, ¥ÀæPÁ±ÀPÀgÀÄ ¸Àé¥Àß §ÄPï ºË¸ï, ¨ÉAUÀ¼ÀÆgÀÄ. 2013

| B19PC1012 | **Language-II: Hindi** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **1** | **0** | **3** |

**Prerequisites:**

- अध्येता, पी.यु.सी के स्तर पर द्वितीय भाषा के रूप में हिन्दी का अध्ययन करना चाहिए।
- हिन्दी साहित्य के इतिहास का संक्षिप्त ज्ञान की आवश्यकता है।
- हिन्दी व्याकरण का अवबोधन आवश्यक है।
- हिन्दी-अंग्रेजी अनुवाद से संबंधित जानकारी जरुरी है।

**Course Objectives:**

1. संदर्भानुसार उचित भाषा का प्रयोग करने की दक्षता को छात्रों में उत्पन्न करना।
2. साहित्य के माध्यम से समाज एवं मानवीय मूल्यों को समझाकर, उन मूल्यों की रक्षा हेतु प्रेरित करना।
3. छात्रों में पुस्तक पठन एवं लेखन की अकृतिम प्रवृत्ति स्थापित करना।
4. अध्येताओं में साहित्य के माध्यम से प्रभावी एवं कुशल संचार का विकास करना।

**Course Outcomes:**

अध्ययन की समाप्ति पर अध्येता –

1. सामाजिक मूल्य एवं नैतिक जवाबदेही को स्वीकार कर सकता है।
2. साहित्य की प्रासंगिकता को जीवन में समझने की दक्षता रखता है।

3. समाज में अंतर्निहित पद्धतियों एवं विचारधाराओं का व्याख्यान करने में सक्षम बन सकता है।
4. साहित्य के माध्यम से प्रभावी एवं कुशल संचार का विकास कर सकता है।

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC1012 | CO1 | | | | | 2 | 3 | 2 | | | |
| | CO2 | | | | | 2 | 2 | 3 | | | |
| | CO3 | | | | | 3 | 3 | 3 | | | |
| | CO4 | | | | | 3 | 2 | 3 | | | |

**Course Contents:**

**इकाई – 1:** कहानी, संस्मरण **12 hrs.**

कहानी – नशा – प्रेमचंद
कहानी – सुखमय जीवन – चंद्रधर शर्मा गुलेरी
संस्मरण – शरत के साथ बिताया कुछ समय – अमृतलाल नागर

**इकाई – 2:** कहानी, आत्मकथा **12 hrs.**

कहानी – मरने से पहले – भीष्म साहनी
कहानी – लाल हवेली – शिवानी
आत्मकथा – जेल– जीवन की झलक - गणेश शंकर विद्यार्थी

**इकाई – 3:** कहानी, व्यंग्य रचना **12 hrs.**

कहानी – चाय का एक प्याला – कैथरीन मैन्सफील्ड
व्यंग्य रचना – भेड़े और भेडियें – हरिशंकर परसाई

**इकाई – 4:** अनुवाद, संक्षेपण **12 hrs.**

**अनुवाद :** अंग्रेज़ी – हिन्दी (शब्द एवं अनुच्छेद )
**संक्षेपण :** परिच्छेद का एक तिहाई भाग में।

**सूचना : प्रत्येक इकाई 25 अंक केलिए निर्धारित है** ।

**References:**


1. सुबोध व्यवहारिक हिन्दी – डॉ. कुलदीप गुप्त
2. अभिनव व्यवहारिक हिन्दी – डॉ.परमानन्द गुप्त
3. हिन्दी साहित्य का इतिहास - डॉ. नागेन्द्र
4. आधुनिक हिन्दी साहित्य का इतिहास - डॉ. बच्चन सिंह
5. हिन्दी साहित्य का नवीन इतिहास - डॉ. लाल साहब सिंह
6. शुद्ध हिन्दी कैसे बोले कैसे लिखे- पृथ्वीनाथ पाण्डे
7. कार्यालय अनुवाद निदेशिका
8. संक्षेपण और पल्लवन - के.सी.भाटिया&तुमन सिंग

| B19PC1013 | Language-II: Additional English | L | T | P | C |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **1** | **0** | **3** |

**Prerequisites:**

Knowledge of intermediate English Grammar and LSRW skills.

**Course Objectives:**

1. To ensure the development of the linguistic prowess of the students
2. To motivate the students to appreciate literature
3. To help students build strong language fundamentals
4. To promote an appreciable reading habit among the students

**Course Outcomes:**

On completion of the course, learners will be able to:

1. Demonstrate a thorough understanding of sensitive and critical social issues.
2. Develop reading skills and vocabulary range
3. Critically analyse a piece of prose or poetry
4. Express their opinion in a coherent and communicable manner

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **B19PC1013** | **CO1** | | | | | **3** | **3** | **3** | **2** | | |
| | **CO2** | | | | | **3** | **3** | **3** | **3** | | |
| | **CO3** | | | | | **3** | **3** | **3** | **2** | | |
| | **CO4** | | | | | **3** | **3** | **3** | **2** | | |

**Course Contents:**

**Unit-I: Values and Ethics** **12 Hrs**

Literature: Rabindranath Tagore - Where the Mind is Without Fear, William Wordsworth – Three Years She Grew in Sun and Shower, Saki – The Lumber-room, William Shakespeare – Extract from *Julius Caesar* (Mark Antony's Speech) Language: Vocabulary Building

**Unit-II: Natural & Super Natural** **12 Hrs**

Literature: John Keats – La Belle Dame Sans MerciCharles Dickens – The Signal Man
Hans Christian Anderson - The Fir TreeWilliam Shakespeare – An Excerpt from *The Tempest*
Language: Collective Nouns

**Unit-III: Travel and Adventure** **12 Hrs**

Literature: R.L. Stevenson – Travel, Elizabeth Bishop - The Question of Travel, H.G. Wells – The Magic Shop, Jonathan Swift – Excerpt from *Gulliver's Travels Book – I*
Writing Skills: Travelogue

**Unit-IV: Success Stories** **12 Hrs**

Literature: Emily Dickinson – Success is Counted SweetestRupert Brooke – Success
Dr. Martin Luther King - I Have a DreamHelen Keller – Excerpt from *The Story of My Life*
Writing Skills: Brochure &Leaflet

**Reference Books:**


1. Tagore, Rabindranath. *Gitanjal*i. Rupa Publications, 2002.
2. Wordsworth, William. *The Complete Works of William Wordsworth*. Andesite Press, 2017.
3. Munro, Hector Hugh. *The Complete Works of Saki*. Rupa Publications, 2000.
4. Shakespeare, William. *The Complete Works of William Shakespeare*. Sagwan Press, 2015.
5. Chindhade, Shirish. *Five Indian English Poets: Nissim Ezekiel, A.K. Ramanujan, ArunKolatkar, DilipChitre, R. Parthasarathy*. Atlantic Publications, 2011.
6. Dickens, Charles. *The Signalman and Other Horrors: The Best Victorian Ghost Stories of Charles Dickens: Volume 2*. Createspace Independent Publications, 2015.
7. Anderson, Hans Christian. *The Fir Tree*. Dreamland Publications, 2011.
8. Colvin, Sidney (ed). *The Works of R. L. Stevenson. (Edinburgh Edition)*. British Library, Historical Prints Edition, 2011.
9. Bishop, Elizabeth. *Poems*. Farrar, Straus and Giroux, 2011.
10. Swift, Jonathan. *Gulliver's Travels*. Penguin, 2003.
11. Dickinson, Emily. *The Complete Poems of Emily Dickinson*. Createspace Independent Publications, 2016.
12. Brooke, Rupert. *The Complete Poems of Rupert Brooke*. Andesite Press, 2017.
13. King, Martin Luther Jr. &James M. Washington. *I Have a Dream: Writings and Speeches That Changed The World.* Harper Collins, 1992.
14. Keller, Helen. *The Story of My Life*. Fingerprint Publishing, 2016.
15. Green, David. *Contemporary English Grammar Structures and Composition*. New Delhi: MacMillan Publishers, 2010.
16. Thorpe, Edgar and Showick Thorpe. *Basic Vocabulary*. Pearson Education India, 2012.
17. Leech, Geoffrey and Jan Svartvik. *A Communicative Grammar of English*. Longman, 2003.
18. Murphy, Raymond. *Murphy's English Grammar with CD*. Cambridge University Press, 2004.


| B19PC1020 | **Functional English-I** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **1** | **0** | **3** |

**Prerequisites:**

Knowledge of intermediate English Grammar and LSRW skills.

**Course Objectives:**

1. To develop basic communication skills in English for the learners of Bachelor of Science.
2. To prioritize listening and reading skills among the learners.
3. To simplify writing skills needed for academic as well as workplace context.
4. To examine that the learners, use the electronic media such as internet and supplement the learning materials used in the classroom.

**Course Outcomes:**

On completion of the course, learners will be able to:

1. Interpret audio files and comprehend different spoken discourses/ excerpts in different accents.
2. Demonstrate speaking ability with clarity, confidence and comprehension and communicate with one or many listeners using appropriate communicative strategies.
3. Make use of reading different genres of texts adopting various reading strategies.
4. Develop the ability to write cohesively, coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC1020 | CO1 | | | | | 3 | 3 | 3 | 1 | | |
| | CO2 | | | | | 3 | 3 | 3 | 2 | | |
| | CO3 | | | | | 3 | 3 | 3 | 2 | | |
| | CO4 | | | | | 3 | 3 | 3 | 1 | | |

**Course Contents:**

**Unit-I: Functional English** **12 Hrs**

Grammar: Prepositions; Modal Auxiliaries, Listening: Listening to audio (verbal & sounds) Speaking: Debating Skills, Reading: Skimming a reading passage; Scanning for specific information, Writing: Email communication

**Unit-II: Interpersonal Skills** **12 Hrs**

Grammar: Tenses; Wh-questions, Listening& Speaking: Listening and responding to video lectures / talks, Reading: Reading Comprehension; Critical Reading; Finding key information in a given text, Writing: Process descriptions (general/specific); Recommendations

**Unit-III: Multi tasking Skills** **12 Hrs**

Grammar: Conditional Sentences, Listening & Speaking: Listening to specific task; focused audio tracks and responding, Reading: Reading and interpreting visual material, Writing: Channel conversion (flowchart into process); Types of paragraph (cause and effect / compare and contrast / narrative / analytical); Note Taking/ Note Making.

**Unit-IV: Communicative Skills** **12 Hrs**

Grammar: Direct and indirect speech, Listening & Speaking: Watching videos / documentaries and responding to questions based on them; Role plays, Reading: Making inference from the reading passage; predicting the content of a reading passage, Writing: Interpreting visual materials (line graphs, pie charts etc.); Different types of Essay Writing

**Reference Books:**


1. Green, David. *Contemporary English Grammar Structures and Composition*. New Delhi: MacMillan Publishers, 2010.
2. Thorpe, Edgar and Showick Thorpe. *Basic Vocabulary*. Pearson Education India, 2012.

3. Leech, Geoffrey and Jan Svartvik. *A Communicative Grammar of English*. Longman, 2003.
4. Murphy, Raymond. *Murphy's English Grammar with CD*. Cambridge University Press, 2004.
5. Rizvi, M. Ashraf. *Effective Technical Communication*. New Delhi: Tata McGraw-Hill, 2005.
6. Riordan, Daniel. Technical Communication. New Delhi: Cengage Publications, 2011.
7. Sen et al. Communication and Language Skills. Cambridge University Press, 2015.

| B19PC1030 | **Mechanics and Fluid Dynamics** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **1** | **0** | **3** |

**Prerequisites:**

Basics of Physics.

**Course Objectives:**

1. Equip with the basics of physics to solve problems involving Forces, Moments, Centroids and Moment of inertia
2. Impart knowledge about the relationship between the motion of bodies and moment of inertia
3. Familiarise with the principles of Kinematics and Hydrodynamics for practical applications.
4. Impart knowledge about fundamental laws of fluid mechanics and the Bernoulli's principle of practical applications for flow rate measurements.

**Course Outcomes:**

On successful completion of this course; the student will be able to:

1. Apply Newton's laws of motion to as certain the state of the systems.
2. Compute the elastic properties of the materials.
3. Apply the concepts of conservation of energy and momentum to elastic and inelastic Collisions.
4. Summarise the concepts of surface tension and viscosity.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **B19PC1030** | **CO1** | **3** | **3** | **3** | **3** | **2** | | **1** | **3** | **3** | **3** |
| | **CO2** | **3** | **3** | **3** | **3** | **2** | | **3** | **3** | **3** | **3** |
| | **CO3** | **3** | **3** | **3** | **2** | **2** | | **2** | **3** | **3** | **3** |
| | **CO4** | **3** | **3** | **3** | **2** | **2** | | | | **2** | **2** |

**Course Contents:**

**Unit-I** **12 Hrs**

**Motion of a particle:** The position vector r(t) of a moving particle and its Cartesian components. Velocity and acceleration as the vector derivatives, radial and transverse component of velocity and acceleration for arbitrary planar motion, centripetal force and its derivation using vector notation, problems.

**Frames of reference:** Inertial reference frames with examples and uniform rectilinear motion in an inertial frame, Special theory of relativity. The Galilean principle of relativity, Galilean

transformation equation. Non-inertial reference frame- illustration of an earth as non–inertial frame, concept of weightlessness by freely falling Lift. Qualitative discussion on centrifugal force, Coriolis force.

**Unit-II** **12 Hrs**

**Conservation Laws:** Basic symmetries of nature, Conservation of linear momentum for a system of two particles, Rocket motion in a uniform gravitational field (single stage rocket equation -- with and without gravity), Multi stage rocket, Elastic and inelastic collisions, Elastic Head on collision, Elastic oblique collision in lab frame, reduced mass, problems.
**Conservation of energy:** Conservative and non-conservative forces with examples, conservation of energy in a conservative force field. Applications – **1.** Vertical oscillations of loaded light spiral spring, **2.** Calculation of escape velocity in the gravitational field of the earth.

**Unit-III** **12 Hrs**

**Conservation of Angular Momentum:** Relation between torque and angular momentum, concept of Central forces, Kepler's laws of planetary motion –derivation using Newton's law of gravitation.
**Fluid Dynamics:** Streamline and Turbulent Flow Expression for critical velocity, Reynold's number and its significance, coefficient of viscosity, Stokes law (no derivation) terminal velocity-Expression for terminal velocity of small ball falling through viscous fluid.
**Surface Tension:** surface tension-expression for pressure inside curved liquid surface. The drop-weight method, Angle of contact - Quincke's method –Theory.

**Unit-IV** **2 Hrs**

**Rigid body Dynamics:** Moment of Inertia of a body; Theorem of Moment of Inertia-Parallel and perpendicular axes theorem with proofs (2-D case); Calculation of moment of inertia of a disc, annular ring, solid sphere and rectangular bar; Conservation of angular momentum with illustrations.
**Elasticity:** Hooke's law. Moduli of elasticity. Relation between elastic constants. Poisson's ratio-limiting values, bending moment. Theory of single cantilever. Torsion-calculation of couple per unit twist.

**Reference Books:**


1. J C. Upadhyay. Classical Mechanics, 11th edition, 2014
2. David Halliday. Robert Resnick, and Jearl Walker, Fundamentals of Physics, Sixth Edition, John Wiley & Sons, Inc.
3. Berkeley. Physics -Vol. 1, 2nd edition
4. D.C. Mathur. Mechanics, 5th edition 2016
5. Brijlal & Subramanyam. Properties of Matter, S Chand and Co., New Delhi


| B19PC1040 | **Chemistry-I** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **1** | **0** | **3** |

**Prerequisites:**

Atomic models, fundamental particles of an atom, periodic table and its origin, hydrogen carbons and its classifications, states of matter.

**Course objectives:**

1. Provide brief descriptions of the accomplishments of Planck, Einstein, Rutherford, Rydberg, Bohr, de Broglie and Schrodinger; and how these contributed to understanding the structure of atom
2. Calculate the energy and wavelength of a given electronic transition in hydrogen atom.
3. Discuss the periodic properties of the elements, and their variations across the period and down the group.
4. Explain the preparation, properties and reactions of alkanes, alkens and alkynes.
5. Applications of various reagaents and reactions on organic synthesis.
6. Focuses on the Maxwell-Boltzmann distribution of molecular velocities.

**Course Outcomes:**

1. Formulate Rydberg equation to calculate all spectral lines of hydrogen atom.
2. Discuss the importance of atomic number in constructing periodic table.
3. Examine the role of reagents, named reactions and their applications in organic chemistry.
4. Utilize the concepts of different types of molecular velocities and establish the relationship between them.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC1040 | CO1 | 3 | 3 | 2 | 1 | | | 1 | 1 | 2 | 2 |
| | CO2 | 3 | 2 | 2 | 1 | | | 1 | 2 | 2 | 3 |
| | CO3 | 2 | 3 | 2 | 2 | | 1 | | 2 | 2 | 3 |
| | CO4 | 3 | 3 | 2 | 1 | | | | | 2 | 3 |

**Course Contents:**

**Unit-I:** **2 Hrs**

**Atomic Structure Quantum Mechanics:** Fundamental particles of atoms, atomic orbitals Planck Quantization - Black body radiation, various atomic models, Bohr's theory and its limitations, dual behavior of matter and radiation, De Broglie's hypothesis equation, Heisenberg Uncertainty principle. Hydrogen atomic spectra, Aufbau and Pauli exclusion principles. Hund s multiplicity rule electronic configurations of the elements.

**Quantum Mechanics**: Introduction, wave functions, time independent Schrodinger equation and meaning of various terms in it. Significance of $\psi$ and $\psi^2$, Radial and angular parts of the hydrogenic wave functions (atomic orbitals) and their variations for 1*s*, 2*s*, 2*p*, 3*s*, 3*p* and 3*d* orbitals (Only graphical representation). Radial and angular nodes and their significance.

**Unit-II:** **12 Hrs**

**Periodic Table and Periodicity** Modern periodic law: Division of elements into s, p, d & f blocks based on their outer shell configuration. Periodic properties-periodicity & causes of periodicity.

i. Atomic radius – definitions of covalent, metallic & vanderwall's radius; calculation of atomic radius from inter nuclear distance
ii. Ionic radius –definition; calculation of iso electronic ions by paulings method.

iii. Ionization energy and electron affinity, -definations; principles of methods of determination.
iv. Electronegetivity evaluation by Paulings and Mullikan's methods.

Trends of the above properties across a period and down a group. Application of the above in predicting oxidizing / reducing property across a period. Comparative study of groups 1,2, 16 and 17 with respect to electronic configuration, atomic and ionic radii, ionization energy, electronegetivity and compound (halides, oxides and carbonates of groups 1 and 2 ; detailed comparative study of diagonal relationship between Li and Mg, cause for diagonal relationship ; hydrides of group 16 and 17) Applications of electronegetivity.

**Unit-III: 12 Hrs**

**Introduction to Organic Chemistry: Alkanes:** methods of formation (corey-house reaction and de carboxylation of carboxylic acid) and physical and chemical properties. (Melting and Boiling point, Free radical substitution reactions-Halogenation, Nitration), Oxidation reaction-Combustion.

**Alkenes:** Preparation of alkenes by wittig, Hoffmann's elimination. Mechanism of electrophilic addition, oxymercuration, reduction, hydroboration – oxidation and epoxidation-Chemical oxidation of alkene with $KMnO_4$ and $OsO_4$, ozonolysis.

**Dienes:** Types, relative stabilities of dienes, conjugated dienes – 1,3 butadiene-structure, 1,2 and 1,4- addition reactions with $H_2$ and halogens, Diel's Alder reaction with an example.

**Alkynes:** Methods of preparation – Dehydrohalogenation, vicinal and gem dihalides, reactions of alkynes –Electrophilic additions with HCN, $CH_3COOH$ and $H_2O$.

**Types of organic reactions:** Definition with examples of addition, substitution, elimination and rearrangement reactions

**Reactive intermediates:** Generation, stability of carbocations, carbanions, free radicals, nitrene, carbenes and ylide.

**Hybridization:** Tetravalency of carbon, $sp^3$, $sp^2$ and sp – hybridization (in brief). Bond length, bond angle, bond energy, localized and delocalized chemical bonds –hyperconjugation, inductive effect, mesomeric effectandresonance effect. (self study).

**Unit-IV: 12 Hrs**

**Gaseous state:** Maxwell-Boltzmann distribution of molecular velocities (no derivation – assume equation) explanation. Effect of temperature on distribution of molecular velocities using distribution curve (graph). Boltzmann factor (significance and equation). Energy distribution as a function of temperature. Types of molecular velocities and relation ship between – average (uav) - root mean square velocity (urms) - most probable velocity (ump) and numerical.

The critical phenomena – Andrew's experiments on $CO_2$, critical constants – Tc, Pc and Vc. temperature and Critical pressure by using relation between Vander Waal's Constants 'a' and 'b' and critical constants Tc, Pc and Vc to be derived using isotherms of $CO_2$. Law of corresponding states and reduced equation of state (to be derived) Liquefaction of gases – Principle underlying liquefaction of gases – Joule Thomson effect, Joule Thomson coefficient, Inversion temperature, definitions and its relation between Van der Waal's constants ('a' and 'b').

**Text Books:**


1. Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.
2. Bahl, A. & Bahl, B.S. Advanced Physical Chemistry, S. Chand, 2010.
3. J. N. Gurtu and Aayushi Gurtu, Undergraduate Physical Chemistry, Vol I, Vol II and Vol III Pragati Prakashan.
4. Principles of Inorganic Chemistry by Puri, Sharma, Kalia

**Reference Books:**


1. Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).
2. Finar, I.L. Organic Chemistry (Vol. I & II), E.L.B.S.
3. Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.
4. Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning India Pvt. Ltd., New Delhi (2009).
5. Mahan, B.H. University Chemistry 3rd Ed. Narosa (1998).
6. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
7. Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd ed., Wiley.


| B19PC1050 | Mathematics-I | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **1** | **0** | **3** |

**Prerequisites:**

Definition and types of matrices, differentiation and integration formulas and knowledge about differential equation, order and degree.

**Course Objectives:**

1. Familiarize the concepts of matrix and its applications in various fields.
2. Understand the concepts of successive differentiation and $n^{th}$ order derivative.
3. Learn about reduction formula with limit and without limit and differentiation under integral sign - Leibnitz rule.
4. Provide the fundamental concepts of differential equations and apply multiple approaches/appropriate techniques to solve first order ODEs.

**Course Outcomes:**

1. Apply the matrix theory to solve the system of linear equations.
2. Demonstrate the knowledge of successive differentiation to solve the problems relative with standard formulae and Leibnitz theorem to find $n^{th}$ differentiation of functions.
3. Gain the Knowledge of reduction formulae and differentiation under integral sign by Leibnitz rule to solve integral equations.
4. Utilize the concepts of order, degree and linearity of ODE and recognize ODEs.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **B19PC1050** | **CO1** | **3** | **2** | **2** | | | | | | **3** | **2** |
| | **CO2** | **3** | **2** | **2** | | | | | | **3** | **2** |
| | **CO3** | **3** | **2** | **2** | | | | | | **3** | **3** |
| | **CO4** | **3** | **2** | **1** | **1** | | | | | **3** | **2** |

**Course Contents:**

**Unit-I: Theory of Matrices** **12 Hrs**

Elementary row and column transformations (operations), Equivalent matrices, Theorems on it. Row - reduced echelon form, Normal form of a matrix, Rank of a matrix, Problems. Homogeneous and Non – Homogeneous systems of '*m*' linear equations in '*n*' unknown's, Consistency criterion, Criterion for uniqueness of solutions. Solution of the same by elimination method. Eigenvalues and Eigenvectors of a square matrix of order 2 and 3, Standard properties, Cayley-Hamilton theorem (**with proof**). Finding $A^{-1}, A^{-2}$ & $A^2, A^3, A^4$. Solving the linear equations with three unknowns.

**Unit-II: Differential Calculus – 1** **12 Hrs**

Successive differentiations, n$^{th}$ differentiation of standard functions

$$\left(e^{ax},(ax+b)^n,\frac{1}{(ax+b)},\log(ax+b),\sin(ax+b),\cos(ax+b),e^{ax}\sin(bx+c),e^{ax}\cos(bx+c)\right)$$

Leibnitz's theorem (**with proof**) and its application (problems).

**Unit-III: Integral Calculus - 1** **12 Hrs**

Reduction formula for

$\int \sin^n xdx, \int \cos^n xdx, \int \tan^n xdx, \int \cot^n xdx, \int \sec^n xdx, \int \operatorname{cosec}^n xdx$ & $\int \sin^m x\cos^n xdx$, with definite limits, Differentiation under integral sign by Leibnitz rule.

**Unit-IV: Differential Equation – 1** **12 Hrs**

Solutions of ordinary differential equations of first order and first degree: Linear differential equations, Reducible to linear differential equation, Exact equations, Equation reducible to exact. Equations of first order and higher degree, Non linear first order, Higher degree – (Mention) Solvable for p, Solvable for y, Solvable for x, Clairaut's equation, Singular solution, Geometric meaning. Orthogonal trajectories in Cartesian and polar forms.

**Text Books:**


1. Shanthi Narayan and P. K. Mittal, Differential Calculus, Reprint. New Delhi: S. Chand & Company Ltd., 2011.
2. Shanthi Narayan, Integral Calculus, Reprint. New Delhi: S. Chand and Company Ltd., 2004.
3. G K Ranganath, Text book of B.Sc. Mathematics, Revised ed. New Delhi, India: S Chand and Company Ltd., 2011.
4. Krishnamoorty V K and Mainra V P and Arora J L, An Introduction to Linear Algebra, Reprint. New Delhi, India: Affiliated East West Press Pvt. Ltd., 2003.
5. G K Ranganath, Text book of B.Sc., Mathematics, Revised ed. New Delhi, India: S Chand and Co., 2011.


**Reference Books:**


1. G B Thomas and R L Finney, Calculus and Analytical geometry, 10th ed.: Addison – Wesley, 2000.
2. S. Narayanan & T. K. Manicavachogam Pillay, Calculus: S. Viswanathan Pvt. Ltd., 1996, vol. I & II.
3. S. Narayanan and T. K. Manicavachogam Pillay, Calculus (I & II). Chennai, India: S. Viswanathan Pvt. Ltd., 1996.

4. Joseph Edwards, An elementary treatise on the differential calculus: with applications and numerous examples, Reprint. Charleston, USA: BiblioBazaar, 2010.

| Course Code | Course Title | Course Type | L | T | P | C | Hrs/Week |
|---|---|---|---|---|---|---|---|
| B19PC1060 | Constitution of India and Professional Ethics | FC | 2 | 0 | 0 | 2 | 2 |

**Course Objectives:**

1. To impart knowledge on Constitution of India.
2. To facilitate the understanding of Fundamental Rights, Duties and other Rights which is been given by our law.
3. To facilitate the understanding of Constitution perspective and make them face the world as a bonafide citizen.
4. To attain knowledge about ethics and also know about professional ethics.
5. Explore ethical standards followed by different companies.

**Course Outcomes**:

On completion of this course the student will be able to:

1. Explain the Indian constitutional provisions and fololllow them.
2. Demonstrate the fundamental rights and human rights.
3. Explain the duties and more importantly practice them in a right way.
4. Adopt the habit of raising their voice against a unconstitutionality of any laws and upon any legal discrimination as we have session of debates on Constitutional validity.
5. Demonstrate professional ethics and know about etiquettes about it.
6. Practice ethical standards of different companies which will increase their professional ability.

**Course Content:**

**Unit -I: Constitution of India: 6 Hrs**

Making of Indian Constitution, features of Indian Constitution Preamble to the Constitution of India, Fundamental Rights under Part III; Rights to Equality, Right to Freedom, Right against Exploitation, Rights to Freedom of Religion, Cultural and Educational Rights, Constitutional Remedies. Fundamental Duties of the Citizen, Significance and Characteristics. Elements of National Significance; National Flag, National Anthem, National Emblem.

**Unit -II: Legislature and Executive 6 Hrs**

Organs of the Government; Legislature, Executive and Judiciary. Union and State Executives: President, Vice President, Prime Minister, Cabinet, Governor, Council of Ministers, Electoral process, Election Commission.

**Unit -III: Judiciary 6 Hrs**

Supreme Court of Indian, High Court, Right to Information Act 2005, Consumer Protection-Consumer Rights- Caveat Emptor and Caveat Venditor.

**Unit-IV: Professional Ethics 6 Hrs**

Definition Scope and need of Ethics for professional, Personal Ethics and Business Ethics, Ethical Standards, Duties of Employers and Employees. Due Care theory, Environmental Ethics, Ethical Code of Conduct in ethics. Best Ethical Companies in India and Abroad; Corporate Social Responsibilities, Code of Conduct and Ethical Excellence.

**Text Books:**

1. M V Pylee, An introduction to Constitution of India
2. M Govindarajan, S Natarajan, V S Senthil Kumar, Engineering Ethics.
3. Dr. Durga Das Basu, Introduction to constitution of India

| B19PC1070 | Physics Lab-I | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **0** | **0** | **2** | **2** |

**Prerequisites:**

Knowledge of Higher secondary/Pre-University level physics.

**Course Objectives:**

1. Develop the ability to apply knowledge of Physics and engineering in calculating the elastic properties of materials.
2. Equip with the ability to use the techniques, modern engineering tools necessary for
3. material testing.
4. Impart the knowledge of using the techniques, skills for testing of fluid properties.
5. Equip with knowledge of professional and ethical responsibility in the areas of material testing.

**Course Outcomes:**

On successful completion of this course; the student will be able to:

1. Compute the values of moment of inertia, mass and density and elastic properties of a given material through experiment.
2. Compute the liquid properties like surface tension and viscosity of the given liquid through experiment.
3. Calculate acceleration due to gravity through experiment.
4. Develop the ability to communicate effectively the mechanical properties of materials.

**Mapping of Course Outcomes with programme Outcomes**

| **Course Code** | **POS/ COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **B19PC1070** | **CO1** | **3** | **2** | **2** | | **1** | | | | **3** | **3** |
| | **CO2** | **3** | **2** | **2** | | **1** | | | | **3** | **3** |
| | **CO3** | **2** | **2** | **2** | | **1** | | | | **2** | **3** |
| | **CO4** | **3** | **2** | **2** | | **1** | | | | **3** | **2** |

**Course Contents:**

Any EIGHT of the following experiments:

1. Bar pendulum: Determination of the acceleration due to gravity (graphical method).
2. Fly wheel: Determination of moment of inertia, mass and density.
3. Drop weight method: Determination of surface tension of water and kerosene.
4. Quincke's method: Determination of surface tension and angle of contact of mercury.
5. Determination of Young's modulus by single cantilever method.
6. Searle's double bar: Determination of young's modulus, the rigidity modulus, bulk modulus and Poisson's ratio.
7. Torsional pendulum: Determination of the rigidity modulus.
8. Determination of the Young's modulus by stretching method.
9. Determination of terminal velocity of small ball falling through viscous fluid and its coefficient of viscosity.

**Text books:**


1. Thiruvadigal, J. D., Ponnusamy, S. Sudha.D. and Krishnamohan M., "Physics for Technologists", Vibrant Publication, Chennai, 2013
2. R. K. Shukla and Anchal Srivastava, "Practical Physics", 1st Edition, New Age International (P) Ltd, New Delhi, 2006.


**Reference Books:**


1. G. L. Souires, "Practical Physics", 4th Edition, Cambridge University, UK, 2001.
2. D. Chattopadhyay, P. C. Rakshit and B. Saha, "An Advanced Course in Practical Physics", 2nd ed., Books & Allied Ltd., Calcutta, 1990.
3. Advanced Practical Physics – B.L. Worshnop and H.T. Flint (KPH)
4. Practical Physics – S. L. Gupta &V. Kumar (PragatiPrakashan).


| B19PC1080 | Chemistry Lab-I | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **0** | **0** | **2** | **2** |

**Prerequisites:**

Knowledge of chemicals, glasswares and instruments, systematic way of recording readings, basics of mathematics.

**Course Objectives:**

1. Provide basic knowledge of handling hazardous chemicals and safety precautions while performing experiments.
2. Hands on training about conduction of experiments independently.
3. Prepare the required solutions, using molarity and normality equations.
4. Apply suitable formule to obtain results, based on the results draw conclusions.

**Course Outcomes:**

1. Acquire the skill of handling glasswares, chemicals and instuments used in the laboratory.
2. Prepare the standard solutions and use the same for the estimation of requied from the given solution.
3. Build analytical skills such as recording the reading, interpretation of the date and drawing conclusions.
4. Estimate the amount of chlorine present in bleaching powder and COD in waste water.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **B19PC1080** | **CO1** | **2** | | | **3** | | **2** | **2** | **2** | **2** | **2** |
| | **CO2** | **3** | **2** | | **3** | | **2** | **1** | **3** | **3** | **3** |
| | **CO3** | **3** | **3** | **3** | **3** | | | **2** | **2** | **3** | **2** |
| | **CO4** | **3** | **3** | **2** | **2** | | **2** | **2** | **3** | **3** | **2** |

**Course Contents:**

1. Calibration of: (i) Pipette (ii) Burette (iii) Volumetric flask
2. Estimation of Carbonate and Bicarbonate in a given mixture using standard hydrochloric acid.
3. Estimation of potassium permanganate by using standard solution of oxalic acid present in the solution.
4. Determination of the percentage of available chlorine in the given sample of bleaching powder.
5. Estimation of ferrous and ferric iron in a given mixture using standard potassium dichromate solution
6. Estimation of COD of given waste water sample.
7. Estimation of total hardness of water.
8. Estimation of ammonium chloride using standard sodium hydroxide and standard hydrochloric acid solutions (back titration).
9. Determination of the density using specific gravity bottle and viscosity of a liquid using Ostwald's viscometer.
10. Determination of the density using specific gravity bottle and surface tension of a liquid using stalagmometer.
11. Effect surfactants on the surface Tension of water (Stock solution)

**Suggested Text Books and References:**


1. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).
2. S.W. Rajbhoj and T. K. Chondhekar, Systematic Experimental Physical Chemistry, Anjali Publication, Second Edition 2000.
3. Sunita Rattan, Experiments in Applied Chemistry, S.K. Kataria & Sons, Second edition 2008.
4. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).
5. Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. Experiments in Physical Chemistry


| B19PC1090 | Mathematics Lab-I | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **0** | **0** | **2** | **2** |

**Prerequisites:**

Definition and types of matrices, differentiation and integration formulas and knowledge about differential equation, order and degree.

**Course Objectives:**

1. Practical introduction to understand the concepts of matrix and its applications in various fields.
2. Acquire skill in solving problems on differential equation using *Maxima*.
3. Gain proficiency in using *Scilab* and *Maxima* to solve the problems of differential calculus and integral calculus

**Course Outcomes:**

1. Demonstrate the use of *Scilab* to understand concepts in matrix theory.
2. Be familiar with the built-in functions to find derivatives of any order in differential calculus
3. Acquire problem solving skills on differential equation
4. Exhibit the use of *Scilab* and *Maxima* to understand and interpret the concepts of reduction formula.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC1090 | CO1 | 3 | 2 | 2 | | 1 | | | | 3 | 3 |
| | CO2 | 3 | 2 | 2 | | 1 | | | | 3 | 3 |
| | CO3 | 2 | 2 | 2 | | 1 | | | | 2 | 3 |
| | CO4 | 3 | 2 | 2 | | 1 | | | | 3 | 2 |

**Course Contents:**

1. Introduction to *Scilab*.
2. Introduction to *Scilab* commands connected with matrices.
3. Computation with matrices.
4. Row reduced echelon from and normal form.
5. Establishing consistency or otherwise and solving system of linear equations.
6. Introduction to *Maxima*
7. *Maxima* commands for derivatives and $n^{th}$ derivatives.
8. Introduction to $n^{th}$ derivative without Leibnitz rule.
9. $n^{th}$ derivative with Leibnitz rule.
10. *Maxima* commands for reduction formula with or without limit.
11. *Scilab* and *Maxima* commands for plotting functions.
12. Solution of differential equations using *Scilab*/*Maxima* and plotting the solution – I.
13. Solution of differential equations using *Scilab*/*Maxima* and plotting the solution – II.

**Suggested Text Books and References:**


1. SCILAB: A Practical Introduction to Programming and Problem Solving [Print Replica] Kindle Edition by Tejas Sheth (Author).
2. The Maxima Book Paulo Ney de Souza Richard J. Fateman Joel Moses Cliff Yapp 19th September 2004.

## SECOND SEMESTER

| B19PC2011 | Language-II: Kannada | L | T | P | C |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **1** | **0** | **3** |

**Prerequisites:**

- PÀ£ÀßqÀ ¨sÁµÉAiÀÄ §UÉUÉ ¥ÁæxÀ«ÄPÀ w¼ÀÄªÀ½PÉ CUÀvÀå.
- ¨sÁµÉAiÀÄ£ÀÄß NzÀ®Ä ªÀÄvÀÄÛ §gÉAiÀÄ®Ä w½¢gÀ¨ÉÃPÀÄ.
- ¥ÀzÀ« ¥ÀÆªÀð ²PÀëtzÀ°è PÀ£ÀßqÀ ¨sÁµÉAiÀÄ£ÀÄß N¢gÀ¨ÉÃPÀÄ.

**Course Objectives:**

£Á®Ä¸É«Ä¸ÀÖgïUÀ¼À°è ¸ÀªÀÄUÀæ PÀ£ÀßqÀ ¸Á»vÀåªÀ£ÀÄß ¥ÀjZÀ¬Ä¸ÀÄªÀ GzÉÝÃ±ÀªÀ£ÀÄß ºÉÆA¢zÉ. CzÀgÀAvÉ JgÀqÀ£ÉAiÀÄ ¸É«Ä¸ÀÖgï£À°è ¥ÁæaÃ£À, ªÀÄzsÀåPÁ°Ã£À PÁªÀåUÀ¼ÀÄ, ¯ÉÃR£ÀUÀ¼ÀÄ ºÁUÀÄ ¥Àæ²Á¸À PÀxÀ£À ¸Á»vÀåªÀ£ÀÄß ¥ÀoÀåªÀ£ÁßV DAiÉÄÌ ªÀiÁrPÉÆAqÀÄ, «zÁåyðUÀ¼À°è ¸Á»vÀåzÀ §UÉÎ ¸ÀzÀ©ügÀÄaAiÀÄ£ÀÄß ªÀÄÆr¸À¯ÁUÀÄvÀÛzÉ. ¸ÁA¸ÀÌøwPÀ w¼ÀÄªÀ½PÉAiÀÄ eÉÆvÉUÉ ªÀåQÛvÀé «PÀ¸À£ÀzÀ PÀqÉUÉ UÀªÀÄ£À ¤ÃqÀ¯ÁUÀÄvÀÛzÉ.

1. ¨sÁµÉ, ¸Á»vÀå, EwºÁ¸À ªÀÄvÀÄÛ ¸ÀA¸ÀÌøwUÀ¼À£ÀÄß PÀ£ÀßqÀ, PÀ£ÁðlPÀPÉÌ ¸ÀA§A¢ü¹zÀAvÉ ¥ÀjZÀ¬Ä¸À¯ÁUÀÄvÀÛzÉ.
2. «zÁåyðUÀ¼À ¸ÀªÀðvÉÆÃªÀÄÄR ¨É¼ÀªÀtÂUÉUÉ C£ÀÄªÁUÀÄªÀAvÉ ºÁUÀÆ CªÀgÀ°è ªÀiÁ£ÀªÀ ¸ÀA§AzsÀUÀ¼À §UÉÎ UËgÀªÀ, ¸ÀªÀiÁ£ÀvÉ ªÀÄÆr¹, ¨É¼É¸ÀÄªÀ ¤nÖ£À°è ¥ÀoÀåUÀ¼À DAiÉÄÌAiÀiÁVzÉ.
3. CªÀgÀ°è ¸ÀÈd£À²Ã®vÉ, ±ÀÄzÀÞ ¨sÁµÉ, GvÀÛªÀÄ «ªÀÄ±Áð UÀÄt, ¤gÀUÀð¼À ¸ÀA¨sÁµÀuÉ, ¨sÁµÀt PÀ¯É ºÁUÀÆ §gÀºÀ PË±À®åUÀ¼À£ÀÄß ¨É¼É¸ÀÄªÀåzÀÄ UÀÄjAiÀiÁVzÉ
4. ¸ÀàzsÁðvÀäPÀ ¥ÀjÃPÉëUÀ½UÉ C£ÀÄPÀÆ®ªÁUÀÄªÀAvÀºÀ «µÀAiÀÄUÀ¼À£ÀÄß UÀªÀÄ£ÀzÀ°èèlÄÖPÉÆAqÀÄ ¸ÀÆPÀÛ ¥ÀoÀåUÀ¼À£ÀÄß DAiÉÄÌ ªÀiÁrPÉÆ¼Àî¯ÁVzÉ.

**Course Outcomes:**

¥ÁæaÃ£À, ªÀÄzsÀåPÁ°Ã£À PÁªÀåUÀ¼ÀÄ, ºÉÆ¸ÀUÀ£ÀßqÀzÀ ¯ÉÃR£ÀUÀ¼ÀÄ ºÁUÀÄ ¥Àæ²Á¸À PÀxÀ£À ¸Á»vÀå PÀ°PÉAiÀÄ ªÀÄÆ®PÀ PÁ®zÀ ¹ÜvÀåAvÀgÀUÀ¼À£ÀÄß CzÀgÀ M¼À£ÉÆÃlUÀ¼À£ÀÄß ¨É¼É¸ÀÄvÀÛzÉ.

1. ¸ÁªÀiÁfPÀ, gÁdQÃAiÀÄ, zsÁ«ÄðPÀ, ¸ÁA¸ÀÌøwPÀ ºÁUÀÆ °AUÀ¸ÀA§A¢ü «ZÁgÀUÀ¼ÉqÉ UÀªÀÄ£ÀºÀj¸ÀÄªÀÅzÀgÉÆA¢UÉ «zÁåyðUÀ¼À°è ZÀZÁð ªÀÄ£ÉÆÃ¨sÁªÀªÀÅ ¨É¼ÉAiÀÄÄvÀÛzÉ.
2. fÃªÀ£ÀzÀ°è §gÀÄªÀ C©ü¥ÁæAiÀÄ ¨ÉÃzsÀUÀ¼ÀÄ, ¸ÀªÀÄ¸ÉåUÀ¼À£ÀÄß DzsÀÄ¤PÀ ¸ÀAzÀ¨sÀðzÀ°è ªÀiÁ£À«ÃAiÀÄvÉAiÉÆA¢UÉ ¤ªÀð»¸ÀÄªÀAvÉ ¥ÉæÃgÉÃ¦¸ÀÄvÀÛzÉ.
3. ¸ÁªÀiÁfPÀ CjªÀÅ ªÀÄÆr¸ÀÄvÀÛzÉ
4. GvÀÛªÀÄ ¸ÀAªÀºÀ£À PÀ¯ÉAiÀÄ£ÀÄß ¨É¼É¸ÀÄªÀ GzÉÝÃ±ÀªÀ£ÀÄß FqÉÃj¸ÀÄvÀÛzÉ.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC2011 | CO1 | | | | | 2 | 3 | | | | |
| | CO2 | | | | | 2 | 3 | | | | |
| | CO3 | | | | | | 3 | | | | |
| | CO4 | | | | | | | 3 | 2 | | |

**Course Contents:**

**Unit-I: ªÀÄzsÀåPÁ°Ã£À PÁªÀå** **12 Hrs**

1. ZÀAzÀæªÀÄw «¯Á¥À - gÁWÀªÁAPÀ
2. ºÀUÉUÀ¼À£ÀÄ »ArzÀ£ÀÄ ªÀÄ£ÀzÉÆ¼ÀUÉ - PÀÄªÀiÁgÀªÁå¸À
3. ªÀÄÄ½îrzÀ ªÀÄgÀ£ÉÃjzÀAvÁzÀÄzÀÄ - ®QëöäÃ±À
4. UÉÆÃgÀPÀë ¥Àæ¸ÀAUÀ - ZÁªÀÄgÀ¸À

**Unit-II: ªÀÄzsÀåPÁ°Ã£À PÁªÀå** **12 Hrs**

1. wæ¥À¢UÀ¼ÀÄ - ÀªÀðdÕ ºÉ¼ÀªÀ£À
2. ªÀÄÄAzÀPÉÌ ¯ÉÃ¸ÀÄAIÄ £ÀªÀÄUÉ – PÀmÉÖ VjAiÀÄªÀÄä
3. UÀÄgÀÄ«£À UÀÄ¯ÁªÀÄ£ÁUÀÄªÀ vÀ£ÀPÀ - ¥ÀÄgÀAzÀgÀ zÁ¸ÀgÀÄ
4. PÀgÉzÀÄ PÉÆlÖ£ÀÄ ±Á¥ÀªÀ£ÀÄ - PÀ£ÀPÀzÁ¸ÀgÀÄ

**Unit-III: ¯ÉÃR£ÀUÀ¼ÀÄ** **12 Hrs**

1. ªÉÆÃPÀë ºÀÄqÀÄPÀÄvÀÛ ¦æÃwAiÀÄ §AzsÀ£ÀzÀ°è - ¦. ®APÉÃ±À
2. gÁªÀÄ-PÀÈµÀÚ-²ªÀ - ÉÆÃ»AiÀiÁ
3. ªÀiÁ£À«ÃAiÀÄvÉ CAvÁgÀ¯Áè - zÉÃªÀ£ÀÆgÀÄ ªÀÄºÁzÉÃªÀ
4. ¨sÀÆvÁ¬Ä ªÀÄÄ¤zÁ¼ÀÄ - ªÀÄÄgÁj §¯Áè¼À

**Unit-IV: ¥ÀæªÁ¸À PÀxÀ£À** **12 Hrs**

1. £À£ÉÆß¼ÀV£À ºÁqÀÄ PÀÆå¨Á - f.J£ï. ªÉÆÃºÀ£ï

**¥ÀgÁªÀÄ±Àð£À UÀæAxÀUÀ¼ÀÄ :**


1. ªÀÄÄUÀ½ gÀA.²æÃ., PÀ£ÀßqÀ ¸Á»vÀå ZÀjvÉæ, ¥ÀæPÁ±ÀPÀgÀÄ VÃvÁ §ÄPï ºË¸ï, ªÉÄÊ¸ÀÆgÀÄ. 2014
2. ¹ÃªÀiÁwÃvÀ PÀ£ÀßqÀ ¸Á»vÀå ZÀjvÉæ ¸ÀA¥ÀÄl 1,2,3,4,5 ªÀÄvÀÄÛ 6, PÀÄªÉA¥ÀÄ PÀ£ÀßqÀ CzsÀåAiÀÄ£À ¸ÀA¸ÉÜ, ªÉÄÊ¸ÀÆgÀÄ «±Àé«zÁå¤®AiÀÄ, ªÉÄÊ¸ÀÆgÀÄ. 2014
3. ºÀA¥À £ÁUÀgÁdAiÀÄå, ¸ÁAUÀvÀå PÀ«UÀ¼ÀÄ, ¥ÀæPÁ±ÀPÀgÀÄ ¸Àé¥Àß §ÄPï ºË¸ï, ¨ÉAUÀ¼ÀÆgÀÄ. 2010
4. PÁ¼ÉÃUËqÀ £ÁUÀªÁgÀ, wæ¥À¢, gÀUÀ¼É ªÀÄvÀÄÛ eÁ£À¥ÀzÀ ¸Á»vÀå, ¥ÀæPÁ±ÀPÀgÀÄ ¸Àé¥Àß §ÄPï ºË¸ï, ¨ÉAUÀ¼ÀÆgÀÄ. 2010
5. ¸ÀA. ¨É£ÀUÀ¯ï gÁªÀÄ gÁªï ªÀÄvÀÄÛ ¥Á£ÀåA ¸ÀÄAzÀgÀ ±Á¹ÛçÃ, ¥ÀÄgÁt £Á²ÀÄ ZÀÆqÁªÀÄtÂ, ¥ÀæPÁ±ÀPÀgÀÄ ¥Àæ¸ÁgÁAUÀ, ªÉÄÊ¸ÀÆgÀÄ «±Àé«zÁå¤®AiÀÄ. 2010
6. ¸ÀA. §¸ÀªÀgÁdÄ J¯ï. ¸ÀªÀðdÕ£À ªÀZÀ£ÀUÀ¼ÀÄ, ¥ÀæPÁ±ÀPÀgÀÄ VÃvÁ §ÄPï ºË¸ï, ªÉÄÊ¸ÀÆgÀÄ. 2012
7. ªÀÄgÀÄ¼À¹zÀÝ¥Àà PÉ, µÀlà¢ ¸Á»vÀå, ¥ÀæPÁ±ÀPÀgÀÄ ¸Àé¥Àß §ÄPï ºË¸ï, ¨ÉAUÀ¼ÀÆgÀÄ. 2010
8. ¸ÀA. ¸ÉÃvÀÄgÁªÀÄ gÁªï C.gÁ., ²æÃ ®QëöäÃ±À£À eÉÊ«Ä¤ ¨sÁgÀvÀ(ªÀÄÆ®-vÁvÀàAiÀÄð-¸ÀavÀæ), ¥ÀæPÁ±ÀPÀgÀÄ PÁªÀÄzsÉÃ£ÀÄ ¥ÀÄ¸ÀÛPÀ ¨sÀªÀ£À, ¨ÉAUÀ¼ÀÆgÀÄ. 2010

9. ¸ÀA. f.J¸ï.¨sÁmï., PÀÄªÀiÁgÀªÁå¸À£À PÀuÁðl ¨sÁgÀvÀ PÀxÁªÀÄÄAdj ¥ÀæªÉÃ±À, ¥ÀæPÁ±ÀPÀgÀÄ CPÀëgÀ ¥ÀæPÁ±À£À, ºÉUÉÆÎÃqÀÄ, ¸ÁUÀgÀ. 2006
10. QÃvÀð£ÁxÀ PÀÄvÀðPÉÆÃn, PÀ£ÀßqÀ ¸Á»vÀå ¸ÀAUÁw, ¥ÀæPÁ±ÀPÀgÀÄ PÀÄvÀðPÉÆÃn ªÉÄªÉÆÃjAiÀÄ¯ï læ¸ïÖ, zsÁgÀªÁqÀ. 2009
11. ±ÁªÀÄgÁAiÀÄ vÀ.¸ÀÄ., PÀ£ÀßqÀ ¸Á»vÀå ZÀjvÉæ, ¥ÀæPÁ±ÀPÀgÀÄ vÀ¼ÀÄQ£À ªÉAPÀtÚAiÀÄå ¸ÁägÀPÀ UÀæAxÀªÀiÁ¯É, ªÉÄÊ¸ÀÆgÀÄ -2014
12. ²ªÀgÀÄzÀæ¥Àà f.J¸ï. PÀ£ÀßqÀ ¸Á»vÀå ¸À«ÄÃPÉë, ¥ÀæPÁ±ÀPÀgÀÄ ¸Àé¥Àß §ÄPï ºË¸ï, ¨ÉAUÀ¼ÀÆgÀÄ. 201

| B19PC2012 | **Language-II: Hindi** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **1** | **0** | **3** |

**Prerequisites:**

- अध्येता, पी.यु.सी के स्तर पर द्वितीय भाषा के रूप में हिन्दी का अध्ययन करना चाहिए।
- हिन्दी साहित्य के इतिहास का संक्षिप्त ज्ञान की आवश्यकता है।
- हिन्दी व्याकरण का अवबोधन आवश्यक है।
- हिन्दी-अंग्रेजी अनुवाद से संबंधित जानकारी जरुरी है।

**Course Objectives:**

1. संदर्भानुसार उचित भाषा का प्रयोग करने की दक्षता को छात्रों में उत्पन्न करना।
2. साहित्य के माध्यम से समाज एवं मानवीय मूल्यों को समझाकर, उन मूल्यों की रक्षा हेतु प्रेरित करना।
3. छात्रों में पुस्तक पठन एवं लेखन की अकृतिम प्रवृत्ति स्थापित करना।
4. अध्येताओं में साहित्य के माध्यम से प्रभावी एवं कुशल संचार का विकास करना।

**Course Outcomes:**

अध्ययन की समाप्ति पर अध्येता –

1. सामाजिक मूल्य एवं नैतिक जवाबदेही को स्वीकार कर सकता है।
2. साहित्य की प्रासंगिकता को जीवन में समझने की दक्षता रखता है।
3. समाज में अंतर्निहित पद्दतियाँ एवं विचारधाराओं का व्याख्यान करने में सक्षम बन सकता है।
4. साहित्य के माध्यम से प्रभावी एवं कुशल संचार का विकास कर सकता है।

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **B19PC2012** | **CO1** | | | | | **2** | **3** | **2** | | | |
| | **CO2** | | | | | **2** | **2** | **3** | | | |
| | **CO3** | | | | | **3** | **3** | **3** | | | |
| | **CO4** | | | | | **3** | **2** | **3** | | | |

**Course Contents:**

**इकाई – 1:** प्राचीन कविता, आधुनिक कविता **12 hrs.**

कबीर के दोहे
कविता –जलियाँवाला बाग में बसंत- सुभद्राकुमारी चौहान
कविता – सुभाष की मृत्यु पर - धर्मवीर भारती

**इकाई – 2:** मध्यकालीन कविता, आधुनिक कविता **12 hrs.**
रसखान के दोहे
कविता – हमारी जिन्दगी - केदारनाथ अग्रवाल
कविता –चलना हमारा काम है।- शिवमंगल सिंह सुमन

**इकाई – 3:** मध्यकालीन कविता, आधुनिक कविता **12 hrs.**
मीराबाई के पद
कविता – मेरे सपने बहुत नहीं हैं- गिरिराज कुमार माथुर
कविता – अभी न होगा मेरा अंत – निराला

**इकाई – 4:** अनुवाद, निबंध **12 hrs.**
**अनुवाद :** हिन्दी – अंग्रेजी
**निबंध :**

1. भारत में किसानों की स्थिति
2. निर्वाचन आयोग का महत्व
3. प्रेस की आजादी कितनी सार्थक
4. भारतीय नारी
5. साहित्य का उद्देश्य

**References**


1. पाठ्य पुस्तक – रेवा विश्वविद्यालय
2. सुबोध व्यवहारिक हिन्दी – डॉ. कुलदीप गुप्त
3. अभिनव व्यवहारिक हिन्दी – डॉ.परमानन्द गुप्त
4. हिन्दी साहित्य का इतिहास - डॉ. नागेन्द्र
5. आधुनिक हिन्दी साहित्य का इतिहास - डॉ. बच्चन सिंह
6. हिन्दी साहित्य का नवीन इतिहास - डॉ. लाल साहब सिंह
7. शुद्ध हिन्दी कैसे बोले कैसे लिखे- पृथ्वीनाथ पाण्डे
8. कार्यालय अनुवाद निदेशिका
9. हिन्दी निबंध संग्रह


| B19PC2013 | **Language-II: Additional English** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **1** | **0** | **3** |

**Prerequisites:**

Knowledge of intermediate English Grammar and LSRW skills.

**Course Objectives:**

1. To ensure the development of the linguistic prowess of the students
2. To motivate the students to appreciate literature

3. To help students build strong language fundamentals
4. To promote an appreciable reading habit among the students

**Course Outcomes:**

On completion of the course, learners will be able to:

1. Demonstrate a thorough understanding of sensitive and critical social issues.
2. Develop reading skills and vocabulary range
3. Critically analyse a piece of prose or poetry
4. Express their opinion in a coherent and communicable manner

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC2013 | CO1 | | | | | 3 | 3 | 3 | 2 | | |
| | CO2 | | | | | 3 | 3 | 3 | 3 | | |
| | CO3 | | | | | 3 | 3 | 3 | 2 | | |
| | CO4 | | | | | 3 | 3 | 3 | 2 | | |

**Course Contents:**

**Unit – I** **12 Hrs**

**Literature:** Toru Dutt - Casuarina Tree**;** Robert Frost – Stopping by Woods on a Snowy Evening**;** Tomas Rivera–The Harvest**;** C.V. Raman – Water – The Elixir of Life; **Language:** Degrees of Comparison

**Unit – II** **12 Hrs**

**Literature:** Tadeusz Rozewicz – Pigtail**;** Jyoti Lanjewar – Mother**;** Sowvendra Shekhar Hansda – The Adivasi Will Not Dance**;** Harriet Jacobs – Excerpt from *Incidents in the Life of a Slave Girl***; Language:** Prefix and Suffix

**Unit – III** **12 Hrs**

**Literature:** Kamala Das – An Introduction**;** Usha Navrathnaram – To Mother; Rabindranath Tagore – The Exercise Book**;** Jamaica Kincaid – Girl**; Writing Skills:** Dialogue Writing

**Unit – IV** **12 Hrs**

**Literature:** Rudyard Kipling – The Absent-minded Beggar; Sir Arthur Conan Doyle – The Hound of the Baskervilles; Aldous Huxley – The Beauty Industry**; Writing Skills:** Story Writing

**Reference Books:**


1. Agrawal, K.A. *Toru Dutt the Pioneer Spirit of Indian English Poetry - A Critical Study*. Atlantic Publications, 2009.
2. Latham, Edward Connery (ed). *The Poetry of Robert Frost*. Holt Paperbacks, 2002.
3. Gale, Cengage Learning. *A Study Guide for Tomas Rivera's The Harvest*. Gale, Study Guides, 2017.
4. Basu, Tejan Kumar. *The Life and Times of C.V. Ram*an. PrabhatPrakashan, 2016.
5. Rozewicz, Tadeusz. *New Poems*. Archipelago, 2007.

6. Manohar, Murli. *Critical Essays on Dalit Literature*. Atlantic Publishers, 2013.
7. Hansda, SowvendraShekhar. *The Adivasi Will Not Dance: Stories*. Speaking Tiger Publishing Private Limited, 2017.
8. Jacobs, Harriet. *Incidents in the Life of a Slave Girl*. Createspace Independent Publication, 2014.
9. Das, Kamala. *Selected Poems*. Penguin Books India, 2014.
10. Tagore, Rabindranath. *Selected Short Stories of Rabindranath Tagore*. Maple Press, 2012.
11. Gale, Cengage Learning.*A Study Guide for Jamaica Kincaid's Girl*. Gale, Study Guides, 2017.
12. Kipling, Rudyard. *The Absent-Minded Beggar*. Hardpress Publishing, 2013.
13. Doyle, Arthur Conan. *The Hound of the Baskervilles*. General Press, 2017.
14. Dixson, Robert J. *Everyday Dialogues in English*. Prentice Hall India Pvt Ltd., 1988.
15. Turton, Nigel D. *ABC of Common Errors*. Mac Millan Publishers, 1995.
16. Samson, T. (ed.) *Innovate with English.* Cambridge University Press, 2010.
17. Kumar, E Suresh, J. Savitri and P Sreehari (ed). *Effective English*. Pearson Education, 2009.

| B19PC2020 | **Functional English-II** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **1** | **0** | **3** |

**Prerequisites:**

Knowledge of intermediate English Grammar and LSRW skills.

**Course Objectives:**

1. To utilize the ability of using language skills effectively in real-life scenarios.
2. To develop the learners' competence in employability skills.
3. To improve the habit of writing, leading to effective and efficient communication.
4. To prioritize specially on the development of technical reading and speaking skills among the learners.

**Course Outcomes:**

On completion of the course, learners will be able to:

1. Interpret audio files and comprehend different spoken discourses/ excerpts in different accents.
2. Demonstrate speaking ability with clarity, confidence and comprehension and communicate with one or many listeners using appropriate communicative strategies.
3. Make use of reading different genres of texts adopting various reading strategies.
4. Develop the ability to write cohesively, coherently and flawlessly avoiding grammatical errors

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **B19PC2020** | **CO1** | | | | | **3** | **3** | **3** | **1** | | |
| | **CO2** | | | | | **3** | **3** | **3** | **2** | | |
| | **CO3** | | | | | **3** | **3** | **3** | **1** | | |
| | **CO4** | | | | | **3** | **3** | **3** | **1** | | |

**Course Contents:**

**Unit – I** **12 Hrs**

**Grammar:** Active and passive voice; **Listening & Speaking:** Listening to informal conversations and interacting; **Reading:** Developing analytical skills; Deductive and inductive reasoning; **Writing:** Giving Instructions; Dialogue Writing

**Unit – II** **12 Hrs**

**Grammar:** Compound words; Phrasal verbs; **Listening:** Listening to situation based dialogues; **Speaking:** Group Discussions; **Reading:** Reading a short story or an article from newspaper; Critical reading; **Writing:** Formal letters (Accepting/ inviting/ declining); Personal letters (Inviting your friend to a function, congratulating someone for his / her success, thanking one's friends / relatives)

**Unit – III** **12 Hrs**

**Grammar:** Homonyms; Homophones; **Listening:** Listening to conversations; Understanding the structure of conversations; **Speaking:** Presentation Skills; **Reading**: Extensive reading; **Writing:** Report Writing (Feasibility/ Project report - report format – recommendations/ suggestions - interpretation of data using charts, PPT); Precise Writing.

**Unit – IV** **12 Hrs**

**Grammar:** Idioms; Single Word Substitutes; **Listening:** Listening to a telephone conversation; Viewing model interviews (face-to-face, telephonic and video conferencing); **Speaking:** Interview Skills, Mock Interviews; **Reading:** Reading job advertisements and the profile of the company concerned; **Writing:** Applying for a job; Writing a cover letter with résumé / CV.

**Reference Books:**


1. Bansal, R.K. and J.B. Harrison. *Spoken English*. Orient Blackswan, 2013.
2. Raman, Meenakshi and Sangeeta Sharma. *Technical Communication*. Oxford University Press, 2015.
3. Thorpe, Edgar and Showick Thorpe. *Objective English*. Pearson Education, 2013.
4. Dixson, Robert J. *Everyday Dialogues in English*. Prentice Hall India Pvt Ltd., 1988.
5. Turton, Nigel D. *ABC of Common Errors*. Mac Millan Publishers, 1995.
6. Samson, T. (ed.) *Innovate with English.* Cambridge University Press, 2010.
7. Kumar, E Suresh, J. Savitri and P Sreehari (ed). *Effective English*. Pearson Education, 2009.
8. Goodale, Malcolm. *Professional Presentation*. Cambridge University Press, 2013.


| B19PC2030 | **Heat and Thermodynamics** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **1** | **0** | **3** |

**Prerequisites:**

Concepts of Physics.

**Course Objectives:**

1. Impart knowledge about basics of physics to solve problems involving mean velocity, probable velocity.
2. Explain the relationship between the laws of radiation.

3. Familiarise with the principles of Thermodynamics for practical applications.
4. Familiarize with fundamental laws of Thermodynamics.

**Course Outcomes:**

On successful completion of this course, the student is expected to be able to:

1. Apply the laws of Kinetic theory of gases and concept of Low Temperature Physics to analyse and explain the problems in thermodynamics.
2. Demonstrate the concepts of different laws to explain the nature of radiation emitted by various bodies.
3. Analyse the heat flow in different bodies by the concepts of thermal conductivity and thermodynamics.
4. Interpret scientific information of heat and thermodynamics.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC2030 | CO1 | 3 | 2 | 2 | 3 | | | | | 3 | 2 |
| | CO2 | 2 | 2 | 2 | 2 | | | | | 3 | 3 |
| | CO3 | 3 | 2 | 2 | 3 | | | | | 3 | 3 |
| | CO4 | 3 | 2 | 2 | 2 | | | | | 3 | 2 |

**Course Contents:**

**Unit-I** **12 hrs**

**Kinetic theory of gases:** Degrees of freedom. Principle of equipartition of energy based on kinetic theory of gases, U=3/2 RT-derivation. Maxwell's law of distribution of molecular velocity (no derivation)-its interpretation. Mean free path-derivation probability of a molecule having mean free path. Andrews isothermals, Vander walls equations-expression for critical constants, calculation of mean velocity, most probable velocity and RMS velocity.

**Low Temperature Physics:** Ideal and real gases. Porous plug experiment and its theory, Joule Thomson expansion-expression for the temperature of inversion, inversion curve. Relation between temperature of inversion and critical temperature of gas.

**Unit-II** **12 hrs**

**Radiation:** Planck's quantum theory of radiation, Stefan's law, Derivation of Planck's law of radiation - Deduction of Rayleigh-Jeans' law and Wien's displacement law from Planck's radiation law, Induced absorption, spontaneous and stimulated emission of radiation, Einstein's coefficients under thermal equilibrium condition.

**Thermal conductivity:** Equation of flow of heat through a solid bar. Determination of the thermal conductivity of a bad conductor by Lee and Charlton method.

**Unit-III** **12 hrs**

**Thermodynamics-I:** Thermodynamic coordinates, concept of heat, work and internal energy, The Zeroth law of Thermodynamics, Indicator and phase diagrams, Isothermals and Adiabatic changes – Expression for work done, First law of Thermodynamics-mathematical formulation.

**Second law of thermodynamics** – Kelvin Planck's statement and Clausius statement. The Carnot engine – expression for efficiency, the Carnot's theorem-its proof. Reversible and irreversible process, reversibility of carnot's cycle, Refrigerators-principle of working and coefficient of performance. Qualitative discussion on diesel engine.

**Unit-IV** **12 hrs**

**Thermodynamics-II:** Thermodynamic scale of temperature and its identity with perfect gas scale, Clausius-Clapeyron first latent heat equation. The concept of Entropy, Entropy of ideal gas, Change of entropy in reversible and irreversible cycles. Principle of increase of entropy –Clausius inequality, Entropy and II law of Thermodynamics, Concept of absolute zero and the third law of thermodynamics, thermodynamic potentials – internal energy, Gibb's free energy, Helmholtz free energy and their significance, Maxwell's equations.

**Reference Books:**


1. Brijal and Subramanyam: Heat and Thermodynamics 5th edition,2016
2. Heat and Thermodynamics for Degree Students. Author, J. B. Rajam. Edition, 9. Publisher, S. Chand, 1981.
3. D.S. Mathur: Heat, S. Chand, 1995
4. David Halliday, Robert Resnick, and Jearl Walker, Fundamentals of Physics, Sixth
5. Edition, John Wiley & Sons, Inc. Kittal & Dekkar


| B19PC2040 | Chemistry-II | L | T | P | C |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **1** | **0** | **3** |

**Prerequisites:**

Knowledge of atomic structure, electronic configuration, valence electrons, sigma and pi bond, types of reactions, isomerism, properties of liquid and liquid mixtures.

**Course Objectives:**

1. Understand various interactions in liquid mixtures and their effect on mixture properties.
2. Study the effect of temperature on the behavior of miscible and immiscible liquids.
3. Acquire the concept of fractional distillation, its principles and applications.
4. Fundamental concepts of chemical bonding, Ionic bonding, Covalent Bonding etc.
5. Brief the concepts of binary mixtures, laws of miscibility, fractional distillation etc.
6. Defie the concepts of vapour pressure, elevation of boiling points, cryoscopic constant, isotonic solutions, plasmolysis etc.

**Course Outcomes:**

1. Apply Fajans rules and determine the percentage covalent character of an ionic compound.
2. Categorise the oraganic cyclic compounds into aromatic, non-aromatic and anti-aromatic character.
3. Draw conclusions form the properties of the solute and solvents and their interactions.
4. Explain the preparation of artificial semipermeable membrane by Morse-Frazer method.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC2040 | **CO1** | **3** | **3** | **2** | **3** | | | **2** | **1** | **2** | **2** |
| | **CO2** | **3** | **3** | **3** | **2** | | | **1** | **2** | **2** | **3** |
| | **CO3** | **3** | **2** | **2** | **2** | | | **2** | **1** | **2** | **3** |
| | **CO4** | **3** | **2** | **1** | **2** | | | **2** | **3** | **3** | **3** |

**Course Contents:**

**Unit – I: Chemical Bonding** **12 Hrs**

**Ionic Bonding:** General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy, Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, dipole moment and percentage ionic character.

**Covalent bonding**: VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonalbipyramidal and octahedral arrangements. Concept of resonance and resonating structures in various inorganic compounds.

**MO Approach**: Rules for the LCAO method, bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules ($O_2$, $N_2$) of 1st and 2nd periods (including idea of s-p mixing) and heteronuclear diatomic molecules such as CO, NO and $NO^+$. Comparison of VB and MO approaches. Hydrogen bond and vanderwalls interaction, metallic bond and coordinate bond (introduction).

**Unit-II:** **12Hrs**

**Aromaticity-**Huckel's rule with respect to benzenoids, (benzene, naphthalene, anthracene and phenanthracene) and non-benzenoid compounds (cyclopentadienylanion, cycloheptadienylcation) anti-aromaticity.

Aromatic electrophillic substitution – Arenium mechanism, reactivity and orientation effects in benzene substituents- electron donating groups (-$CH_3$, -Cl, and -OH groups) and electron withdrawing groups (-$NO_2$, and –$SO_3H$ groups). Friedelcraft alkylation and Acylation.

**Stereochemistry I**- Stereo isomerism; Optical isomerism; Symmetry and chirality; Optical isomerism in lactic acid and tartaric acid; Sequence rules; Enantiomers, diastereomers; Geometrical Isomerism; E-Z system of nomenclature, conformational analysis of ethane butane and Cyclohexane.

**Unit-III:** **12Hrs**

**Liquid mixtures:** Classification of, completely miscible and completely immiscible pairs of binary mixtures – partially miscible liquids (explanation with examples for each type). Raoult's law, definition of ideal and non- ideal solutions based on Raoult's law.

**Partially miscible liquids:** Critical solution temperature (CST) – types – phenol-water system, triethylamine-water system, (mutual solubility temperature (MST) vs composition curves to be drawn). Effect of addition of non-volatile solute on CST.Binary mixtures of completely miscible liquids.

**Vapour pressure** – definition, vapor pressure – composition diagrams and boiling point – composite diagrams. Classification into the types – obeying Raoult's law (type I), showing positive deviation from Raoult's Law (type II) and showing negative deviation from Raoult's Law (type III) – examples for each type.

**Principles of fractional distillation:** Fractional distillation of type I, type II and type III liquid mixtures (with examples). Azeotropic mixtures (definition). Binary mixtures of completely immiscible liquids (with examples), weight fraction of distillates (no derivation), principle of distillation, applications (numerical problem on weight fractions of components).

**Unit-IV:** **12 Hrs**

**Properties of liquids:** Viscosity- Coefficient of viscosity, effect of temperature, size, weight, shape of molecules and intermolecular forces on it. Surface tension and Parachor-Definition, mathematical expression, numerical problems and factors affecting them.

**Colligative Properties:** Concept of vapour pressure, variation of vapour pressure with temperature. Effect of dissolution of solute on the vapour pressure of the solvent. Raoult's law – relation between relative lowering of vapour pressure and molar mass (to be derived). Determination of relative molar mass of solute by dynamic method.

Elevation of boiling point and its relation to lowering of vapour pressure and molar mass (to be derived). Ebullioscopic constant of the solvent and its relation to the boiling point (only equation). Determination of molar mass of the solute by Walker-Lumsden method. Depression in freezing point and its relation to lowering of vapour pressure and molar mass (to be derived). Cryoscopic constant and its relation to the melting point (equation). Determination of molar mass of a non-volatile solute by Beckmann's method (problems to be worked out).

Semi permeable membrane – natural and artificial, preparation of copper ferrocyanide membrane by Morse-Frazer method. Definition of osmosis, osmotic pressure (mention application), determination of osmoticpressure by Berkley-Hartley's method, laws of osmotic pressure analogy with gas laws, determination ofmolar mass from osmotic pressure measurements (relation to be derived), isotonic solutions, plasmolysis.

**Suggested Text Books:**


1. Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.
2. Bahl, A. & Bahl, B.S. Advanced Physical Chemistry, S. Chand, 2010.
3. J. N. Gurtu and Aayushi Gurtu, Undergraduate Physical Chemistry, Vol I, Vol II and Vol III Pragati Prakashan.
4. Principles of Inorganic Chemistry by Puri, Sharma, Kalia


**Reference Books:**


1. Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).
2. Finar, I.L. Organic Chemistry (Vol. I & II), E.L.B.S.
3. Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.
4. Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning India Pvt. Ltd., New Delhi (2009).
5. Mahan, B.H. University Chemistry 3rd Ed. Narosa (1998).
6. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
7. Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd ed., Wiley.

| B19PC2050 | Mathematics –II | L | T | P | C |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **1** | **0** | **3** |

**Prerequisites:**

Definition and properties of groups, concept of polar and Cartesian form, formulas and knowledge about differentiation and partial derivatives.

**Course Objectives:**

1. Make the students to learn fundamental concepts of groups.
2. Make the students to develop the knowledge of differential calculus in polar coordinates.
3. Make the students to be familiar with curve tracing.
4. Find derivative of functions of more than one variable.
5. Illustrate about the application areas of partial differentiation.

**Course Outcomes:**

1. Explain the classification of finitely generated abelian groups and subgroups.
2. Demonstrate asymptotes and singular points
3. Gain knowledge on the concepts such as asymptotes, singular points and apply the same for curve tracing
4. Master the fundamental concepts of partial differentiation and apply Euler's theorem for homogeneous functions.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC2050 | **CO1** | **3** | **2** | **2** | | | | | | **3** | **2** |
| | **CO2** | **2** | **2** | **2** | | | | | | **3** | **3** |
| | **CO3** | **3** | **2** | **2** | | | | | | **3** | **3** |
| | **CO4** | **3** | **2** | **2** | | | | | | **3** | **2** |

**Course Contents:**

**Unit-I: Group Theory-1** **12 Hrs**

Binary operation, Algebraic structure, Problems on finding identity and inverse. Definitions of semi group and group, Abelian group, problems on finite and infinite groups. Properties of group with proof, Standard problems on groups, Any group of order less than five is abelian, permutation groups.

**Unit-II: Differential Calculus -2** **12Hrs**

Polar coordinates, Angle between the radius vector and the tangent, Angle of intersection of curves (polar form), Polar sub tangent and polar subnormal, Perpendicular from pole on the tangent, Pedal equations, Derivative of an arc in Cartesian, parametric and polar forms.

**Unit-III: Differential Calculus – 3** **12Hrs**

Curvature of plane curves, Formula for radius of curvature in Cartesian, parametric, polar and pedal forms, Centre of curvature, Evolutes. Singular points, Asymptotes, Envelopes. General rules for tracing of curves.

**Unit-IV: Partial Differentiation – 1** **12 Hrs**

Partial differentiation, Function of two and three variables, First and higher derivatives, Homogeneous functions - derivatives - Euler's theorem and its extension (with proof). Total derivative and differential, Differentiation of implicit functions and composite functions – Problems, Jacobians - Properties of Jacobians problems.

**Suggested Text Books:**


1. The first course in Abstract Algebra by John B Fraleigh, Narosa Publishing House.
2. Topics in Algebra, I N Herstein, Wiley easter.
3. Shanthi Narayan and P. K. Mittal, Differential Calculus, Reprint. New Delhi: S. Chand & Company Ltd., 2011
4. G K Ranganath, Text book of B.Sc., Mathematics, Revised ed. New Delhi, India: S Chand and Co., 2011.


**Reference Books:**


1. G B Thomas and R L Finney, Calculus and Analytical geometry, 10th ed.: Addison – Wesley, 2000.
2. S. Narayanan & T. K. Manicavachogam Pillay, Calculus: S. Viswanathan Pvt. Ltd., 1996, vol. I & II.
3. S. Narayanan and T. K. Manicavachogam Pillay, Calculus (I & II). Chennai, India: S. Viswanathan Pvt. Ltd., 1996.
4. Joseph Edwards, An elementary treatise on the differential calculus: with applications and numerous examples, Reprint. Charleston, USA: BiblioBazaar, 2010.
5. M D Raisinghania, Ordinary and Partial Differential Equations, S Chand and Co. Pvt. Ltd., 2014.


| B19PC2060 | **Environmental Studies** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **0** | **0** | **2** |

**Prerequisites:**

Basic knowledge of Environmental Science studied at higher secondary & school level.

**Course Objectives:**

1. Discuss Foster clear awareness and concern about economic, social, political and ecological interdependence in urban and rural area
2. Influence the new patterns of behaviors of individuals, groups and society as a whole towards the environment
3. List the knowledge values, attitudes, commitment and skills needed to protect and improve the environment
4. Elaborate the evaluation of the environmental measures and education programs.

**Course Outcomes:**

On successful completion of this course, the student will be able to:

1. Adapt the environmental conditions and protect it
2. Estimate the role of individual, government and NGO in environmental protection.
3. Interpret the new renewable energy resources with high efficiency through active research.
4. Analyze the ecological imbalances and protect it.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC2060 | CO1 | 1 | 2 | 1 | 1 | 1 | 2 | 3 | 1 | 1 | 1 |
| | CO2 | 1 | 3 | 1 | 1 | 1 | 3 | 3 | 1 | 1 | 1 |
| | CO3 | 2 | 3 | 2 | 1 | 3 | 3 | 3 | 1 | 1 | 1 |
| | CO4 | 1 | 2 | 1 | 1 | 1 | 2 | 3 | 1 | 1 | 1 |

**Course Contents:**

**Unit-I** **6 Hrs**

**Multidisciplinary Nature Of Environmental Studies:** Introduction to Environment, objectives and guiding principles of environmental education, Components of environment, Structure of atmosphere, Sustainable environment/Development, Impact of technology on the environment in terms of modern agricultural practices and industrialization, Environmental Impact Assessment.

**Environmental protection –** Role of Government-Assignments of MOEF, Functions of central and state boards, Institutions in Environment and People in Environment, Initiative and Role of Non-government organizations in India and world.

**Self study:** Need for public awareness on the environment, Gaia Hypothesis.

**Unit-II** **6 Hrs**

**Environmental pollution, degradation & Waste management:**

**Environmental Pollution –** Definition, sources and types, Pollutant-Definition & classification, Concepts of air pollution, water pollution, Soil pollution, Automobile Pollution-Causes, Effects & control measures.

**Self study:** Case studies of London smog, Bhopal gas tragedy, marine pollutions and study of different waste water treatment processes.

**Environmental degradation** – Introduction, Global warming and greenhouse effect, Acid rain-formation & effects, Ozone depletion in stratosphere and its effect.

**Solid Waste management –** Municipal solid waste, Biomedical waste, Industrial solid waste and Electronic waste (E-Waste).

**Self study:** Disaster management, early warning systems-bio indicators for Tsunami and other natural disasters.

**Unit-III** **6 Hrs**

**Energy & Natural resources:**

**Energy –** Definition, classification of energy resources, electromagnetic radiation-features and applications, Conventional/Non-renewable sources – Fossil fuels based(Coal, petroleum & natural

gas), nuclear energy, Non-conventional/renewable sources – Solar, wind,hydro, biogas, biomass, geothermal, ocean thermal energy, Hydrogen as an alternative as a future source of energy.

**Self study:** Remote sensing and its applications, Chernobyl (USSR) nuclear disaster and Fukushima (Japan) nuclear disaster.

**Natural resources** –water resource (Global water resource distribution, Water conservation methods, Water quality parameters, Uses of water and its importance), Mineral resources (Types of minerals, Methods of mining & impacts of mining activities), Forest wealth (Importance's, Deforestation-Causes, effects and controlling measures)

**Self study:** Hydrology & modern methods adopted for mining activities.

**Unit-IV** **6 Hrs**

**Ecology and ecosystem:**

Ecology-Definition, branches, objectives and classification, Concept of an ecosystem – Structure and functions, Characteristics of an Ecosystem-Ecosystem Resilience, Ecological succession and productivity, Balanced ecosystem, Components of ecosystem-abiotic and biotic, biological diversity. Biogeochemical cycles and its environmental significance – Carbon, nitrogen and phosphorus cycle, Energy flow in ecosystem, food chains –types, food web & Ecological Pyramids.

**Self study:** Need for balanced ecosystem and restoration of degraded ecosystems.

**Reference Books**


1. "Environmental Studies", by R.J. Ranjit Daniels and JagadishKrishnaswamy, (2017),
2. Wiley India Private Ltd., New Delhi, Co-authored &Customised by Dr. M. S. Reddy & Chandrashekar, REVA University.
3. "Environmental Studies", by R.J. Ranjit Daniels and JagadishKrishnaswamy, (2009), Wiley India Private Ltd., New Delhi.
4. "Environmental Studies" by Benny Joseph, Tata McGraw – Hill Publishing Company Limited.
5. Environmental Studies by Dr. S. M. Prakash, Elite Publishers Mangalore, 2007
6. Rajagopalan R. 2005, "Environmental Studies – from Crisis to cure", Oxford University Press.
7. Environmental Science by Arvind walia, Kalyani Publications, 2009.
8. Environmental Studies by AnilkumarDey and Arnab kumarDey.


| Course Code | Course Title | Course Type | L | T | P | C | Hrs/Week |
|---|---|---|---|---|---|---|---|
| **B19PC2070** | **Sports / Yoga / Music / Dance / Theatre** | **RULO** | **2** | **0** | **0** | **2** | **2** |

**Note:** Music, Dance, and Theater courses are offered by the School of Performing Arts, whereas the Sports and Yoga courses are offered by the Department of Physical Education. The students have to choose any **ONE** of these courses.

**A. YOGA FOR HEALTH (B19PC2071)**

**Course Objectives:**

Following are the Course Objectives.

- To prepare the students for the integration of their physical, mental and spiritual faculties;
- To enable the students to maintain good health;
- To practice mental hygiene and to attain higher level of consciousness;
- To possess emotional stability, self control and concentration; and

- To inculcate among students' self discipline, moral and ethical values.

**Course Outcomes:**

On completion of the course learners will be able to:

- Practice yoga for strength, flexibility, and relaxation.
- Learn techniques for increasing concentration and decreasing anxiety
- Become self disciplined and self-controlled
- Improve physical fitness and perform better in studies
- Gain self confidence to face the challenges in the society with commitment to serve the society

**Course Content:**

**Unit-I:**
**Yoga:** Introduction; **Surya Namaskara: -** 12 counts

**Unit-II:**
**Asanas: Sitting-** Vajrasana, Dandasana, Padmasana, Matsyasana, Paschimottasana, Shirasasana.
**Asanas: Standing-** Tadasana, Trikonasana, Parshwa konasana, Veerabadrasana.

**Unit-III:**
**Asanas: Prone Position-** Bhujangasana, Dhanurasana.
**Asanas: Supine Position-** Sarvangasana, Halasana.
**Mudras-** Dhyana mudra, Namaste mudra, Nasika mudra

**Unit-IV:**
**Pranayams: -** Anuloma – Viloma, Basthrika, Bhramari.
**Dhyana & its types:** Competition format, Rules and their interpretations

**B. VOLLEYBALL (B19PC2072)**

**Course Objectives:**

To learn the rules, fundamental skills, and strategies of volleyball

1. To develop skills in passing, setting, serving, spiking, and blocking.
2. To learn basic offensive and defensive patterns of play.
3. To develop a positive attitude towards volleyball as a lifetime sport and to improve physical fitness through participation in volleyball.

**Course Outcomes:**

On completion of the course learners will be able to:

1. Learn basic skills and knowledge associated with volleyball.
2. Apply these skills while playing volleyball and exhibit improved performance
3. Improve physical fitness and practice positive personal and lifestyle.
4. Gain an understanding of the value of sports in attaining wellness, maintaining good health and developing spirit of teamwork.

**Course Content:**

**Unit-I**

- Introduction about Volleyball

- Players Stance, Receiving and passing
- The Volley (Overhead pass), The Dig (Underhand pass), Service Reception

**Unit-II**

- Service- Under Arm Service, Tennis Service, Side Arm Spin Service, Round Arm Service, High spin service, Asian serve / American serve (floating)
- Setting the ball- Set for attack, Back set, Jump set

**Unit-III**

- Smash/Spike- Straight smash, Body turn smash, Wrist outward smash, Wrist inward smash
- Block- Single block, Double block, Three-man block
- Rolls- Overhead pass & back rolling, One hand underhand pass with side rolling, Forward dive

**Unit-IV**

- Attack Combination, Defense Systems, Libero play
- Court marking, Rules and their interpretations and Duties of officials

## C. BASKETBALL (B19PC2073)

**Course Objectives:**

1. To learn the rules, fundamental skills, and strategies of Basketball
2. To develop technical skills in passing, in ball handling, individual offense, individual defense, rebounding, screen, team offense, team defense and fast break.
3. To learn basic offensive and defensive strategies of play.
4. To develop a positive attitude towards Basketball as a lifetime sport and to improve physical fitness through participation in Basketball.
5. To develop positive understanding and appreciation of the basketball game.

**Course Outcomes:**

On completion of the course learners will be able to:

1. Learn basic skills and knowledge associated with basketball.
2. Apply these skills while playing basketball and exhibit improved performance
3. Improve physical fitness and practice positive personal and lifestyle.
4. Gain an understanding of the value of sports in attaining wellness, maintaining good health and developing spirit of teamwork.

**Course Content:**

**Unit-I**

- Basketball: Introduction
- Grip; Player stance- Triple threat stance and Ball handling exercises
- Passing (Two hand/one hand)- Chest pass, Bounce Pass, over head pass, Underhand pass, Hook Pass, Behind the back pass, Baseball pass, Side arm pass and passing in running.
- Receiving-Two Hand receiving, one hand receiving, receiving in stationary position, receiving while jumping, receiving while running.

**Unit-II**

- Dribbling- How to start dribble, how to stop dribble, High / Low dribble with variations
- Shooting- Layup shot and its variations, One hand set shot, one hand jump shot, Free throw, Hook shot, Tip-in shot.
- Stopping- Stride/Scoot, Pivoting and Faking /Feinting footwork.

**Unit-III**

- Rebounding- Defensive rebound, Offensive rebound, Box out, Rebound Organization.
- Individual Defensive- Guarding the man with the ball and without the ball.
- Offensive drills, Fast break drills, Team Defense/Offense, Team Tactics

**Unit-IV**

- Court marking, Rules and their interpretations

**D. FOOTBALL (B19PC2074)**

**Course Objectives:**

1. To learn the rules, fundamental skills, and strategies of football.
2. To develop skills in passing, receiving, controlling the ball, dribbling, shielding, shooting, tackling, beating a defender and heading in football.
3. To learn basic offensive and defensive patterns of play
4. To use different parts of the body in utilizing the above skills while playing football
5. To develop a positive attitude towards football as a lifetime sport and to improve physical fitness through participation in football.

**Course Outcomes:**

On completion of the course learners will be able to:

1. Learn basic skills and knowledge associated with football.
2. Apply these skills while playing football and exhibit improved performance
3. Use the knowledge and understanding to perform, refine and adapt the above skills and related skills with precision, accuracy, fluency and clarity in any situation.
4. Improve physical fitness and practice positive personal and lifestyle.
5. Gain an understanding of the value of sports in attaining wellness, maintaining good health and developing spirit of teamwork.

**Course Content:**

**Unit-I**

**Football: Introduction**

- Kicks- Inside kick, Instep kick, Outer instep kick, Lofted kick, Chipping, Volley, Half Volley
- Trapping- Trapping rolling the ball, Trapping bouncing ball with sole

**Unit-II**

- Dribbling- With instep and outer instep of the foot.
- Heading- From standing, running and jumping.
- Feinting- With the lower limb and upper part of the body.

**Unit-III**

- Tackling- Simple tackling, Slide tackling.
- Throw-in- Standing and Sliding
- Goal Keeping- Collection of balls, Ball clearance, throwing and deflecting.

**Unit-IV**

- Ground marking, Rules and their interpretations

**E. ATHLETICS (TRACK AND FIELD) (B19PC2075)**

**Course Objectives:**

1. To teach students the skilled techniques in sprints, relay running, hurdles, long jump, high jump, and shot put and practice them.
2. To develop competence among students in demonstrating all the techniques covered in the course.
3. To make students understand some of the scientific and empirical principles and their rationale underlying the development of skilled performance.
4. To inculcate among students the habit of team work and cooperative learning and develop competence in detecting / correcting technique errors.
5. To develop a positive attitude towards sports in general and athletics in particular and to improve physical fitness through participation in various athletic games / sports activities.

**Course Outcomes:**

On completion of the course learners will be able to:

1. Display competencies in executing basic techniques and skills associated with select track and field events.
2. Develop basic skills and techniques to improve one's running posture and take-off position for different jumps.
3. Learn regular practice of select track and field events and improve physical fitness
4. Appreciate track and field events by applying sports science knowledge to explain the execution of the events.

**Course Content:**

**Unit-I**

- Athletics: Introduction
- Track Events - Steeple Chase, Race Walking, Middle- and Long-distance races
- Race walking - Technique, Faults and Officiating.
- Middle- and Long-distance races – Technique and Training

**Unit-II**

- Jumping Events - High Jump and Triple Jump: Basic Skills and techniques
- High Jump - Straddle Roll & Flop Technique, Approach, Take-off, Technique in the air, Clearance over the bar & Landing
- Triple Jump – Hop, Step and Jump Technique, Approach, Take-off & Landing

**Unit-III**

- Throwing Events - Discus Throw and Hammer Throw: Basic Skills and techniques
- Discus Throw - Standing and Rotatory techniques, Grip, Stance, Rotation Technique, Power stance, Release and Reverse (Follow through)

- Hammer Throw - Grip, Swings, Rotation foot work, Release and Follow through

**Unit-IV**

- Rules, Officiating and Marking - Ground / Sector Marking, Interpretation of Rules.

**Reference Books**


1. Arthur E. Ellison (ed) (1994). Athletic Training and Sports Medicine.
2. Ballisteros, J.M. (1998). Hurdles Basic Coaching Manual, IAAF.
3. Bosen K.O. (1993). Teaching Athletics Skills and Technique.
4. Bosen K.O. (1990). Study Material on Hurdles for the Regular Course Students.
5. Doherty K. (1995). Track and Field Omni book.
6. Martin, David E. Peter N. Coe (1991). Training Distance Runner.
7. Howard S. (1981). Science of Track and Field Athletics.
8. Briggs Graeme (1987). "Track and field coaching Manual", Australian Track and Field Coaches Association. Rothmans Foundation National Sports Division.
9. Carr, Gerry (1999). "Fundamentals of Track and Field. Track Athletics Title G.V. 1060 5.e. 368.
10. I.A.A.F. Level-II (2001). Text Book on Jumping Event.
11. Jarver, Jesse (1987). "The Jumps", Track and Field Coaching Manual Australia.


## F. DRAMATICS (B19PC2076)

**Pre-requisites**: Students with background in Theatre Arts/ Keen interest in Dramatics.

**Course Objectives:**

- To imbibe the acting skills.
- To understand the broader applications of theatre studies in allied arts forms.
- To be able to use body language for better communication.
- Students shall also be able to understand voice modulation and Navarasas.

**Course Outcomes:**

On successful completion of this course, students should be able to:

- Freely express improvisation in non-verbal communication.
- Shall hone good acting skills and be able to emote better.
- Be able to put up a theatre act and play a key role.
- Be able to differentiate good acting and understand the importance of good lyrics, stage crafting, music, dance, costume and lighting.

**Course Content:**

**UNIT – 1**

**Working on Body:**

Body and its analysis. Understanding physical abilities (Anga, Pratyanga and Upanga). Challenges of the body. Using body as metaphor and language. The class's bodies as a collective, an ensemble, a collaborative team.

**UNIT – 2**

**Sound and Movement:**

Awareness of creating sound patterns, voice modulations, rhythm in speech and diaologues. Understanding the rhythm and patterns of movements like walking, framing, shaping, primitive and animal movements.

**UNIT – 3**

**Characterization and Improvisation:**

Observation of people around. Getting into the role and living it. Developing a character from establishment (pace and rhythm). Improvisation techniques of body and mind.

**UNIT – 4**

**Group work and Production:**

Develop a theme, concept or a play and include all the theatre skills, stage craft, costuming and put up an act. Choosing theme and characters.

**Reference Books:**


1. All about Theatre – Off stage – Chris Hogget.
2. Rangadalli Anataranga – K V Subbanna
3. The Indian Theatre – Hemendranath Das Gupta.
4. A Practical handbook for an Actor – Milisa Bruder, ee Milchel Cohn, Madeleine Oliek et al, Zigler Publisher.


## G. INDIAN CLASSICAL DANCE FORMS

**(**Bharatanatyam, Kuchipudi, Mohiniyattam) (**B19PC2077**)

**Prerequisites: Background of classical dance training or any other dance forms.**

**Note: Non-classical dancers can also join.**

**Course Objectives:**

- To develop an understanding about the Indian classical dance forms and its universal application.
- To be able to understand the fine nuances of Classical dance.
- To understand the importance of health through Indian classical dance, strengthen the body capacity.
- To understand mythology and its characters in Indian classical dance form through lessons of Abhinaya.

**Course Outcomes:**

- To be able to identify and appreciate the classical dance forms.
- To be able to execute basics of Adavus with finesse.
- To be able to express through abhinaya.
- To be able to perform to perform the fundamentals in the chosen dance form.

**Course Content:**

**Unit – 1**

An introduction to Indian classical dance forms

Bharatanatyam, Kuchipudi, Mohiniyattam

**Unit - 2**

Learning of Fundamentals
Exercises and Adavus- I (Bharathanatyam, Kuchipudi, Mohiniyattam)

**Unit - 3**
Adavus –II (Bharathanatyam, Kuchipudi, Mohiniyattam)

**Unit - 4**
Learn a basic composition in the chosen dance form.

**Reference Books**

1. Indian classical dance forms –U S Krishna Rao, U K Chandrabhaga Devi
2. Classical Dances –Sonal Mansingh, Avinash Parischa
3. Kuchipudi – Sunil Kothari
4. Bharatanatyam an in-depth study- Saroja vydyanathan
5. Mohiniyattam – Bharathi Shivaji

## H. PERCUSSION INSTRUMENT (TABLA AND MRIDANGAM) (B19PC2078)

**Pre-requisites**: Students with background in Percussion instruments and knowledge of Rhythm/ Keen interest in studying Mridagam / Tabala.

**Course Objectives:**

- To understand the Rhythmology.
- To understand the importance of Laya, Taala.
- To be able to understand the fine finger techniques of playing the instrument.

**Course Outcomes:**
On successful completion of this course, students should be able to:

- To be able to set instrument to Sruthi.
- To be able to play the fundamentals on instrument.
- To be able to learn and perform a particular taala.

**Course Content:**

**UNIT - 1**
1. Introduction to Musical Instruments; 2. Percussion Instruments; 3. Mridangam and its History

**UNIT - 2**
1. Introduction to Tala System; 2. Definitions of five jaathis and their recitation; 3. Adi Talam and its various forms; 4. Definitions and recitation of different gathis

**UNIT - 3**
1. Tisra Jaathi; 2. Khanda Jaathi; 3. Misra Jaathi; 4. Sankeerna Jaathi

**UNIT - 4**

1. Learning of Jathi Formation; 2. Basic jathis; 3. Jathis for Dance forms ; 4. Some Basic Definitions of Korvai, Teermanam etc.

**Reference Books:**


1. Mridangam- An Indian Classical Percussion Drum – Shreejayanthi Gopal
2. Theory and practice of Tabala – Sadanand Naimpally.
3. Theory and practice of Mridangam – Dharmala Rama Murthy
4. The Art of the Indian Tabala – Srdjan Beronja.


| B19PC2080 | Physics Lab-II | L | T | P | C |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **0** | **0** | **2** | **2** |

**Prerequisites:**

Knowledge of basics of physics.

**Course Objectives:**

1. Impart knowledge about various laws of thermodynamics through experiments
2. Familiarise with the concepts of thermal conductivity through experiments
3. Familiarise with various experiments in thermodynamics and mechanics Lab
4. Enable to understand physical constant through experiments

**Course Outcomes:**

On completion of the course, learners will be able to:

1. Verify various laws of thermodynamics through experiments
2. Analyse the concepts of thermal conductivity through experiments
3. Demonstrate the various experiments in thermodynamics and mechanics Lab
4. Determination of physical constant through experiments

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC2080 | **CO1** | **3** | **2** | **2** | | **1** | | | | **3** | **3** |
| | **CO2** | **3** | **2** | **2** | **1** | **1** | | | | **3** | **3** |
| | **CO3** | **2** | **2** | **2** | **2** | **2** | | | | **3** | **3** |
| | **CO4** | **3** | **2** | **2** | | **1** | | | | **3** | **3** |

**Course Contents:**

Any **Eight** of the Following Experiments

1. Verification of Gaussian distribution law and calculation of standard deviation –Monte Carlo experiment.
2. Specific heat of a liquid by cooling – graphical method.
3. Determination of thermal conductivity of a bad conductor by Lee-Charlton method.
4. Verification of Stefan – Boltzmann law by using Ohm's law.
5. Determination of boiling point of a liquid using platinum resistance thermometer.
6. Determination of moment of inertia of irregular body using Torsional pendulum.

7. Determination of rigidity modulus by the static torsion method.
8. Determination of Young's modulus by uniform bending method.
9. Spiral spring: Determination of the acceleration due to gravity (graphical method).
10. Determination of wavelength of a given LASER by diffraction method.

**Text books:**


1. Thiruvadigal, J. D., Ponnusamy, S.Sudha.D. and Krishnamohan M., "Physics for Technologists", Vibrant Publication, Chennai, 2013
2. R. K. Shukla and Anchal Srivastava, "Practical Physics", 1st Edition, New Age International (P) Ltd, New Delhi, 2006.


**Reference Books:**


1. G. L. Souires, "Practical Physics:", 4th Edition, Cambridge University, UK, 2001.
2. D. Chattopadhyay, P. C. Rakshit and B. Saha, "An Advanced Course in Practical Physics", 2nd ed., Books & Allied Ltd., Calcutta, 1990.
3. Advanced Practical Physics – B.L. Worshnop and H.T. Flint (KPH)


| B19PC2090 | Chemistry Lab-II | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **0** | **0** | **2** | **2** |

**Prerequisites:**

Knowledge of physical properties, functional groups, solubility chart, elements and chemical reactions,

**Course Objectives:**

1. Obtain skill of handling strong acids and reagents used for functional group anlysis.
2. Perform independently detection of elements, solubility of the compound, functional group analysis and preparation of suitable solid derivative.
3. Perform the distinguishing test between aldehyde and ketone using Schif's reagent.
4. Catogerize the nitrogen containing functional groups based on their response to diazotization and carbylamine tests.

**Course Outcomes:**

1. Acquire knowledge of steps involved in organic functional group analysis.
2. Test for elements such as sulfur, nitrogen and halogens using sodium fusion extract.
3. Determine the physical constants of both compound and its derivative using melting point apparatus.
4. Examine the solubility of the given organic compound using solubility chart, that will dierect to perfom functional group anlaysis.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC2090 | **CO1** | **2** | **2** | **3** | **2** | **1** | | **2** | **2** | **1** | **3** |
| | **CO2** | **3** | **3** | **3** | **3** | **1** | | **2** | **3** | **2** | **2** |
| | **CO3** | **3** | **2** | **2** | **3** | | | **2** | **2** | **3** | **2** |
| | **CO4** | **2** | **3** | **2** | **2** | **1** | | **2** | **3** | **2** | **2** |

**Course Contents:**

**Qualitative analysis of mono functional organic compounds**

1. Acids, 2. Alcohols, 3. Aldehydes, 4. Amide, 5. Amine, 6. Halogenated hydrocarbons, 7. Hydrocarbons, 8. Ketones, 9. Nitro compounds, 10. Phenols

**Reference Books for Practicals:**


1. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., *Textbook of Practical Organic Chemistry*, Prentice-Hall, 5th edition, 1996.
2. Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry* Orient-Longman, 1960.
3. Pandey, O.P., Bajpai D. N. & Giri S. *Practical Chemistry, Revised Edition*, (For BSc. I, II, III Year Students of All Indian Universities) S. Chand Company Pvt Limited, 2014.
4. Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry*, R. Chand & Co.: NewDelhi (2011).


| B19PC2X10 | Mathematics Lab-II | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **0** | **0** | **2** | **2** |

**Prerequisites:**

Definition and properties of groups, concept of polar and Cartesian form, formulas and knowledge about differentiation and partial derivatives.

**Course Objectives:**

1. Obtain skill in creating simple programs using *Scilab* and *Maxima*.
2. Acquire skill in tracing standard curves using *Maxima*.
3. Gain proficiency in using *Maxima* to solve problems on Differentiation and Euler's theorem and its extension.

**Course Outcomes:**

1. Acquire proficiency in using *Scilab* to find identity and inverse element of a group and in construction of Caley –Table.
2. Demonstrate the use of *Maxima* to understand and interpret the various types of functions from the algebraic and graphical points of view.
3. Sketch graphs of standard curves using *Maxima* to interpret tracing of curves.
4. Be familiar with the built-in functions to find derivatives of any order and solve application problems dealing with the concept of partial derivatives.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC2X10 | **CO1** | **3** | **2** | **2** | | **1** | | | | **3** | **3** |
| | **CO2** | **3** | **2** | **2** | **1** | **1** | | | | **3** | **3** |
| | **CO3** | **2** | **2** | **2** | **1** | **1** | | | | **3** | **3** |
| | **CO4** | **3** | **2** | **2** | | **1** | | | | **3** | **3** |

**Course Contents:**

1. Creating a *Scilab* program (Simple examples).
2. Creating a *Maxima* program (Simple examples).
3. Verifying whether given operator is binary or not.
4. To find identity and inverse element of a group.
5. Construction of Caley –Table.
6. Plotting of standard Cartesian curves using *Scilab* / *Maxima*.
7. Plotting of standard Cartesian curves using *Scilab* / *Maxima*.
8. Plotting of standard parametric curves using *Scilab* / *Maxima*.
9. Plotting of standard polar curves using *Scilab* / *Maxima*.
10. Obtain partial derivative of some standard function.
11. Verification of Euler's theorem and its extension.
12. Verification of Jacobians.

**Suggested Text Books and References:**


1. SCILAB: A Practical Introduction to Programming and Problem Solving [Print Replica] Kindle Edition by Tejas Sheth (Author).
2. The Maxima Book Paulo Ney de Souza Richard J. Fateman Joel Moses Cliff Yapp 19th September 2004.

# THIRD-SEMESTER

| B19PC3011 | Language: Kannada-III | L | T | P | C |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **1** | **0** | **3** |

**Prerequisites:**

PÀ£ÀßqÀ ¨sÁµÉAiÀÄ §UÉUÉ ¥ÁæxÀ«ÄPÀ w¼ÀÄªÀ½PÉ CUÀvÀå.
¨sÁµÉAiÀÄ£ÀÄß NzÀ®Ä ªÀÄvÀÄÛ §gÉAiÀÄ®Ä w½¢gÀ¨ÉÃPÀÄ.
¥ÀzÀ« ¥ÀÆªÀð ²PÀëtzÀ°è PÀ£ÀßqÀ ¨sÁµÉAiÀÄ£ÀÄß N¢gÀ¨ÉÃPÀÄ.

**Course Objectives:**

£Á®Ä¸É«Ä¸ÀÖgïUÀ¼À°è ¸ÀªÀÄUÀæ PÀ£ÀßqÀ ¸Á»vÀåªÀ£ÀÄß ¥ÀjZÀ¬Ä¸ÀÄªÀ GzÉÝÃ±ÀªÀ£ÀÄß ºÉÆA¢zÉ. CzÀgÀAvÉ ªÀÄÆgÀ£ÉAiÀÄ ¸É«Ä¸ÀÖgï£À°è ºÉÆ¸ÀUÀ£ÀßqÀ ¸Á»vÀå ¥ÀæPÁgÀUÀ¼ÁzÀ £ÀªÉÇÃzÀAiÀÄ, £ÀªÀå PÁªÀå, ¸ÀtÚPÀxÉUÀ¼ÀÄ ºÁUÀÄ £ÁlPÀ ¸Á»vÀåªÀ£ÀÄß ¥ÀoÀåªÀ£ÁßV DAiÉÄÌ ªÀiÁrPÉÆAqÀÄ, «zÁåyðUÀ¼À°è ¸Á»vÀåzÀ §UÉÎ ¸ÀzÀ©ügÀÄaAiÀÄ£ÀÄß ªÀÄÆr¸À¯ÁUÀÄvÀÛzÉ. ¸ÁA¸ÀløwPÀ w¼ÀÄªÀ½PÉAiÀÄ eÉÆvÉUÉ ªÀåQÛvÀé «PÀ¸À£ÀzÀ PÀqÉUÉ UÀªÀÄ£À ¤ÃqÀ¯ÁUÀÄvÀÛzÉ.

1. ¨sÁµÉ, ¸Á»vÀå, EwºÁ¸À ªÀÄvÀÄÛ ¸ÀA¸ÀløwUÀ¼À£ÀÄß PÀ£ÀßqÀ, PÀ£ÁðlPÀPÉÌ ¸ÀA§A¢ü¹zÀAvÉ ¥ÀjZÀ¬Ä¸À¯ÁUÀÄvÀÛzÉ.
2. «zÁåyðUÀ¼À ¸ÀªÀðvÉÆÃªÀÄÄR ¨É¼ÀªÀtÂUÉUÉ C£ÀÄªÁUÀÄªÀAvÉ ºÁUÀÆ CªÀgÀ°è ªÀiÁ£ÀªÀ ¸ÀA§AzsÀUÀ¼À §UÉÎ UËgÀªÀ, ¸ÀªÀiÁ£ÀvÉ ªÀÄÆr¹, ¨É¼É¸ÀÄªÀ ¤nÖ£À°è ¥ÀoÀåUÀ¼À DAiÉÄÌAiÀiÁVzÉ.
3. CªÀgÀ°è ¸ÀÈd£À²Ã®vÉ, ±ÀÄzÀÞ ¨sÁµÉ, GvÀÛªÀÄ «ªÀÄ±Áð UÀÄt, ¤gÀUÀð¼À ¸ÀA¨sÁµÀuÉ, ¨sÁµÀt PÀ¯É ºÁUÀÆ §gÀºÀ PË±À®åUÀ¼À£ÀÄß ¨É¼É¸ÀÄªÀåzÀÄ UÀÄjAiÀiÁVzÉ
4. ¸ÀàzsÁðvÀäPÀ ¥ÀjÃPÉëUÀ½UÉ C£ÀÄPÀÆ®ªÁUÀÄªÀAvÀºÀ «µÀAiÀÄUÀ¼À£ÀÄß UÀªÀÄ£ÀzÀ°èèlÄÖPÉÆAqÀÄ ¸ÀÆPÀÛ ¥ÀoÀåUÀ¼À£ÀÄß DAiÉÄÌ ªÀiÁrPÉÆ¼Àî¯ÁVzÉ.

**Course Outcomes:**

**ºÉÆ¸ÀUÀ£ÀßqÀ ¸Á»vÀå ¥ÀæPÁgÀUÀ¼ÁzÀ £ÀªÉÇÃzÀAiÀÄ, £ÀªÀå PÁªÀå, ¸ÀtÚPÀxÉUÀ¼ÀÄ ºÁUÀÄ £ÁlPÀ ¸Á»vÀå PÀ°PÉAiÀÄ ªÀÄÆ®PÀ PÁ®zÀ ¹ÜvÀåAvÀgÀUÀ¼À£ÀÄß CzÀgÀ M¼À£ÉÆÃl UÀ¼À£ÀÄß ¨É¼É¸ÀÄvÀÛzÉ.**

1. ¸ÁªÀiÁfPÀ, gÁdQÃAiÀÄ, zsÁ«ÄðPÀ, ¸ÁA¸ÀløwPÀ ºÁUÀÆ °AUÀ¸ÀA§A¢ü «ZÁgÀUÀ¼ÉqÉ UÀªÀÄ£ÀºÀj¸ÀÄªÀÅzÀgÉÆA¢UÉ «zÁåyðUÀ¼À°è ZÀZÁð ªÀÄ£ÉÆÃ¨sÁªÀªÀÅ ¨É¼ÉAiÀÄÄvÀÛzÉ.
2. fÃªÀ£ÀzÀ°è §gÀÄªÀ C©ü¥ÁæAiÀÄ ¨ÉÃzsÀUÀ¼ÀÄ, ¸ÀªÀÄ¸ÉåUÀ¼À£ÀÄß DzsÀĤPÀ ¸ÀAzÀ¨sÀðzÀ°è ªÀiÁ£À«ÃAiÀÄvÉAiÉÆA¢UÉ ¤ªÀð»¸ÀÄªÀAvÉ ¥ÉæÃgÉÃ¦¸ÀÄvÀÛzÉ.
3. ¸ÁªÀiÁfPÀ CjªÀÅ ªÀÄÆr¸ÀÄvÀÛzÉ
4. GvÀÛªÀÄ ¸ÀAªÀºÀ£À PÀ¯ÉAiÀÄ£ÀÄß ¨É¼É¸ÀÄªÀ GzÉÝÃ±ÀªÀ£ÀÄß FqÉÃj¸ÀÄvÀÛzÉ.

## Mapping of Course Outcomes with programme Outcomes

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC3011 | CO1 | | | | | 2 | 3 | | | | |
| | CO2 | | | | | 2 | 3 | | | | |
| | CO3 | | | | | | 3 | | | | |
| | CO4 | | | | | | | 3 | 2 | | |

**Course Contents:**

**Unit** I **£ÀªÉÇÃzÀAiÀÄ PÀ«vÉUÀ¼ÀÄ** **12 Hours**

1. ªÀÄÄ¢AiÀÄ gÁªÀÄUËqÀ ©. JA. ²æÃ
2. ¨É¼ÀUÀÄ zÀ.gÁ. ¨ÉÃAzÉæ
3. PÀ°Ì PÀÄªÉA¥ÀÄ
4. PÀ£Àßqï ¥ÀzÀUÉÆ¼ï f. ¦. gÁdgÀvÀßA

**Unit** II **£ÀªÉÇÃzÀAiÀÄ ºÁUÀÄ £ÀªÀå PÀ«vÉUÀ¼ÀÄ** **12 Hours**

1. CªÀzsÀÆvÀ ¸ÀÄ.gÀA.JPÀÄÌAr
2. ªÀÄ£É¬ÄAzÀ ªÀÄ£ÉUÉ PÉ.J¸ï.£À
3. £À£Àß ºÀtvÉ f.J¸ï.J¸ï.
4. £ÀA©PÉ ZÀ£Àß«ÃgÀ PÀt«

**Unit** III **¸ÀtÚ PÀxÉUÀ¼ÀÄ** **12 Hours**

1. ªÀÄÄzÀÝt ªÀÄ£ÉÆÃgÀªÉÄ ¸À¯Áè¥À ªÀÄÄzÀÝt
2. zÁ½ £ÀqÉzÁªÀ CuÁÚ CªÀÄgÉÃ±À £ÀÄUÀqÉÆÃtÂ
3. PÉÆ£ÉAiÀÄ VgÁQ ¤gÀAd£À
4. ªÀiÁ¤Ãlgï vÉÃd¹é

**Unit IV** **£ÁlPÀ** **12 Hours**

«ÄÃrAiÀiÁ C£ÀÄªÁzÀ.: PÉ. ªÀÄgÀÄ¼À ¹zÀÞ¥Àà

**Suggested Text Books and References:**


1. ªÀÄÄUÀ½ gÀA.²æÃ., PÀ£ÀßqÀ ¸Á»vÀå ZÀjvÉæ, ¥ÀæPÁ±ÀPÀgÀÄ VÃvÁ §ÄPï ºË¸ï, ªÉÄÊ¸ÀÆgÀÄ. 2014
2. ¹ÃªÀiÁwÃvÀ PÀ£ÀßqÀ ¸Á»vÀå ZÀjvÉæ ¸ÀA¥ÀÄl 1,2,3,4,5 ªÀÄvÀÄÛ 6, PÀÄªÉA¥ÀÄ PÀ£ÀßqÀ CzsÀåAiÀÄ£À ¸ÀA¸ÉÜ, ªÉÄÊ¸ÀÆgÀÄ «±Àé«zÁå¤®AiÀÄ, ªÉÄÊ¸ÀÆgÀÄ. 2014
3. qÁ. CgÀ«AzÀ ªÀiÁ®UÀwÛ, ¸Á»vÀå ¸ÀA¸Àløw ªÀÄvÀÄÛ zÀ°vÀ ¥ÀæeÉÕ, ¥ÀæPÁ±ÀPÀgÀÄ PÀ£ÀßqÀ ¸Á»vÀå ¥ÀjµÀvÀÄÛ, ¨ÉAUÀ¼ÀÆgÀÄ. 2014
4. qÁ. F.J¸ï. DªÀÄÆgÀ, PÀ£ÀßqÀ PÀxÀ£À ¸Á»vÀå : PÁzÀA§j, ¥ÀæPÁ±ÀPÀgÀÄ ¸Àé¥Àß §ÄPï ºË¸ï, ¨ÉAUÀ¼ÀÆgÀÄ. 2016
5. QÃvÀð£ÁxÀ PÀÄvÀðPÉÆÃn, PÀ£ÀßqÀ ¸Á»vÀå ¸ÀAUÁw, ¥ÀæPÁ±ÀPÀgÀÄ PÀÄvÀðPÉÆÃn ªÉÄªÉÆÃjAiÀÄ¯ï læ¸ïÖ, zsÁgÀªÁqÀ. 2009
6. ¸ÀA. ©.J¸ï. PÉÃ±ÀªÀgÁªï. PÉÊ¯Á¸ÀA PÀ£ÀßqÀ £ÁlPÀUÀ¼ÀÄ, ¥ÀæPÁ±ÀPÀgÀÄ CAQvÀ ¥ÀÄ¸ÀÛPÀ, ¨ÉAUÀ¼ÀÆgÀÄ. 2005
7. ±ÁªÀÄgÁAiÀÄ vÀ.¸ÀÄ., PÀ£ÀßqÀ ¸Á»vÀå ZÀjvÉæ, ¥ÀæPÁ±ÀPÀgÀÄ vÀ¼ÀÄQ£À ªÉAPÀtÚAiÀÄå ¸ÁägÀPÀ UÀæAxÀªÀiÁ¯É, ªÉÄÊ¸ÀÆgÀÄ -2014

8. DzsÀÄ¤PÀ PÀ£ÀßqÀ PÁªÀå ¨sÁUÀ-2, PÀÄªÉA¥ÀÄ PÀ£ÀßqÀ CzsÀåAiÀÄ£À ¸ÀA¸ÉÜ, ªÉÄÊ¸ÀÆgÀÄ «±Àé«zÁå¤®AiÀÄ, ªÉÄÊ¸ÀÆgÀÄ. 2004
9. ²ªÀgÀÄzÀæ¥Àà f.J¸ï. PÀ£ÀßqÀ ¸Á»vÀå ¸À«ÄÃPÉë, ¥ÀæPÁ±ÀPÀgÀÄ ¸Àé¥Àß §ÄPï ºË¸ï, ¨ÉAUÀ¼ÀÆgÀÄ. 2013

| B19PC3012 | **Language – II: Hindi** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **1** | **0** | **3** |

**Prerequisites:**

- अध्येता को, हिन्दी नाटक साहित्य का संक्षिप्त ज्ञान आवश्यक है |
- हिन्दी साहित्य के इतिहास का संक्षिप्त ज्ञान की आवश्यकता है |
- हिन्दी व्याकरण का अवबोधन आवश्यक है |
- मीडिया लेखन की बुनियादी जानकारी चाहिए |
- अंग्रेज़ी – हिन्दी अनुवाद से संबंधित जानकारी जरुरी है|

**Course Objectives:**

1. संदर्भानुसार उचित भाषा का प्रयोग करने की दक्षता को छात्रों में उत्पन्न करना|
2. साहित्य के माध्यम से समाज एवं मानवीय मूल्यों को समझाकर, उन मूल्यों की रक्षा हेतु प्रेरित करना|
3. छात्रों में पुस्तक पठन एवं लेखन की अकृतिम प्रवृत्ति स्थापित करना|
4. अध्येताओं में साहित्य के माध्यम से प्रभावी एवं कुशल संचार का विकास करना|

**Course Outcomes:**

अध्ययन की समाप्ति पर अध्येता –

1. सामाजिक मूल्य एवं नैतिक जवाबदेही को स्वीकार कर सकता है|
2. साहित्य की प्रासंगिकता को जीवन में समझने की दक्षता रखता है|
3. समाज में अंतर्निहित पद्दतियाँ एवं विचारधाराओं का व्याख्यान करने में सक्षम बन सकता है|
4. साहित्य के माध्यम से प्रभावी एवं कुशल संचार का विकास कर सकता है|

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **B19PC3012** | **CO1** | | | | | **2** | **3** | **2** | | | |
| | **CO2** | | | | | **2** | **2** | **3** | | | |
| | **CO3** | | | | | **3** | **3** | **3** | | | |
| | **CO4** | | | | | **3** | **2** | **3** | | | |

**Course Contents:**

**इकाई – 1:** नाटक : एक और द्रोणाचार्य – डॉ. शंकर शेष **12 hrs.**

लेखक परिचय
प्रथम दृश्य
द्वितीय दृश्य

**इकाई – 2:** नाटक : एक और द्रोणाचार्य **12 hrs.**
तृतीय दृश्य
चतुर्थ दृश्य

**इका ई – 3:** नाटक : एक और द्रोणाचार्य **12 hrs.**
पंचम दृश्य
छठा दृश्य

**इकाई – 4:** अनुवाद, जनसंचार माध्यम **12 hrs.**

**अनुवाद :** अंग्रेजी - हिन्दी ( समाचार पत्र से संबंधित )
**जनसंचार माध्यम :** स्वरुप, उद्भव और विकास |

**सन्दर्भ ग्रन्थ :**


1. एक और द्रोणाचार्य – डॉ. शंकर शेष
2. मीडिया लेखन एवं जनसंचार – डॉ.संजीव कुमार
3. हिन्दी साहित्य का इतिहास - डॉ. नागेन्द्र
4. आधुनिक हिन्दी साहित्य का इतिहास - डॉ. बच्चन सिंह
5. हिन्दी साहित्य का नवीन इतिहास - डॉ. लाल साहब सिंह
6. शुद्ध हिन्दी कैसे बोले कैसे लिखे- पृथ्वीनाथ पाण्डे
7. कार्यालय अनुवाद निदेशिका
8. मीडिया विमर्श – रामशरण जोशी
9. संस्कृति, जनसंचार और बाजार – नन्द भरद्वाज


| B19PC3013 | **Language-II: Additional English** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **1** | **0** | **3** |

**Prerequisites:**

Knowledge of intermediate English Grammar and LSRW skills.

**Course Objectives:**

1. To ensure the development of the linguistic prowess of the students
2. To motivate the students to appreciate literature
3. To help students build strong language fundamentals
4. To promote an appreciable reading habit among the students

**Course Outcomes:**

On completion of the course, learners will be able to:

1. Demonstrate a thorough understanding of sensitive and critical social issues.
2. Develop reading skills and vocabulary range
3. Critically analyse a piece of prose or poetry
4. Express their opinion in a coherent and communicable manner

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC3013 | CO1 | | | | | 3 | 3 | 3 | 2 | | |
| | CO2 | | | | | 3 | 3 | 3 | 3 | | |
| | CO3 | | | | | 3 | 3 | 3 | 2 | | |
| | CO4 | | | | | 3 | 3 | 3 | 2 | | |

**Course Contents:**

**UNIT-I: Gender & Identity** **12hrs**

Anne Sexton – Consorting with Angels; Eugene Field – The Doll's Wooing; Suniti Namjoshi – Extracts from *Feminist Fables*; Ruth Vanita & Saleem Kidwai (ed) – *Same Sex Love in India* (Extract); Charlotte Perkins Gilman – The Yellow Wallpaper

**UNIT-II: Love & Romance** **12hrs**

Alfred Noyes – The Highway Man; William Shakespeare – Sonnet 116; Frank Richard Stockton – The Lady or the Tiger?; Oscar Wilde – The Nightingale and the Rose; William Shakespeare – *Excerpt from Romeo and Juliet* (Balcony Scene)

**UNIT-III: War & Trauma** **12hrs**

Lord Alfred Tennyson – The Charge of the Light Brigade; Taufiq Rafat – The Medal; Guy de Maupassant – Two Friends; Sadaat Hasan Manto – Toba Tek Singh; Bertolt Brecht – Excerpt from *Fear and Misery of the Third Reich*

**UNIT-IV: Children's Literature** **12hrs**

William Wordsworth – Three Years She Grew in Sun and Shower; D.H. Lawrence – Discord in Childhood; Hans Christian Anderson – The Snow Queen; Anna Sewell – *The Black Beauty* (Extract); Rudyard Kipling – *The Jungle Book* (Extract)

**Reference Books**:


1. Sexton, Anne. *The Complete Poems*. Houghton Mifflin, 1999.
2. Namjoshi, Suniti. *Feminist Fables*. Spinifex Press, 1998.
3. Vanita, Ruth &Saleem Kidwai (ed.) *Same Sex Love in India*. Penguin India, 2008.
4. Gilman, Charlotte Perkins. *The Yellow Wallpaper*. Rockland Press, 2017.
5. Gale, Cengage Learning. *A Study Guide for Alfred Noyes's "The Highwayman".* Gale, Study Guides, 2017. (Kindle Edition Available)
6. Shakespeare, William. *Poems and Sonnets of William Shakespeare*. Cosimo Classics, 2007.
7. Stockton, Frank Richard. *The Lady, or the Tiger?* Create space Independent Publications, 2017.
8. Wilde, Oscar. *The Collected Works of Oscar Wilde*. Wordsworth Editions Ltd., 1997.
9. Shakespeare, William. *Romeo and Juliet*. Rupa, 2001.
10. Tennyson, Lord Alfred. *The Complete Works of Alfred Tennyson*. Forgotten Books, 2017.
11. Owen, Wilfred. *The Poems of Wilfred Owen*. Wordsworth Editions Ltd., 1994.
12. Maupassant, Guy de. *Guy de Maupassant-The Complete Short Stories*. Projapati, 2015.

13. Manto, Sadaat Hasan. *Manto: Selected Short Stories*. RHI, 2012.
14. Brecht, Bertolt. *Fear and Misery in the Third Reich*. Methuen Drama, 2012.
15. Ricks, Christopher. *Metaphysical Poetry*. Penguin, 2006.
16. Anderson, Hans Christian. *Fairy Tales by Hans Christian Anderson*. Read Books, 2010.
17. Sewell, Anna. *The Black Beauty*. Maple Press, 2014.
18. Kipling, Rudyard. *The Jungle Book*. Amazing Reads, 2018.

| B19PC3020 | **Communicative English-I** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **1** | **0** | **3** |

**Prerequisites:**

Knowledge of intermediate English Grammar and LSRW skills.

**Course Objectives:**

1. To attune young minds to concerns and issues which have a broad and wide scope of use and application to life.
2. To acquire a functional use of language in context.
3. To equip students to deliver formal and informal oral presentations to a variety of audiences in multiple contexts.
4. To enable students to construct effective written message in various formats and styles.
5. To inculcate the habit of reading and writing leading to effective and efficient communication.

**Course Outcomes:**

After the completion of the course, students will be able to

1. Demonstrate ethical and political responsibilities in taking cognizance of issues relating to society, environment and media.
2. Develop a process-oriented approach to writing.
3. Make use of grammatical skills developed during the course aptly.
4. Utilize the target language effectively to focus on interpersonal skills and develop a good Command over the language.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **B19PC3020** | **CO1** | | | | | **3** | **3** | **3** | **2** | | |
| | **CO2** | | | | | **3** | **3** | **3** | **3** | | |
| | **CO3** | | | | | **3** | **3** | **3** | **2** | | |
| | **CO4** | | | | | **3** | **3** | **3** | **2** | | |

**Course Contents:**

**UNIT – I:** **12Hrs**

**Remedial Grammar:** Past Simple; Past Continuous; Irregular Verbs**; Writing Skills:** Paragraph Writing**; Activities:** Conversations; Leaving Phone Messages **Literature:** Chief Seattle – The End of Leaving and Beginning of Survival

**UNIT – II: 12Hrs**

**Remedial Grammar:** Present Simple & Present Continuous; Activity & State Verbs**; Writing Skills:** Official Letters**; Activities:** Making Apologies; Invitations & Making Arrangements**; Literature:** Ruskin Bond – Tiger in the Tunnel

**UNIT – III: 12Hrs**

**Remedial Grammar:** Present Perfect; For, Since & How Long; -ed& -ing adjectives; Prefix & Opposites of Adjectives**; Writing Skills:** Note Making**; Activities:** Agreeing & Disagreeing with Opinions**; Literature:** Jesse Owens - My Greatest Olympic Prize.

**UNIT – IV: 12Hrs**

**Remedial Grammar:** Collocations; Prepositions**; Writing Skills:** Precis Writing**; Activities:** Offers, Suggestions & Requests**; Literature:** Avijit Pathak – Onscreen Magic

**Reference Books**:


1. Green, David. *Contemporary English Grammar Structures and Composition*. New Delhi: MacMillan Publishers, 2010.
2. Thorpe, Edgar and Showick Thorpe. *Basic Vocabulary*. Pearson Education India, 2012.
3. Leech, Geoffrey and Jan Svartvik. *A Communicative Grammar of English*. Longman, 2003.
4. Murphy, Raymond. *Murphy's English Grammar with CD*. Cambridge University Press, 2004.
5. Rizvi, M. Ashraf. *Effective Technical Communication*. New Delhi: Tata McGraw-Hill, 2005.
6. Riordan, Daniel. Technical Communication. New Delhi: Cengage Publications, 2011.
7. Sen et al. Communication and Language Skills. Cambridge University Press, 2015.


| B19PC3030 | **Waves and Optics** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **1** | **0** | **3** |

**Prerequisites:**

This is introductory physics course which covers topics in simple harmonic motion waves, basic theory of light, optics, optical instruments and optical phenomenon like diffraction, interference and polarization.

**Course Objectives:**

1. To understand progressive and simple harmonic wave motions and the mathematical equations that govern them.
2. To understand superposition of simple harmonic wave motions and the phenomenon related to them.
3. To study the theory of light and the basic design principles of optical instruments.
4. To analyse and explain interference, diffraction and polarization of light.

**Course Outcomes:**

On completion of this course the student will be able to

1. Explain the phenomenon related to simple harmonic motion waves.
2. Explain the laws of reflection and refraction based on Huygen's principle.
3. Describe the working of optical instruments based on different types of lens.
4. Differentiate between interference, diffraction and polarization.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC3030 | CO1 | 3 | 3 | 3 | 3 | | | 1 | 2 | 3 | 3 |
| | CO2 | 3 | 3 | 3 | 3 | | | 2 | 2 | 3 | 3 |
| | CO3 | 3 | 2 | 2 | 2 | | | 2 | 2 | 3 | 3 |
| | CO4 | 3 | 3 | 2 | 2 | | | 2 | 2 | 3 | 3 |

**Course Contents:**

**UNIT-I** **12 hours**

**Waves**

Waves in one dimension. Differential equation of wave motion. Relation between amplitude and intensity. Expression for velocity of progressive waves in a medium. Newton's formula, Laplace's correction. Longitudinal vibrations in a rod. Expression for frequency of vibration of a stretched string-harmonics. Kundt's tube experiment

**Superposition of simple harmonic motions**: Lissajou's figures, Equation for damped vibrations, Forced vibration, Solution in exponential form.

**Resonance:** Expression for amplitude and phase at resonance.

**UNIT-II** **12 hours**

**Theory of light:** Huygen's principle. Explanation of the laws of reflection and refraction. Lens formula.

**Optics:** Kerr effect. Determination of velocity of light by Kerr cell method, Defects of lenses.

**Optical Instruments:** Achromatic combinations of lenses. Huygen's and Ramsden's eye pieces. Resolving and magnifying power of the telescope and microscope (qualitative treatment only).

**UNIT-III** **12 hours**

**Interference:** Theory of interference. Expression for fringe width. Coherent sources. Interference by division of wave front and division of amplitude. Fresnel's biprism. Lloyd's mirror. Thin films of uniform thickness. Newton's rings. Interference at a wedge. Michelson's interferometer - Measurement of $\lambda$ and $d\lambda$.

**Diffraction:** Fresnel and Fraunhofer diffraction. Explanation of rectilinear propagation of light. Theory of the zone plate. Comparison with a convex lens. Fresnel diffraction at a straight edge. Fraunhofer diffraction at a single slit. Transmission grating-theory for the case of normal incidence.

**UNIT-IV** **12 hours**

**Polarization:** Double refraction in uniaxial crystals. Huygen's theory. Positive and negative crystal. Principal refractive indices. Huygen's constructions of O and E wave fronts in a uniaxial crystal. Retarding plates. Production and analysis of linearly. Circularly and elliptically polarized light. Optical activity, Fresnel's theory, Rotatory polarization. Use of bi quartz. Applications of Polaroid's. Construction and working of Polarimetry, Specific rotation.

**Suggested Text Books:**


1. Halliday and Resnick: Fundamentals of Physics, 9th edition, Wiley India, 2011.
2. R. H. Dittaman and M. W. Zemansky: Heat and Thermodynamics, 7th edition, The McGraw-Hill companies, 2007.
3. S. J. Blundell and K. M. Blundell: Concepts in Thermal Physics, 2nd edition, Oxford University Press, 2006.
4. Brijlal, N. Subramanyam P.S. Hemne: Heat Thermodynamics and Statistical Physics, 1st edition. S Chand Publishing, 2007.
5. S C Gupta: Thermodynamics, 1st edition, Pearson, 2005.
6. Satya Prakash: Optics and Atomic Physics, 11th, Ratan Prakashan Mandir, 1994.
7. C. L. Arora: Refresher Course in Physics Vol I, S Chand publishing, 2011.
8. S. R. Shankara Narayana: Heat and Thermodynamics, 2nd edition, Sulthan Chand and Sons, 1990.


| B19PC3040 | Chemistry –III | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **1** | **0** | **3** |

**Prerequisites:**

Knowledge of chemical bonding, periodic table, stereochemistry, thermodynamics.

**Course Objectives:**

1. Conclude the different bonding like metallic, hydrogen and certain nature of bonding in metal carbonyls, Boron Carbon Nitrogen Sulphur and halogens.
2. Defend the following topics Alkyl halides, aryl halides, alcohols, nomenclature and reactions. Stereochemistry and Conformational analysis of acyclic alkane system.
3. Analysis of Ostwald's dilution law, Activity and activity coefficients, Mean ionic activity coefficients.
4. Develop the practical skills to understand the theory of strong electrolytes, Debye-Huckel-Onsagar equation, Debye-Huckel Limiting equation for activity coefficients.

**Course Outcomes:**

Upon successful completion of this course, students will be able to:

1. Illustrate the nature of bonding in metal carbonyls, boron, halogens and its properties, identify different functional groups.
2. Understand the nomenclature, different reactions and its mechanism of various named reactions.
3. Analyze different stereochemical conformations of acyclic alkane system. Derive various equations like Debye-Huckel theory of strong electrolytes.
4. Conclude the limitations and advantages of Debye-Huckel-Onsager equation, Debye-Huckel Limiting equation.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC3040 | CO1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| | CO2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| | CO3 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| | CO4 | 2 | 1 | 1 | 2 | 1 | 2 | 2 | 1 | 1 | 2 |

**Course Contents:**

**Unit-I:** **12 Hrs**

**Metallic bond:** Definition, factors favouring the formation of metallic bond, Band theory, explanation of electrical conductance of metals, semiconductors (n- and p-type), Insulators and Superconductors (Explanation and applications with suitable examples). **Hydrogen bonding:** Types of hydrogen bonding, conditions for the formation of H-bond. Hydrogen bonding in HF, $H_2O$, $NH_3$.
**Metal carbonyls:** Definition, classification with examples, nature of M-CO bonding in carbonyls.
**Chemistry of Non-Metals:**
**Boron:** Boron hydrates – diborane, preparation, structure and uses.
**Carbon:** Fullerenes – production, structure of $C_{60}$ and $C_{70.}$ Diamond, graphite – properties and structure.
**Silicon:** Structure of silica. Silicates – types and structure with one example for each type.
**Nitrogen:** Preparation, properties, structure and applications of hydrazine, hydroxyl amine.
**Sulphur:** Preparation, properties, structures and applications of thionyl chloride, sulphuryl chloride.
**Halogens:** Bleaching powder – preparation, properties and structure.
**Pseudo halogens:** Preparation, properties and structure of cyanogen and thiocyanogen (any one method of preparation and any three properties to be discussed.

**Unit-II:** **12 Hrs**

**Alcohols:** Definition and classification, oxidation reaction ($CrO_{3,}$ Jones reagent, PCC) reduction reaction ($LiAlH_4$)
**Phenols:** Definition, classification with examples, acidity of phenols, effect of substituents on acidity of phenols. Mechanism of Reimer-Tiemann reaction and Kolbe reaction.
**Alkyl halides**: Isomerism and classification, nomenclature. Substitution reaction-$S_N1$, $S_N2$, with mechanism. Effect of substrate and nucleophiles. Nature of leaving group.
Relative reactivity of alkyl, allyl, vinyl and aryl halides towards nucleophilic substitution reactions.

**Stereochemistry II**- Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Configuration: Geometrical E/Z Nomenclature and Optical isomerism; Concept of chirality (up to two carbon atoms). Racemic mixture, racemisation and resolution. Threo and erythro; D and L; CIP Rules: R/S (for up to 2 chiral carbon atoms) atropisomerism. (up to two C=C systems). Geometrical isomerism in alicyclic compounds.

**Unit-III:** **12 Hrs**

**Ionic equilibria:** Ionic equilibria in aqueous solutions, strong and weak electrolytes – definition and examples. Ostwald's dilution law (to be derived) and its limitations (numerical problems). Activity

and activity coefficients – definition and their relation. Mean ionic activity coefficients – ionic strength –determination and its calculation. Debye-Huckel theory of strong electrolytes (relaxation time effect, electrophoretic effect and viscous effect). Debye-Huckel-Onsagar equation (no derivation), Debye-Huckel limiting equation for activity coefficients (no derivation). Solvent system concept of acids and bases. Role of solvents in altering strengths of acids and bases. Hydrolysis of salts – derivation of hydrolysis constant and degree of hydrolysis of the salt of weak acid and weak base (ammonium acetate), effect of temperature on degree of hydrolysis.

**Distribution Law:** Nernst distribution law in liquid-liquid systems, distribution coefficient, statement of Nernst distribution law – verification of distribution law taking distribution of $I_2$ in $H_2O$ and $CCl_4$ –limitations of the law, conditions for the validity of distribution law, association of the solute in one of the solvents, dissociation of the solute in one of the solvents, application of distribution law with respect to solvent extraction process (numerical problems)**.**

**Unit-IV: 12 Hrs**

**Basic Thermodynamics:** Definition of thermodynamic terms: system, surrounding etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Concept of heat and work. Zeroth Law of thermodynamics, First law of thermodynamics: statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law – Joule – Thomson coefficient for ideal gas and real gas: and inversion temperature. Calculation of w. q. dU&dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process, Temperature dependence of enthalpy, Kirchhoff's equation. Bond energies and applications of bond energies.

**Indicator** – Definitions, types (acid-base, redox, adsorption indicators), examples for each type. Theory of indicators – Oswald's theory and Quinonoid theory – indicator constant – action of phenolphthalein and methyl orange in acid-base solutions – pH titration curves for strong acid vs strong base, weak acid vs strong base, weak base vs strong acid, choice of indicators in these types of titrations – colour change and pH range. Mathematical expression for Freundlich's and Langmuir's adsorption isotherms. Applications of adsorption.

**Adsorption:** Introduction, principle involved. Sorption, absorption and adsorption (statement, differences and examples) physical and chemical adsorption – definition and differences. Adsorption of gases on solids – factors which influence. Adsorption isotherms.

**Suggested Text Books:**


1. Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.
2. Bahl, A. & Bahl, B.S. Advanced Physical Chemistry, S. Chand, 2010.
3. J. N. Gurtu and Aayushi Gurtu, Undergraduate Physical Chemistry, Vol I, Vol II and Vol III Pragati Prakashan.
4. Principles of Inorganic Chemistry by Puri, Sharma, Kalia


**Reference Books:**


1. Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).
2. Finar, I.L. Organic Chemistry (Vol. I & II), E.L.B.S.
3. Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.
4. Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning India Pvt. Ltd., New Delhi (2009).

5. Mahan, B.H. University Chemistry 3rd Ed. Narosa (1998).
6. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
7. Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd ed., Wiley.

| B19PC3050 | Mathematics-III | L | T | P | C |
|---|---|---|---|---|---|
| Duration: 14 Wks | | 2 | 1 | 0 | 3 |

**Prerequisites:**

Differentiation, integration, basic concepts of differential equations, basic arithmetic and algebra.

**Course Objectives:**

1. Develop the knowledge about the subgroups and group homomorphisms.
2. Familiarize with the concept of higher order ordinary differential equations.
3. Understand the concept of Laplace transform.
4. Familiarize with Inverse Laplace transforms.

**Course Outcomes:**

1. Classify and generate subgroups and normal subgroups.
2. Solve higher order linear differential equations.
3. Apply the knowledge of Laplace transform.
4. Discuss inverse Laplace transforms.

**Mapping of Course Outcomes with Programme Outcomes**

| Course Code | POs/ COs | PO1 | P02 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC3050 | CO1 | 3 | 3 | 3 | 3 | | | 1 | 2 | 3 | 3 |
| | CO2 | 3 | 3 | 3 | 3 | | | 1 | 2 | 3 | 3 |
| | CO3 | 3 | 2 | 2 | 2 | | | 2 | 2 | 3 | 3 |
| | CO4 | 3 | 2 | 2 | 2 | | | 2 | 2 | 3 | 3 |

**Course Content:**

**Unit-I: Group Theory-2** **12 Hrs**

Subgroups-Theorems on subgroups (**with proof**), problems Normal subgroups, Homomorphism, Isomorphism, Left and Right cosets, The kernal of a homomorphism.

**Unit-II: Differential Equations-2** **12 Hrs**

Higher order linear differential equations, Solution of homogeneous linear differential equations of order *n* with constant coefficients, Solution of the non-homogeneous linear differential equations with constant coefficients by means of polynomial operators, Method of undetermined coefficients, Method of variation of parameters, Linear differential equations with non-constant coefficients, Cauchy-Euler equation, System of linear differential equations, Solution of a system of linear equations with constant coefficients.

**Unit-III: Laplace Transforms** **12 Hrs**

Definition and basic propertiesof Laplace transform of some common functions and standard results, Laplace transform of periodic functions, Laplace transforms ofderivatives and the integral of

functions, Laplace transforms of the Heaviside/Unit step function, Convolution theorem (with proof)and problems.

**Unit-IV: Inverse Laplace Transforms** **12 Hrs**

Inverse Laplace transforms, Properties of inverse Laplace transform, Solution of differential equations using Laplace transforms, Convolution theorem, Solution of differential equations using Laplace transforms.

**Text Books:**


1) John B Fraleigh, The first course in Abstract Algebra, Narosa Publishing House.
2) I N Herstein, Topics in algebra, Wiley easter.
3) G K Ranganath, Text book of B.Sc., Mathematics, Revised ed. New Delhi, India: S Chand and Co., 2011.
4) Raisinghania M D., Laplace and Fourier Transforms. New Delhi, India: S. Chand and Co. Ltd., 1995.


**Reference Books:**


1) S Narayanan and T K ManicavachogamPillay, Differential Equations, S V Publishers Private Ltd., 1981.
2) Erwin Kreyszig, Advanced Engineering Mathematics, 8th ed. New Delhi, India: Wiley India Pvt. Ltd., 2010.
3) Murray R, Spiegel L: Laplace Transforms (Schaum Series).


| B19PC3060 | **Physics in Everyday Life** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **4** | **0** | **0** | **4** |

**Prerequisites:**

Basics of Physics and its importance in everyday life.

**Course Objectives:**

1. To have a clear understanding of the working and principles of home appliances
2. To understand phenomena of light and its application
3. To know the formation of clouds and cyclic process.
4. To implement and understand properties of smart materials for their application in various places.

**Course Outcomes:**

On successful completion of this course, the student is expected to be able to:

1. Postulate the basics of principles and working of electrical devices in our daily life
2. Explain the physical phenomena of sensors and electronic components
3. Analyse the formation of clouds and cyclic process
4. Compresence the properties of smart materials

**Mapping of Course Outcomes with programme Outcomes**

| **Course Code** | **POs/ COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC3060 | **CO1** | **3** | **3** | **3** | **3** | | | **1** | **2** | **3** | **3** |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **CO2** | **3** | **3** | **3** | **3** | | | **2** | **2** | **3** | **3** |
| | **CO3** | **3** | **2** | **2** | **2** | | | **2** | **2** | **3** | **3** |
| | **CO4** | **3** | **3** | **2** | **2** | | | **2** | **2** | **3** | **3** |

**Course Contents:**

**UNIT-I: Gadgets in Daily Life** **12 hrs**

Principle of levers, Frictional force, Electric fans, motors and bulbs, Washing Machines, Kitchen Electronics, Microwave, Dishwasher, Induction Stoves, Smart Refrigerators, Smart alarms, Smart elevator, Smart floor, Smart locks, batteries. working principle of Microphone, Loud speaker, AM and FM receiver and radio, Basics of Smart phones and Digital Cameras

**UNIT-II: Applications of Electromagnetic Waves** **12 hrs**

Introduction to Electromagnetic waves and applications, Scattering of light in atmosphere, LASER and application, Hologram and 3D pictures, Optical fibres and communication system, RADAR & navigation and its applications, Display systems: CRT, LCD, LED and Photodiode, Mobile communication.

**UNIT-III: Atmosphere** **12 hrs**

**Clouds:** Introduction, Atmospheric thermodynamics, Vapor pressure, Formation of Cloud droplets, Lightning, electrical properties of the fair, weather atmosphere, electrical properties of a thunderstorm, Benjamin Franklin's famous kite experiment, cloud-to-ground lightning, Intra-cloud lightning, other forms of lightning, thunder, lightning rods, lightning safety.

**UNIT-IV: Advanced Materials** **12 hrs**

Super conductors, Semiconducting materials, physical principles of optical materials (Polaroids, goggles), dielectrics, piezoelectric, ferroelectric, pyroelectric, magnetic materials and their applications, Motion Sensors, Thermal Sensors and Image Sensors, and Water Level Sensors.

**Recommended Books:**


1. Thomas L Floyd "Electronic Devices" 10th Edition Pearson Education Asia 2018.
2. Jordan Frith, “Smartphones as Locative Media ", Wiley. 2014
3. M. I. Skolnik ―Introduction to Radar Systems, Tata McGraw Hill 2006.
4. A Short Course in Cloud Physics; R. R. Rogers
5. The Physics of Clouds; B. J. Mason
6. Dennis C Brewer, " Home Automation", Que Publishing 2013
7. T. Pratt, C. Bostian and J. Allnutt; ―Satellite Communications, John Wiley and Sons, Second Edition., 2003
8. S.P Basavaraju- Engineering Physics -2016.


| B19PC3070 | Chemistry in daily life | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **4** | **0** | **0** | **4** |

**Prerequisites:**

Basic knowledge of physics, chemistry and biology. Ores and minerls, milk products, oils and fats.

**Course Objectives:**

1. Introduce the concept and discipline of chemistry in our daily life.

2. Acquire the knowledge of composition of milk products, beverages, additives, contaminants, flavouring agents used in day to day life.
3. Classification of pigments, dyes and drugs. Methods of application of dye to the fabrics.
4. Discuss the structure and fuctions of various drugs like paracetamol, aspirin, etc.,
5. Develop the skill of chemical processes that can be used to run our daily life.

**Course Outcomes:**

1. Explain the composition of dairy products, beverages, food additives and flavours
2. Classify typical pigments, Dyes, Drugs, Oils, fats and Soaps & Detergents.
3. Predict the percentage of organic matter present in the soil and deduce the factors affecting decomposition of organic matter in soul.
4. Identify the physical properties of soil and its importance in soil fertility.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC3070 | CO1 | 3 | 2 | 2 | 1 | | 2 | | 3 | 2 | 3 |
| | CO2 | 3 | 2 | 2 | 2 | | 2 | | 3 | 2 | 2 |
| | CO3 | 3 | 2 | 2 | 1 | | 2 | | 3 | 2 | 3 |
| | CO4 | 3 | 3 | 2 | 2 | | 3 | 2 | 3 | 2 | 3 |

**Course Contents:**

**UNIT-I** **12 Hrs**

**Dairy Products:** Composition of milk and milk products. Analysis of fat content, minerals in milk and butter. Estimation of added water in milk.

**Beverages:** Analysis of caffeine in coffee and tea, detection of chicory in coffee, chloral hydrate in toddy, estimation of methyl alcohol in alcoholic beverages.

**Food additives, adulterants and contaminants:** Food preservatives like benzoates, propionates, sorbates, disulphites. Artificial sweeteners: Aspartame, saccharin, dulcin, sucralose and sodium cyclamate.

**Flavours:** Vanillin, alkyl esters (fruit flavours) and monosodium glutamate. Artificial food colorants: Coal tar dyes and non-permitted colours and metallic salts. Analysis of pesticide residues in food.

**UNIT-II** **12 Hrs**

**Pigments & Dyes:** a) White pigments (white lead, ZnO, lithopone, TiO2). Blue, red, yellow and green pigments. b) Colour and constitution (electronic concept) of dye. Classification of dyes. Methods of applying dyes to the fabrics. A general study of azo dyes, Mordant brown, Congo red and methyl organe.

**Drugs:** Classification and nomenclature. Structure and function of: Analgesics – aspirin, paracetamol. Anthelmentic drug: mebendazole. Antiallergic drug: Chloropheneramine maleate. Antibiotics: Pencillin V, Chloromycetin, Streptomycin. Anti-infalmmatory agent: Oxypheno-butazone. Antimalarials: Primazuine phosphate & Chloroquine.

**Oils and fats:** Composition of edible oils, detection of purity, rancidity of fats and oil. Tests for adulterants like aregemone oil and mineral oils.

**Soaps & Detergents:** Structures and methods of use of soaps and detergents.

**UNIT-III** **12 Hrs**

**Soil forming Rocks and Minerals:** Definition of soil, definition, classification and properties of rocks and minerals. Weathering: Definition and types, factors responsible for weathering

**Soil profile:** Definition, soil horizons and typical diagram of soil profile. Soil components- inorganic and organic components in soil-micro and macronutrients.

**Soil fertility and productivity:** Definition, comparison between fertility and productivity and factors affecting them.

**Soil physical properties and their importance in soil fertility:** 1. Soil texture and mechanical analysis of soil. 2. Soil structure. 3. Soil density and porosity. 4. Soil color. 5. Soil temperature 6. Soil aeration.

**UNIT-IV** **12 Hrs**

**Soil water:** Importance, retention and movement of water in soil. Loss of water in soil and plants.

**Soil organic matter:** Sources, composition and decomposition of soil organic matter. Influence of soil organic matter. Factors affecting decomposition of organic matter.

**Ion exchange properties of soil**: Introduction, cation exchange process in soil. Anion exchange.

**Soil reaction and buffering of soil:** Definition, factors controlling soil pH. Relation of soil pH and nutrient availability. Buffer capacity of soil.

**Feritlisers:** Classification of Fertilizers- Straight Fertilizers, Compound/Complex Fertilizers, Fertilizer Mixtures. Manufacture and general prosperities of Fertilizer products- Urea and DAP.

**Reference Books:**


1. B. K. Sharma: introduction to Industiral Chemistry, Goel Publishing, Meerut (1998)
2. Medicinal Chemistry by Ashtoush Kar.
3. Drugs and Pharamaceutical Sciences Series, Marcel Dekker, Vol. II, INC, New York.
4. Analysis of Foods – H.E. Cox: 13. Chemical Analysis of Foods – H.E.Cox and pearson.
5. Foods: Facts and Principles. N. Shakuntala Many and S. Swamy, 4th ed. New Age International (1998) 6. Physical Chemistry – P l Atkins and J. de Paula – 7 th Ed. 2002, Oxford University Press.
6. Handbook on Feritilizer Technology by Swaminathan and Goswamy, 6th ed. 2001, FAI.
7. Fundamental of soil science: Forth and Turk.
8. Principles of soil science: M. M. Rai.
9. Nature and properties of soil: Bookmann and Brady.
10. A textbook of soil science: Dr. J. A. Daji.


| Course Code | Course Title | Course Type | L | T | P | C | Hrs/Week |
|---|---|---|---|---|---|---|---|
| B19PC3080 | **Classical Optimization** | OE | 4 | 0 | 0 | 4 | 4 |

**Course Objectives:**

The objective of this course is to make students to learn principles of optimization, To implement the optimization Concepts for the structural engineering problems. To evaluate different methods of optimization.

**Course Outcomes:**

On completion of this course, students are able to: • Achieve Knowledge of design and development of problem-solving skills. • Understand the principles of optimization. • Design and develop analytical skills. • Summarize the Linear, Non-linear and Geometric Programming • Understands the concept of Dynamic programming

**Course Content:**

**UNIT-I:** **12 Hrs**

Introduction to optimization, engineering applications of optimization, Formulation of structural optimization problems as programming problems. Optimization Techniques: Classical optimization techniques, single variable optimization, multivariable optimization with no constraints

**UNIT-II:** **12 Hrs**

Unconstrained minimization techniques and algorithms constrained optimization solutions by penalty function techniques, Lagrange multipliers techniques and feasibility techniques

**UNIT-III:** **12 Hrs**

Non-linear programming, one dimensional minimization methods, elimination methods, Fibonacci method, golden section method, interpolation methods, quadratic and cubic methods, Unconstrained optimization methods, direct search methods, random search methods, descent methods.

**UNIT-IV:** **12 Hrs**

Constrained optimization techniques such as direct methods, the complex methods, cutting plane method, exterior penalty function methods for structural engineering problems. Formulation and solution of structural optimization problems by different techniques

**Reference Books:**


1. Spunt, "Optimum Structural Design"- Prentice Hall
2. S.S. Rao, "Optimization – Theory and Practice"- Wiley Eastern Ltd.
3. Uri Krisch, "Optimum Structural Design"- McGraw Hill
4. Richard Bronson, "Operation Research"- Schaum's Outline Series
5. Bhavikatti S.S.- "Structural optimization using sequential linear programming"- Vikas publishing house.


| B19PC3090 | Physics Lab-III | L | T | P | C |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **0** | **0** | **2** | **2** |

**Prerequisites:**

This is a laboratory course which covers experiments related to simple harmonic motion waves, basic theory of light and optical phenomenon like diffraction, interference and polarization.

**Course Objectives:**

1. To visualise simple harmonic wave motions and verify the theories that govern them.
2. To visualise interference, diffraction and polarization of light.
3. To use different optical phenomenon in different applications.

**Course Outcomes:**

On successful completion of this course, the student is expected to be able to:

1. Explain the phenomenon related to simple harmonic motion waves.
2. Determine the thickness of thin objects, radius of curvature of a plano-convex lens by interference and diffraction.

3. Analyse observed optical phenomenon in nature.
4. Estimate the costant values related to sound.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **B19PC3090** | **CO1** | **3** | **3** | **3** | **3** | | | | **3** | **3** | **1** |
| | **CO2** | **3** | **3** | **2** | **1** | | | | **1** | **2** | **2** |
| | **CO3** | **3** | **3** | **2** | **2** | | | **1** | **3** | **2** | **1** |
| | **CO4** | **3** | **3** | **3** | **1** | | | | **3** | **3** | **3** |

**Course Contents:**

Any **Eight** of the Following Experiments

1. Kundt's tube experiment – Velocity of sound in air at room temperature.
2. Study of stationary wave on a stretched string – Determination of speed of the transverse waves over the sonometer wire.
3. Characteristics of microphone – loudspeaker system – Determination of Velocity of sound at room temperature.
4. Newton's rings – Determination of radius of curvature of a plano-convex lens.
5. Air wedge – Determination of thickness of a thin paper/diameter of a thin wire.
6. Helmholtz resonator – Determination of frequency of a tuning fork.
7. Diffraction grating – Determination of grating constant and wave length (minimum deviation method).
8. Diffraction at a straight wire – Determination of diameter of a wire.
9. Cauchy's constants using spectrometer.
10. Polarization – Determination of unknown concentration of sugar solution by graphical method using a polarimeter.
11. Determination of refractive indices of calcite and quartz crystal using spectrometer and sodium light.

**Text books:**


1. Thiruvadigal, J. D., Ponnusamy, S. Sudha. D. and Krishnamohan M., "Physics for Technologists", Vibrant Publication, Chennai, 2013
2. R. K. Shukla and Anchal Srivastava, "Practical Physics", 1st Edition, New Age International (P) Ltd, New Delhi, 2006.


**Reference Books:**


1. G. L. Souires, "Practical Physics:", 4th Edition, Cambridge University, UK, 2001.
2. D. Chattopadhyay, P. C. Rakshit and B. Saha, "An Advanced Course in Practical Physics", 2nd ed., Books & Allied Ltd., Calcutta, 1990.


| B19PC3X10 | Chemistry Lab-III | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **0** | **0** | **2** | **2** |

**Prerequisites:**

Knowledge of anions and cations, qualitative and quantitative analysis.

**Course Objectives:**

1. This course is intended to provide basic skills in qualitative analysis at the semi-micro scale.
2. It also emphasizes the importance of organized and systematic approach in carrying out experiments.
3. It also helps in developing analytical reasoning, critical thinking, questioning etc.

**Course Outcomes:**

1. Identify the indivisual anions and cat ions in a compound.
2. Apply the knowledge in determining the strength of analyte.
3. Interprete the involvement of intermediate ions while estimating particular group.
4. Solve the reactions involved related to intermediates and product formation during analysis

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC3X10 | CO1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 |
| | CO2 | 2 | 2 | 1 | 1 | 1 | 2 | 1 | 2 | 2 | 2 |
| | CO3 | 1 | 2 | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| | CO4 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 1 | 2 |

**Course Contents:**

Systematic semi-micro qualitative analysis of a mixture of two simple salts (with no interfering radicals). Including ionic reactions. The constituent ions in the mixture to be restricted to the following.

Anions: $HCO_3^-$, $CO_3^{2-}$, $SO_3^-$, $Cl^-$, $Br^-$, $NO_3^-$, $BO_3^{3-}$, $SO_4^{2-}$ and $PO_4^{3-}$
Cations: $Pb^{2+}$, $Bi^{3+}$, $Cd^{2+}$, $Al^{3+}$, $Fe^{3+}$, $Fe^{2+}$, $Mn^{2+}$, $Zn^{2+}$, $Ba^{2+}$, $Sr^{2+}$, $Ca^{2+}$, $Mg^{2+}$, $K^+$, $Na^+$ and $NH_4^+$.

**Reference Books: Practicals**


1. Mendham, J., A. I. Vogel's *Quantitative Chemical Analysis 6th Ed.,* Pearson, 2009.
2. Vogel's *Qualitative Inorganic Analysis,* Revised by G. Svehla. Pearson Education, 2002.


| B19PC3X20 | Mathematics Lab-III | L | T | P | C |
|---|---|---|---|---|---|
| Duration:14 Wks | | 0 | 0 | 2 | 2 |

**Prerequisites:**

Differentiation, integration, basic concepts of differential equations, basic arithmetic and algebra.

**Course Objectives:**

1. Understand normal subgroups using *Maxima* .
2. Solve higher order linear differential equations using *Maxima*.
3. Apply the knowledge of Laplace transform using *Maxima* .
4. Discuss inverse Laplace transforms using *Maxima*.

**Course Outcomes:**

1. Acquire knowledge in using *Maxima* to verify a normal subgroup, homomorphismof a group and isomorphism of a group.
2. Acquire proficiency in using *Maxima* to study differential calculus.
3. Demonstrate the use of *Maxima* to understand and interpret the concepts in Laplace transform.
4. Exihibit the fundamentals of inverse Laplace transform using *Maxima*.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC3X20 | CO1 | 3 | 2 | 2 | 1 | | | 1 | 1 | 3 | 2 |
| | CO2 | 3 | 2 | 2 | 1 | | | 1 | 1 | 3 | 3 |
| | CO3 | 3 | 2 | 2 | 1 | | | 1 | 1 | 3 | 2 |
| | CO4 | 3 | 2 | 2 | 1 | | | 1 | 1 | 2 | 3 |

**Course Contents:**

1. To verify whether a given subgroup is a normal subgroupor not.
2. To verify whether a given faction is a homomorphisom or not.
3. To verify a given onto homomorphison of a group is isomorphism or not.
4. To verify Lagrange's theorem.
5. To find left and right cost (examples).
6. To find the solution to the differential equation.
7. To find the Laplace transform of given function.
8. To find the inverse Laplace Transform of given function.
9. To solve ODE using Laplace Transform.
10. To find the solution to the differential equation.

**Text Books:**


1. SCILAB: A Practical Introduction to Programming and Problem Solving [Print Replica] Kindle Edition by Tejas Sheth (Author).
2. The Maxima Book Paulo Ney de Souza Richard J. Fateman Joel Moses Cliff Yapp 19th September 2004.

# FOURTH – SEMESTER

| B19PC4011 | Language-II: Kannada | L | T | P | C |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **1** | **0** | **3** |

**Prerequisites:**

- PÀ£ÀßqÀ ¨sÁµÉAiÀÄ §UÉUÉ ¥ÁæxÀ«ÄPÀ w½ÀÄªÀ½PÉ CUÀvÀå.
- ¨sÁµÉAiÀÄ£ÀÄß NzÀ®Ä ªÀÄvÀÄÛ §gÉAiÀÄ®Ä w½¢gÀ¨ÉÃPÀÄ.
- ¥ÀzÀ« ¥ÀÆªÀð ²PÀëtzÀ°è PÀ£ÀßqÀ ¨sÁµÉAiÀÄ£ÀÄß N¢gÀ¨ÉÃPÀÄ.

**Course Objectives:**

**£Á®Ä¸É«Ä¸ÀÖgïUÀ¼À°è ¸ÀªÀÄUÀæ PÀ£ÀßqÀ ¸Á»vÀåªÀ£ÀÄß ¥ÀjZÀ¬Ä¸ÀÄªÀ GzÉÝÃ±ÀªÀ£ÀÄß ºÉÆA¢zÉ. CzÀgÀAvÉ £Á®Ì£ÉAiÀÄ ¸É«Ä¸ÀÖgï£À°è ºÉÆ¸ÀUÀ£ÀßqÀ ¸Á»vÀå ¥ÀæPÁgÀUÀ¼ÁzÀ £ÀªÀå, ¹ÛçÃªÁ¢ ºÁUÀÄ £ÀªÉÇåÃvÀÛgÀ PÁªÀå, ««zsÀ ¯ÉÃR£ÀUÀ¼ÀÄ ºÁUÀÄ PÁzÀA§j ¸Á»vÀåªÀ£ÀÄß ¥ÀoÀåªÀ£ÁßV DAiÉÄÌ ªÀiÁrPÉÆAqÀÄ, «zÁåyðUÀ¼À°è ¸Á»vÀåzÀ §UÉÎ ¸ÀzÀ©ügÀÄaAiÀÄ£ÀÄß ªÀÄÆr¸À¯ÁUÀÄvÀÛzÉ. ¸ÁA¸ÀÌøwPÀ w¼ÀÄªÀ½PÉAiÀÄ eÉÆvÉUÉ ªÀåQÛvÀé «PÀ¸À£ÀzÀ PÀqÉUÉ UÀªÀÄ£À ¤ÃqÀ¯ÁUÀÄvÀÛzÉ.**

1. ¨sÁµÉ, ¸Á»vÀå, EwºÁ¸À ªÀÄvÀÄÛ ¸ÀA¸ÀÌøwUÀ¼À£ÀÄß PÀ£ÀßqÀ, PÀ£ÁðlPÀPÉÌ ¸ÀA§A¢ü¹zÀAvÉ ¥ÀjZÀ¬Ä¸À¯ÁUÀÄvÀÛzÉ.
2. «zÁåyðUÀ¼À ¸ÀªÀðvÉÆÃªÀÄÄR ¨É¼ÀªÀtÂUÉUÉ C£ÀÄªÁUÀÄªÀAvÉ ºÁUÀÆ CªÀgÀ°è ªÀiÁ£ÀªÀ ¸ÀA§AzsÀUÀ¼À §UÉÎ UËgÀªÀ, ¸ÀªÀiÁ£ÀvÉ ªÀÄÆr¹, ¨É¼É¸ÀÄªÀ ¤nÖ£À°è ¥ÀoÀåUÀ¼À DAiÉÄÌAiÀiÁVzÉ.
3. CªÀgÀ°è ¸ÀÈd£À²Ã®vÉ, ±ÀÄzÀÞ ¨sÁµÉ, GvÀÛªÀÄ «ªÀÄ±Áð UÀÄt, ¤gÀUÀð¼À ¸ÀA¨sÁµÀuÉ, ¨sÁµÀt PÀ¯É ºÁUÀÆ §gÀºÀ PË±À®åUÀ¼À£ÀÄß ¨É¼É¸ÀÄªÀÅzÀÄ UÀÄjAiÀiÁVzÉ
4. ¸ÀàzsÁðvÀäPÀ ¥ÀjÃPÉëUÀ½UÉ C£ÀÄPÀÆ®ªÁUÀÄªÀAvÀºÀ «µÀAiÀÄUÀ¼À£ÀÄß UÀªÀÄ£ÀzÀ°èèlÄÖPÉÆAqÀÄ ¸ÀÆPÀÛ ¥ÀoÀåUÀ¼À£ÀÄß DAiÉÄÌ ªÀiÁrPÉÆ¼Àî¯ÁVzÉ.

**Course Outcomes:**

**ºÉÆ¸ÀUÀ£ÀßqÀ ¸Á»vÀå ¥ÀæPÁgÀUÀ¼ÁzÀ £ÀªÀå-£ÀªÉÇåÃvÀÛgÀ PÁªÀå, ««zsÀ ¯ÉÃR£ÀUÀ¼ÀÄ ºÁUÀÄ PÁzÀA§j ¸Á»vÀå PÀ°PÉAiÀÄ ªÀÄÆ®PÀ PÁ®zÀ ¹ÜvÀåAvÀgÀUÀ¼À£ÀÄß CzÀgÀ M¼À£ÉÆÃl UÀ¼À£ÀÄß ¨É¼É¸ÀÄvÀÛzÉ.**

1. ¸ÁªÀiÁfPÀ, gÁdQÃAiÀÄ, zsÁ«ÄðPÀ, ¸ÁA¸ÀÌøwPÀ ºÁUÀÆ °AUÀ¸ÀA§A¢ü «ZÁgÀUÀ¼ÉqÉ UÀªÀÄ£ÀºÀj¸ÀÄªÀÅzÀgÉÆA¢UÉ «zÁåyðUÀ¼À°è ZÀZÁð ªÀÄ£ÉÆÃ¨sÁªÀªÀÅ ¨É¼ÉAiÀÄÄvÀÛzÉ.
2. fÃªÀ£ÀzÀ°è §gÀÄªÀ C©ü¥ÁæAiÀÄ ¨ÉÃzsÀUÀ¼ÀÄ, ¸ÀªÀÄ¸ÉåUÀ¼À£ÀÄß DzsÀĤPÀ ¸ÀAzÀ¨sÀðzÀ°è ªÀiÁ£À«ÃAiÀÄvÉAiÉÆA¢UÉ ¤ªÀð»¸ÀÄªÀAvÉ ¥ÉæÃgÉÃ¦¸ÀÄvÀÛzÉ.
3. ¸ÁªÀiÁfPÀ CjªÀÅ ªÀÄÆr¸ÀÄvÀÛzÉ.
4. GvÀÛªÀÄ ¸ÀAªÀºÀ£À PÀ¯ÉAiÀÄ£ÀÄß ¨É¼É¸ÀÄªÀ GzÉÝÃ±ÀªÀ£ÀÄß FqÉÃj¸ÀÄvÀÛzÉ.

## Mapping of Course Outcomes with programme Outcomes

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC4011 | CO1 | | | | | 2 | 3 | | | | |
| | CO2 | | | | | 2 | 3 | | | | |
| | CO3 | | | | | | 3 | | | | |
| | CO4 | | | | | | | 3 | 2 | | |

**Course Contents:**

**Unit** I **£ÀªÀå-¹ÛçÃªÁ¢ PÀ«vÉUÀ¼ÀÄ** **12 Hrs**

1. PÀlÄÖªÉªÀÅ £ÁªÀÅ UÉÆÃ¥Á®PÀÈµÀÚ CrUÀgÀÄ
2. §Ä¢ÞªÀAvÀjUÉ PÀ£À¸ÀÄ ©zÀÝgÉ J.PÉ.gÁªÀÄ£ÀÄd£ï
3. PÀÄjUÀ¼ÀÄ ¸Ágï PÀÄjUÀ¼ÀÄ ¤¸Ágï CºÀªÀÄzï
4. CPÀÌ ºÉÃ½zÀÄ ¸À. GµÁ

**Unit** II **zÀ°vÀ-§AqÁAiÀÄ** **12 Hrs**

1. £À£Àß PÀªÀ£ÀUÀ¼À°è ºÀÄqÀÄPÀ¢gÀÄ £À£Àß ZÀA¥Á
2. d£À¥ÀzÀ PÀxÉUÀ¼À gÁPÀë¸À ZÀAzÀæ±ÉÃRgÀ PÀA¨ÁgÀ
3. zÀ°vÀgÀÄ §gÀÄªÀgÀÄ zÁj©r ¹zÀÞ°AUÀAiÀÄ
4. PÀlÖqÀzÀ PÉ®¸ÀUÁgÀgÀÄ JZï J¸ï ²ªÀ¥ÀæPÁ±À

**Unit** III **¯ÉÃR£ÀUÀ¼ÀÄ** **12 Hrs**

1. ºÀ¹gÀÄ ºÉÆ¸ÀPÀÄªÀ UÀtÂUÀ¼ÀÄ AiÀÄ®è¥Àà gÉrØ
2. ªÀZÀ£ÀPÁgÀgÀ «ZÁgÀ PÁæAw f.J¸ï.J¸ï
3. eÁUÀwÃPÀgÀtzÀ »£Éß¯ÉAiÀÄ°è UÁA¢üÃfAiÀÄ ¥Àæ¸ÀÄÛvÀvÉ ¹. £ÁUÀtÚ
4. ZÁªÁðPÀgÀÄ : MAzÀÄ n¥ÀàtÂ ¦ J£ï gÀAUÀ£ï

**Unit** IV **PÁzÀA§j** **12 Hrs**

1. ¸ÀA¸ÁÌgÀ AiÀÄÄ.Dgï. C£ÀAvÀªÀÄÆwð

**¥ÀgÁªÀÄ±Àð£À UÀæAxÀUÀ¼ÀÄ :**


1. ªÀÄÄUÀ½ gÀA.²æÃ., PÀ£ÀßqÀ ¸Á»vÀå ZÀjvÉæ, ¥ÀæPÁ±ÀPÀgÀÄ VÃvÁ §ÄPï ºË¸ï, ªÉÄÊ¸ÀÆgÀÄ. 2014
2. ¹ÃªÀiÁwÃvÀ PÀ£ÀßqÀ ¸Á»vÀå ZÀjvÉæ ¸ÀA¥ÀÄl 1,2,3,4,5 ªÀÄvÀÄÛ 6, PÀÄªÉA¥ÀÄ PÀ£ÀßqÀ CzsÀåAiÀÄ£À ¸ÀA¸ÉÜ, ªÉÄÊ¸ÀÆgÀÄ «±Àé«zÁå¤®AiÀÄ, ªÉÄÊ¸ÀÆgÀÄ. 2014
3. ºÀA¥À £ÁUÀgÁdAiÀÄå, ¸ÁAUÀvÀå PÀ«UÀ¼ÀÄ, ¥ÀæPÁ±ÀPÀgÀÄ ¸Àé¥Àß §ÄPï ºË¸ï, ¨ÉAUÀ¼ÀÆgÀÄ. 2010
4. gÀAeÁ£ï zÀUÁð, ±ÀgÀtgÀ ¸ÀªÀÄUÀæ PÁæAw, ¥ÀæPÁ±ÀPÀgÀÄ. ¯ÉÆÃ»AiÀiÁ ¥ÀæPÁ±À£À, §¼Áîj. 2015
5. ªÀ¹µÀ×., gÀvÁßPÀgÀªÀtÂðAiÀÄ ¨sÀgÀvÉÃ±À ªÉÊ¨sÀªÀ, ¥ÀæPÁ±ÀPÀgÀÄ ZÉÃvÀ£À §ÄPï ºË¸ï, ªÉÄÊ¸ÀÆgÀÄ. 1999

6. qÁ. CgÀ«AzÀ ªÀiÁ®UÀwÛ, ¸Á»vÀå ¸ÀA¸Àløw ªÀÄvÀÄÛ zÀ°vÀ ¥ÀæeÉÕ, ¥ÀæPÁ±ÀPÀgÀÄ PÀ£ÀßqÀ ¸Á»vÀå ¥ÀjµÀvÀÄÛ, ¨ÉAUÀ¼ÀÆgÀÄ. 2014
7. qÁ. F.J¸ï. DªÀÄÆgÀ, PÀ£ÀßqÀ PÀxÀ£À ¸Á»vÀå : PÁzÀA§j, ¥ÀæPÁ±ÀPÀgÀÄ ¸Àé¥Àß §ÄPï ºË¸ï, ¨ÉAUÀ¼ÀÆgÀÄ. 2016
8. QÃvÀð£ÁxÀ PÀÄvÀðPÉÆÃn, PÀ£ÀßqÀ ¸Á»vÀå ¸ÀAUÁw, ¥ÀæPÁ±ÀPÀgÀÄ PÀÄvÀðPÉÆÃn ªÉÄªÉÆÃjAiÀÄ¯ï læ¸ïÖ, zsÁgÀªÁqÀ. 2009
9. ±ÁªÀÄgÁAiÀÄ vÀ.¸ÀÄ., PÀ£ÀßqÀ ¸Á»vÀå ZÀjvÉæ, ¥ÀæPÁ±ÀPÀgÀÄ vÀ¼ÀÄQ£À ªÉAPÀtÚAiÀÄå ¸ÁägÀPÀ UÀæAxÀªÀiÁ¯É, ªÉÄÊ¸ÀÆgÀÄ -2014
10. ¸ÀA. qÁ! ¹. Dgï. ZÀAzÀæ±ÉÃRgï, ªÀÄÄAzÁ¼ÀÄvÀ£ÀzÀ ®PÀëtUÀ¼À£ÀÄß ¨É¼É¹PÉÆ¼ÀÄîªÀÅzÀÄ ºÉÃUÉ?, ¥ÀæPÁ±ÀPÀgÀÄ £ÀªÀPÀ£ÁðlPÀ ¥À©èPÉÃµÀ£îì ¥ÉæöÊªÉmï °«ÄmÉqï. 2010
11. DzsÀÄ¤PÀ PÀ£ÀßqÀ PÁªÀå ¨sÁUÀ-2, PÀÄªÉA¥ÀÄ PÀ£ÀßqÀ CzsÀåAiÀÄ£À ¸ÀA¸ÉÜ, ªÉÄÊ¸ÀÆgÀÄ «±Àé«zÁå¤®AiÀÄ, ªÉÄÊ¸ÀÆgÀÄ. 2004
12. ²ªÀgÀÄzÀæ¥Àà f.J¸ï. PÀ£ÀßqÀ ¸Á»vÀå ¸À«ÄÃPÉë, ¥ÀæPÁ±ÀPÀgÀÄ ¸Àé¥Àß §ÄPï ºË¸ï, ¨ÉAUÀ¼ÀÆgÀÄ. 2013

| B19PC4012 | **Language – II: Hindi** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **1** | **0** | **3** |

**Prerequisites:**

- अध्येता को, हिन्दी खंडकाव्य का संक्षिप्त ज्ञान आवश्यक है |
- हिन्दी साहित्य के इतिहास का संक्षिप्त ज्ञान की आवश्यकता है |
- हिन्दी व्याकरण का अवबोधन आवश्यक है |

**Course Objectives:**

1. संदर्भानुसार उचित भाषा का प्रयोग करने की दक्षता को छात्रों में उत्पन्न करना |
2. साहित्य के माध्यम से समाज एवं मानवीय मूल्यों को समझाकर, उन मूल्यों की रक्षा हेतु प्रेरित करना |
3. छात्रों में पुस्तक पठन एवं लेखन की अकृतिम प्रवृत्ति स्थापित करना |
4. अध्येताओं में साहित्य के माध्यम से प्रभावी एवं कुशल संचार का विकास करना |

**Course Outcomes:**

अध्ययन की समाप्ति पर अध्येता –

1. सामाजिक मूल्य एवं नैतिक जवाबदेही को स्वीकार कर सकता है |
2. साहित्य की प्रासंगिकता को जीवन में समझने की दक्षता रखता है |
3. समाज में अंतर्निहित पद्दतियाँ एवं विचारधाराओं का व्याख्यान करने में सक्षम बन सकता है |
4. साहित्य के माध्यम से प्रभावी एवं कुशल संचार का विकास कर सकता है |

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **B19PC4012** | **CO1** | | | | | **2** | **3** | **2** | | | |
| | **CO2** | | | | | **2** | **2** | **3** | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **CO3** | | | | | **3** | **3** | **3** | | | |
| | **CO4** | | | | | **3** | **2** | **3** | | | |

**Course Contents:**

**इकाई** – **1:** खंड काव्य – संशय की रात - नरेश मेहता **12 hrs.**

कवि परिचय
प्रथम सर्ग
द्वितीय सर्ग

**इकाई** – **2:** खंड काव्य – संशय की रात **12 hrs.**

तृतीय सर्ग
चतुर्थ सर्ग

**इका ई** – **3:** खंड काव्य – संशय की रात **12 hrs.**

पंचम सर्ग
छठा सर्ग
सप्तम सर्ग

**इकाई** – **4: व्याकरण** : अलंकार , **सिनिमा रिव्यू** **12 hrs.**

**व्याकरण** : अलंकार

**सिनिमा रिव्यू :**

दंगल ,हिन्दी मीडियम, सत्याग्रह और चेक दे इंडिया |

**सन्दर्भ ग्रन्थ :**


1. संशय की एक रात – नरेश मेहता
2. हिन्दी साहित्य का इतिहास - डॉ. नागेन्द्र
3. आधुनिक हिन्दी साहित्य का इतिहास - डॉ. बच्चन सिंह
4. हिन्दी साहित्य का नवीन इतिहास - डॉ. लाल साहब सिंह
5. शुद्ध हिन्दी कैसे बोले कैसे लिखे- पृथ्वीनाथ पाण्डे
6. भारतीय संस्कृति के आधार - विद्यानिवास मिश्रा
7. रामायण की कहानियाँ - हर्षा शर्मा
8. रस छंद और अलंकार - कृष्णदेव शर्मा और सुरेश अग्रवाल


| B19PC4013 | **Language-II: Additional English** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **1** | **0** | **3** |

**Prerequisites:**

Knowledge of intermediate English Grammar and LSRW skills.

**Course Objectives:**

1. To ensure the development of the linguistic prowess of the students
2. To motivate the students to appreciate literature

3. To help students build strong language fundamentals
4. To promote an appreciable reading habit among the students

**Course Outcomes:**

On completion of the course, learners will be able to:

1. Demonstrate a thorough understanding of sensitive and critical social issues.
2. Develop reading skills and vocabulary range
3. Critically analyse a piece of prose or poetry
4. Express their opinion in a coherent and communicable manner

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC4013 | CO1 | | | | | 3 | 3 | 3 | 2 | | |
| | CO2 | | | | | 3 | 3 | 3 | 3 | | |
| | CO3 | | | | | 3 | 3 | 3 | 2 | | |
| | CO4 | | | | | 3 | 3 | 3 | 2 | | |

**Course Contents:**

**UNIT – I** **12 Hrs**

John W. May – Narcissus; W.B. Yeats – The Second Coming; Devdutt Pattanaik - *Shikhandi and the Other Stories They Don't Tell you* (Extracts); Iravati Karve – *Yuganta* (Extract)

**UNIT – II** **12 Hrs**

Nissim Ezekiel – Night of the Scorpion; Langston Hughes – Mother to Son; Vijay Dan Detha – Double Life; Kate Chopin – The Story of an Hour; Henrik Ibsen – *A Doll's House* (Extract)

**UNIT – III** **12 Hrs**

Edgar Allan Poe – The Raven; Bram Stoker – A Dream of Red Hands; Satyajit Ray – Adventures of Feluda (Extract); Stephen King - Gramma

**UNIT – IV** **12 Hrs**

The Dalai Lama – The Paradox of Our Times; Kamala Wijeratne – To a Student
Sudha Murthy – In Sahyadri Hills, a Lesson in Humility; Booker T. Washington – Extract from *Up from Slavery* (Chapter 3: The Struggle for Education); Frigyes Karinthy – *Refund*

**Reference Books**:


1. Finneran, Richard J. *The Collected Works of W.B. Yeats*(Volume I: The Poems: Revised Second Edition). Simon & Schuster, 1996.
2. Pattanaik, Devdutt. *Shikhandi: Ánd Other 'Queer' Tales They Don't Tell You*. Penguin Books, 2014.
3. Karve, Irawati. *Yuganta: The End of an Epoch*. Orient Blackswan, 2007.
4. Ezekiel, Nissim. *Collected Poems* (With A New Introduction By John Thieme). OUP, 2005.
5. Hughes, Langston. *The Collected Poems of Langston Hughes*. Vintage, 1995.
6. Chopin, Kate. *The Awakening and Selected Stories of Kate Chopin*. Simon & Schuster, 2004.
7. Ibsen, Henrik. *A Doll's House*. Maple Press, 2011.

8. Poe, Edgar Allan. *The Complete Poetry of Edgar Allan Poe*. Penguin USA, 2008.
9. Stoker, Bram. *Dracula*. Fingerprint Publishing, 2013.
10. Ray, Satyajit. *The Complete Adventures of Feluda* (Vol. 2). Penguin Books Ltd., 2015.
11. Lama, Dalai. *Freedom In Exile: The Autobiography of the Dalai Lama of Tibet*. Little, Brown Book Group, 1998.
12. Murthy, Sudha. *Wise and Otherwise: A Salute to Life*. Penguin India, 2006.
13. Wsahington, Booker T. *Up from Slavery*. Infinity, 2015

| B19PC4020 | **Communicative English-II** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **1** | **0** | **3** |

**Prerequisites:**

Knowledge of intermediate English Grammar and LSRW skills.

**Course Objectives:**

1. To attune young minds to concerns and issues which have a broad and wide scope of use and application to life
2. To acquire a functional use of language in context
3. To equip students to deliver formal and informal oral presentations to a variety of audiences in multiple contexts
4. To enable students to construct effective written message in various formats and styles
5. To inculcate the habit of reading and writing leading to effective and efficient communication

**Course Outcomes:**

After the completion of the course, students will be able to

1. Demonstrate ethical and political responsibilities in taking cognizance of issues relating to society, environment and media
2. Develop a process-oriented approach to writing
3. Make use of grammatical skills developed during the course aptly
4. Utilize the target language effectively to focus on interpersonal skills and develop a good Command over the language

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **B19PC4020** | **CO1** | | | | | **3** | **3** | **3** | **2** | | |
| | **CO2** | | | | | **3** | **3** | **3** | **3** | | |
| | **CO3** | | | | | **3** | **3** | **3** | **2** | | |
| | **CO4** | | | | | **3** | **3** | **3** | **2** | | |

**Course Contents:**

**UNIT –I** **12 Hrs**

**Remedial Grammar:** Questions & Negatives; Questions Tags**; Writing Skills:** Email Writing**; Activities:** Group Discussions**; Literature:** Alphonse Daudet - The Last Lesson

**UNIT – II** **12 Hrs**

**Remedial Grammar:** Past Simple & Past Perfect; **Writing Skills:** Report Writing**; Activities:** Book & Movie Reviews; **Literature:** Lord Alfred Tennyson – Ulysses

**UNIT – III** **12 Hrs**

**Remedial Grammar:** Present & Past Passive; Conditionals; **Writing Skills:** Creative Writing**; Activities:** Role Plays**; Literature:** O. Henry – The Gift of the Magi

**UNIT – IV** **12 Hrs**

**Remedial Grammar:** Reported Speech; Idioms; **Writing Skills:** Cover Letter & CV; **Activities:** Exchanging Information**; Literature:** Saki – The Open Window

**Reference Books:**


1. Bansal, R.K. and J.B. Harrison. *Spoken English*. Orient Blackswan, 2013.
2. Raman, Meenakshi and Sangeeta Sharma. *Technical Communication*. Oxford University Press, 2015.
3. Thorpe, Edgar and Showick Thorpe. *Objective English*. Pearson Education, 2013.
4. Dixson, Robert J. *Everyday Dialogues in English*. Prentice Hall India Pvt Ltd., 1988.
5. Turton, Nigel D. *ABC of Common Errors*. Mac Millan Publishers, 1995.
6. Samson, T. (ed.) *Innovate with English.* Cambridge University Press, 2010.
7. Kumar, E Suresh, J. Savitri and P Sreehari (ed). *Effective English*. Pearson Education, 2009.
8. Goodale, Malcolm. *Professional Presentation*. Cambridge University Press, 2013.


| B19PC4030 | Electricity and Magnetism | L | T | P | C |
|---|---|---|---|---|---|
| Duration:14 Wks | | 2 | 1 | 0 | 3 |

**Prerequisites:**

Basics of electricity and magnetism.

**Course Objectives:**

1. Describe how static electricity is produced and list examples where its effects are observed.
2. Explain electrostatic induction and polarization.
3. Describe how magnetism is produced and list examples where its effects are observed.
4. Identify the connection between electricity and magnetism.
5. Understand how to do vector calculations including: vector addition, cross products, dot (scalar) products

**Course Outcomes:**

On completion of this course the student will be able to:

1. Calculate the force on a charged particle
2. Explain the method of measuring voltage and frequency using CRO
3. Explain the response of LR, CR and LCR circuits frequencies.
4. Explain Anderson's bridge, thermocouple and self-inductance of solenoid

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC4030 | CO1 | 3 | 2 | 1 | 1 | | | 1 | 3 | 3 | 2 |
| | CO2 | 3 | 2 | 3 | 2 | | | | 2 | 3 | 2 |
| | CO3 | 3 | 3 | 3 | 3 | | | 2 | 3 | 3 | 3 |
| | CO4 | 3 | 2 | 2 | 2 | | | 2 | 2 | 3 | 2 |

**Course Contents:**

**UNIT-I** **12 hrs**

Electrostatics: Mechanical force and electric pressure on a charged surface. The path traced by a charged particle in uniform electric field. The attracted disc electrometer-construction, theory and applications.

Electrical measurement: C.R.O: construction & working, Measurement of voltage and frequency using a C.R.O.

Galvanometers: Moving coil ballistic galvanometer-construction, theory and derivation, damping correction, current and charge sensitivity, Helmholtz galvanometer – Theory.

**UNIT-II** **12 hrs**

Alternating current: R.M.S. values. Response of LR, CR and LCR circuits to sinusoidal voltages (discussion using the complex analysis). Series and parallel resonance-half-power frequency, band-width and Q-factor. Power in electrical circuits- power factor.

Filters: High-pass and low-pass filters with LR and CR combinations. Expression for cut-off frequency. Band pass filters.

**UNIT-III** **12 hrs**

Inductance and Thermo-electricity: Anderson's bridge; Mutual inductance; Calculation of the mutual inductance of a pair of coils; the thermocouple, Seebeck, Peltier and Thomson effects. Thermodynamic theory of thermoelectric effect. The law of intermediate metals and the law of intermediate temperatures. Applications - Calculation of the self-inductance of a solenoid.

**UNIT-IV** **12 hrs**

Electromagnetism: Scalar and vector fields; the gradient of a scalar field; the divergence and curl of a vector field. The physical significance of gradient. The divergence and curl, Statement of theorems of Gauss and Stokes. Concept of dipole. Ampere's circuital law. Current loop as a dipole. The torque on a dipole. Maxwell's field equations (Quantative). Wave equation for the field vectors. Poynting vector (no derivation). Plane electromagnetic waves–Helmholtz equation, Transverse nature, intrinsic impedance, and wave equation for dielectric.

**Books Recommended:**

1. Halliday/Resnick/Walker: Fundamentals of Physics, 8th edition, John Wiley & Sons (Asia) Pte. Ltd.

2. K. K. Tewari: Electricity and magnetism, Reprint 2007, S. Chand Co. Ltd., New Delhi. B. B. Laud: Electrodynamics, Wiley Eastern Limited, New Delhi.
3. David. J. Griffiths: Introduction to Electrodynamics, 3rd edition, Prentice-Hall of India Private limited, New Delhi.
4. W.H. Hayt and J. A. Buck: Engineering Electromagnetism, 6th edition, Tata Mc Graw Hill, New Delhi.
5. V. K. Mehta & Rohit Mehta: Principles of Electronics, 11th edition, S. Chand & Co. Ltd., New Delhi.
6. BrijLal and N. Subrahmanyam: A text book of Electricity and Magnetism, 19th edition-Ratan Prakashan Mandir, Educational and University Publishers, Agra.
7. A.B. Bhattacharya, R. Bhattacharya, Under Graduate Physics, Volume II, New Central Book Agency (P) Ltd., Kolkata.
8. D.N. Vasudeva: Fundamentals of Magnetism and Electricity, 12th edition- S. Chand and Co. Ltd., New Delhi.

| B19PC4040 | Chemistry –IV | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **1** | **0** | **3** |

**Prerequisites:**

Periodic table, Organic functional groups, Thermodynamics and Chemical kinetics.

**Course Objectives:**

1. The importance of acid-base concept, HSBA rule in compound formation, non-aqueous solvent and noble gas chemistry
2. The fundamental concepts of organic chemistry synthesis of various functional organic compounds
3. Illustrate the Vital concepts thermodynamics and its principles and its importance.
4. Correlate the reaction kinetics and foundation theory and relevant applications.

**Course Outcomes:**

On the successful completion of this course, the student shall be able to**:**

1. Apply the knowledge of noble gases, compounds of N, S and pseudo halogens in explaining, interpreting structures and their reactivities of noble gases and organometallic compounds.
2. Analyze the bonding stability organic compounds and their applications.
3. Recognize the typical named organic reactions and explain their mechanisms through various steps.
4. Correlate the importance of adsorption and catalysis reactions of chemical compounds in industries e.g. Hydrogenation, dehydrogenation.

**Mapping of Course Outcomes with Programme Outcomes**

| Course Code | POs/ Cos | PO1 | P02 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **B19PC4040** | CO1 | **1** | **2** | **1** | **1** | **1** | **1** | **1** | **1** | **2** | **1** |
| | CO2 | **2** | **2** | **1** | **1** | **1** | **2** | **1** | **1** | **2** | **2** |
| | CO3 | **1** | **2** | **1** | **2** | **1** | **2** | **1** | **1** | **1** | **1** |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | CO4 | **2** | **1** | **1** | **2** | **1** | **1** | **2** | **1** | **1** | **2** |

**Course Contents:**

**UNIT-I** **12 Hrs**

**Noble Gases**: Preparation, separation of Noble gases-Dewar'smethod. Preparation, Structure and properties of compounds of Xenon and Krypton ($XeF_2$, $XeO_3$, $KrF_2$, $KrO_3$), Clathrates (explanation with suitable examples, essential conditions for the formation and uses).

**Acid Base Concepts**: Introduction to HSAB concepts.

**Non-aqueous solvents**: classification of solvents, Liquid ammonia-reasons for the solvent properties, typical reactions- solubility of alkali metals; acid-base, precipitation, Ionization of weak acids, advantages and disadvantages. Liquid $SO_2$-reasons for the solvent properties.

**Organometallic Compounds**: Definition with example, organo zinc compounds – preparation of diethylzinc and its applications.

**Organolithium Compounds**: Preparation and synthetic applications.

**UNIT-II** **12 Hrs**

**Ethers**: Williamson ether synthesis, reactions – cleavage and auto-oxidation-Ziesel's method.

**Epoxides**: Synthesis by Darzen's method. Acid and base catalyzed opening of epoxides.

**Crown ethers**: Introduction with examples.

**Carbonyl Compounds**: Distinguish between aldehydes and ketones – oxidation ($K_2cr_2o_7$ and reduction ($H_2Pt$, $LiAlH_4$) method. Addition of alcohols- formation of hemiacetal and acetal. Condensation with $NH_2OH$ and 2, 4-DNP.Mechanism of aldol condensation, Perkins reaction, Cannizzaro reaction, Claisen condensation, Knovenagelreaction.

Reduction: Reduction by LiAlH4 and NaBH4. Mannich reaction. Mechanisms of Clemmensen and Wolff- Kishner reductions.

**Carboxylic acids**: Definition, classification with examples. Synthesis by Arndt-Eistert reaction.

**Hydroxy acids**: Synthesis of lactic, citric and tartaric acids. One method each and their importance.

**Amines**: Definition, classification with example. Distinction tests for 1°, 2°, 3° amines (acetylation and Hoffmann's exhaustive methylation. Action of nitric acid on different amines. Both aliphatic and aromatic 1°, 2°, 3° amines) basicity of amines, Hoffmann-Martiusrearrangement.

**UNIT-III** **12 Hrs**

**Second Law of Thermodynamics**: Limitations of First Law of Thermodynamics – need for II Law of thermodynamics, spontaneous, non-spontaneous and equilibrium processes (definitions and examples for each), different ways of stating II Law, heat engine (example) Carnot cycle, efficiency of Carnot cycle(derivation), concept of entropy – definition and physical significances of entropy – criteria of spontaneity in terms of entropy change, statements of II law in terms of entropy (numerical problems to be worked out on entropy and efficiency of Carnot engine)

**Free Energy**: Helmholtz and Gibb's free energy – their definitions and their relationship, Gibb's – Helmholtz equation at constant pressure and volume (derivations), thermodynamic criteria of equilibrium and spontaneity, Claussius – Clappeyron equation(differential form to be derived), integrated form of Claussius – Clappeyron equation (to be assumed) and its applications (enthalpy of vapourization, boiling point and freezing point at different temperatures), (numerical problems on these applications), Van't Hoff's reaction isotherms and isochore equations (derivation).

**UNIT-IV** **12 Hrs**

**Chemical Kinetics:** Rate of reaction, rate equation, factors influencing the rate of a reaction. Order of a reaction, integrated rate expression for zero order, first order, second and third order reaction. Half-life period of a reaction. Methods of determination of order of reaction, effect of temperature on the rate of reaction – Arrhenius equation. Theories of reaction rate – Simple collision theory for unimolecular and bimolecular collision (hard sphere model). Transition state theory of bimolecular reactions.

**Electrochemistry**: Electrolytic conduction, factors affecting electrolytic conduction, specific, conductance, molar conductance, equivalent conductance and relation among them, their variation with concentration. Arrhenius theory of ionization, Ostwald's Dilution Law. Debye- Hückel – Onsager's equation for strong electrolytes (elementary treatment only) Transport number, definition and determination by
Hittorfs methods, (numerical included), Kohlarausch's Law, calculation of molar ionic conductance and effect of viscosity temperature & pressure on it. Application of Kohlarausch's Law in calculation of conductance of weak electrolytes at infinite dilution. Applications of conductivity measurements: determination of degree of dissociation, determination of $K_a$ of acids determination of solubility product of sparingly soluble salts.

**Reference Books**:


1. Ball, D. W. *Physical Chemistry* Thomson Press, India (2007).
2. Castellan, G. W. *Physical Chemistry* 4th Ed. Narosa (2004).
3. B.S. Bahl, A. Bhal, G. D. Tuli, Essentials of Physical Chemsitry, S. Chand & Company
4. Edition 2006.
5. Gurudeep Raj, Advanced Physical Chemistry, Goel Publication
6. A Text book of Organic Chemistry M. K. Jain S. Chand & Company.
7. A Text book of Organic Chemistry Bhal & Bhal S. Chand & Company.
8. A Text book of Organic Chemistry P. L. Soni S. Chand & Company.
9. Principles of Inorganic Chemistry Puri, Sharma & Kalia Shobhanlal Nagin Chand Co.
10. A Text book of Inorganic Chemistry Gurudeep Raj.
11. Concise Inorganic Chemistry J. D. Lee B-Block Well Science Ltd.
12. A Text book of Inorganic Chemistry Sathya Prakash & others.


| B19PC4050 | Mathematics –IV | L | T | P | C |
|---|---|---|---|---|---|
| Duration:14 Wks | | 2 | 1 | 0 | 3 |

**Prerequisites:**

Differentiation, integration, basic concepts of arithmetic and algebra.

**Course Objectives:**

1. Familiarize with the concept of differential calculus.
2. Uunderstand the concept of sequences.
3. Uunderstand the concept of series of real numbers.
4. Familiarize with vector calculus.

**Course Outcomes:**

1. Apply the concept of limits, continuity, and differentiability of a function at a point.

2. Discuss the different types of sequences.
3. Discuss the nature of series of real numbers.
4. Apply the knowledge of vector calculus.

**Mapping of Course Outcomes with Programme Outcomes**

| Course Code | POs/ COs | PO1 | P02 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **B19PC4050** | CO1 | **3** | **3** | **3** | **3** | | | **1** | **3** | **3** | **3** |
| | CO2 | **3** | **2** | **1** | **2** | | | **1** | **2** | **3** | **3** |
| | CO3 | **3** | **2** | **2** | **2** | | | **1** | **2** | **3** | **3** |
| | CO4 | **3** | **3** | **3** | **3** | | | **1** | **3** | **3** | **3** |

**Course Contents:**

**Unit-I: Differential Calculus-4** **12 Hrs**

Limits and continuity, L-Hospital rule, Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's theorem, Maclaurin's series.

**Unit-II: Sequences of Real Numbers** **12 Hrs**

Definition of a sequences, Bounded sequences, Limit of a sequences, Convergent, Divergent and Oscillatory sequences, Monotonic sequences and their properties, Cauchy's criterion.

**Unit-III: Series of Real Numbers** **12 Hrs**

Definition of convergence, Divergence and oscillation of series, Properties of convergent series, Properties of series of positive terms, Geometric series, Tests for convergence of series, p-series, comparison of series, Cauchy's root test, D'Alembert's test, Raabe'stest, Absolute and conditional convergence, D'Alembert's test for absolute convergence, Alternating series, Leibnitz test, summation of binomial, Exponential and logarithmic series.

**Unit-IV: Vector Calculus-1** **12 Hrs**

Velocity, Acceleration, Angle between two vectors, Tangential normal vector, Gradient, Divergence of a scalar point function and Curl of a vector point function, Directional derivative, Unit normal to a surface, Solenoidal and irrotational vectors, Physical interpretation of divergence and Curl of a vector point function.

**Text Books:**


1. Shanthi Narayan and P KMittal, Differential Calculus, Reprint. New Delhi: S. Chand & Company Ltd., 2011.
2. G K Ranganath, Text book of B.Sc. Mathematics, Revised ed., New Delhi, India: S Chand and Company Ltd., 2011.


**Reference Books:**


1. S Narayanan &ManicavachogamPillay, Vector Algebra and Analysis, 4th ed.: S V Publishers, 1986.
2. RaisinghaniaMd, SaxenaHc, and DassHk, Simplified course in Vector Calculus, 1st ed. New Delhi, India: S. Chand and Company Ltd., 2002.
3. Maurice D Weir, Joel Hass and Frank R. Giordano, Thomas calculus, 11th Edition, Pearson Publications, 2008.

| Course Code | Course Title | Course Type | L | T | P | C | Hrs/Week |
|---|---|---|---|---|---|---|---|
| B19PC4060 | **Soft Skill Training** | RULO | 1 | 1 | 0 | 2 | 3 |

**Note:** Soft Skill Training courses are organised by the **Placement and Training Centre**. The students have to undergo Soft Skill Courses conducted by the said Centre.

| B19PC4070 | Physics Lab - IV | L | T | P | C |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **0** | **0** | **2** | **2** |

**Prerequisites:**

This is a laboratory course which covers experiments related to simple harmonic motion waves, basic theory of light and optical phenomenon like diffraction, interference and polarization.

**Course Objectives:**

1. Develop experimental skills and study practical applications of electricity and magnetism
2. Create and describe series and parallel LCR circuits
3. Study and analyse application of Ballistic galvanometer and CRO
4. Describe the properties of magnetism by plotting B-H Curve.

**Course Outcomes:**

On successful completion of this course, the student is expected to be able to:

1. Draw frequency response of circuits containing R, L and C components;
2. Verify the laws combination of capacitors
3. Design low pass and high pass filters for different frequency and quality factor.
4. Draw magnetic hysteresis and find coercive field and hysteresis loss

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **B19PC4070** | **CO1** | **3** | **2** | **1** | **1** | | | **1** | **3** | **3** | **2** |
| | **CO2** | **3** | **2** | **3** | **2** | | | | **2** | **3** | **2** |
| | **CO3** | **3** | **3** | **3** | **3** | | | **2** | **3** | **3** | **3** |
| | **CO4** | **3** | **2** | **2** | **2** | | | **2** | **2** | **3** | **2** |

**Course Contents:**

Any **Eight** of the Following Experiments

1. Anderson's Bridge – Determination of the self-inductance of the coil.
2. de-Sauty bridge – Verification of laws of combination of capacitances.
3. High resistance by leakage using BG or relevant method

4. BH using Helmholtz double coil galvanometer and potentiometer.
5. Capacity of a condenser using a BG.
6. LCR series circuit – Determination of L & Q factor.
7. Voltage triangle – Measurement of phase difference.
8. Low and High pass filters – Determination of the cut-off frequency.
9. LCR parallel circuit – Determination of L & Q factor.
10. To study the variation of $X_C$ with f and determination of C.
11. Black box – Identification of L, C& R.
12. CRO – determination of voltage and frequency.
13. Determine the magnetic field at the center of the Solenoid.
14. Determine the Hall voltage.

| B19PC4080 | Chemistry Lab-IV | L | T | P | C |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **0** | **0** | **2** | **2** |

**Prerequisites:**

Theory of conductometry, potentiometry and chemical kinetics.

**Course Objectives:**

1. Knowledge on different analytical instrumentation techniques for the estimation of analyte.
2. Apply the laboratory skills in quantitative techniques.
3. Understand the importance electrodes in physical related experiments.
4. Compare the involvement various physical properties in experiments.

**Course Outcomes:**

1. Analyse the importance of instruments while conducting lab experiments.
2. Demonstrate the experimental skills in labs.
3. Operate and interprete experimental data.
4. Identify the causes for unexpected results and to the reach better results.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC4080 | **CO1** | **1** | **2** | **1** | **1** | **1** | **1** | **1** | **1** | **2** | **1** |
| | **CO2** | **2** | **2** | **1** | **1** | **1** | **2** | **1** | **1** | **2** | **2** |
| | **CO3** | **1** | **2** | **1** | **2** | **1** | **2** | **1** | **1** | **1** | **1** |
| | **CO4** | **2** | **1** | **1** | **2** | **1** | **1** | **2** | **1** | **1** | **2** |

**Course Contents:**

1. Hydrolysis of methyl Acetate or Ethyl Acetate at Constant temperature.
2. Potentiometric titration of $KMnO_4$.
3. Conductometric estimation of Strong Acid using Strong Base
4. Potentiometric titration of Fe.
5. Conductometric estimation of mixture of Acids.

6. Colorimeteric estimation of $Cu^{2+}$ ion using $NH_4OH$ as complexing agent.
7. Determination of percentage composition of sodium chloride solution by determining the miscibility temperature of phenol - water system.
8. Determination of disibution coefficient of iodine in water and carbon tetra chloride.
9. Determination of molecular weight of a polymer material by viscosity measurements (celluloseacetate/methyl acrylate).
10. Study of kinetics of reaction between $K_2S_2O_8$ and KI, second order, determination of rate constant.

**Reference Books for Practicles**


1. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).
2. S.W. Rajbhoj and T. K. Chondhekar, Systematic Experimental Physical Chemistry Anjali Publication, Second Edition 2000.
3. Sunita Rattan, Experiments in Applied Chemistry, S.K. Kataria & Sons, Second edition, 2008.
4. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).
5. Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. Experiments in Physical Chemistry.


| B19PC4090 | Mathematics Lab-IV | L | T | P | C |
|---|---|---|---|---|---|
| Duration:14 Wks | | 0 | 0 | 2 | 2 |

**Prerequisites:**

Differentiation, integration, basic concepts of arithmetic and algebra.

**Course Objectives:**

1. Acquire skill in solving problems on differential calculus using *Scilab*/*Maxima*.
2. Gain proficiency in using *Maxima* to solve problems of Rolle's Theorem, Lagrange's Mean Value Theorem, Cauchy's Mean Value Theorem, and Taylor's Theorem.
3. Acquire proficiency in using *Maxima* to solve the concept of sequence and series of real numbers
4. Obtain skill in creating programs on vector calculus using *Scilab* and *Maxima*.

**Course Outcomes:**

1. Apply the concept of limits, continuity, and differentiability of a function at a point using *Maxima*.
2. Demonstrate the use of Maxima to understand and interpret the core concepts in sequences and series.
3. Discuss the nature of series of real numbers using *Maxima*.
4. Apply the knowledge of vector calculus.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC4090 | CO1 | 3 | 2 | 2 | 1 | | | 1 | 1 | 3 | 2 |
| | CO2 | 3 | 2 | 2 | 1 | | | 1 | 1 | 3 | 3 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **CO3** | **3** | **2** | **2** | **1** | | | **1** | **1** | **3** | **2** |
| | **CO4** | **3** | **2** | **2** | **1** | | | **1** | **1** | **2** | **2** |

**Course Contents:**

1. To verify continuity of a function.
2. Evaluation of limits by L hospital's rule.
3. To verify Rolle's theorem for a given function.
4. To verify Lagrange's mean values theorem for a given function.
5. To verify Cauchy's mean values theorem for a given function.
6. To verify Taylor's theorem for a given function.
7. To verify whether given sequence is convergent divergent and oscillatory.
8. To verify whether given series is convergent, divergent and oscillatory.

**Text Books:**


1. SCILAB: A Practical Introduction to Programming and Problem Solving [Print Replica] Kindle Edition by Tejas Sheth (Author).
2. The Maxima Book Paulo Ney de Souza Richard J. Fateman Joel Moses Cliff Yapp 19th September 2004.

## FIFTH-SEMESTER

| B19PC5010 | **Quantum Mechanics** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **1** | **1** | **0** | **2** |

**Prerequisites:**

Basic concept s of wave dualism and quantum mechanics.

**Course Objectives:**

1. To have a clear understanding of the principles of quantum mechanics
2. To understand the laws of quantum mechanics
3. To know the application of Schrodinger wave equations and quantum concepts
4. To implement and understand of vector atom model to explain the various models.

**Course Outcomes:**

On completion of this course the student will be able to:

1. Understand the mathematical representations of particle Properties of Waves and analysis used in quantum mechanics.
2. Postulate the basics of quantum mechanics.
3. Apply Schrodinger wave equation for one dimensional problem like, particle in a box, hormonic oscillator etc.
4. Analyse the different atomic models by vector atom model.

**Mapping of Course Outcomes with programme Outcomes**

| **Course Code** | **POs/ COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC5010 | **CO1** | **3** | **3** | **2** | **3** | **2** | | | | **2** | **1** |
| | **CO2** | **3** | **3** | **2** | **3** | **2** | | | | **3** | **3** |
| | **CO3** | **3** | **3** | **1** | **3** | **2** | | | | **3** | **2** |
| | **CO4** | **3** | **3** | **2** | **3** | **2** | | | | **3** | **3** |

**Course Contents:**

**UNIT-I: Wave particle dualism** **9 Hrs**

Introduction, Photoelectric Effect, Quantum Theory of Light, The Compton Effect; Expression, De-Broglie waves, Wave function, de Broglie Wave Velocity, Wave and Group velocities, G. P. Thomson's experiment, The Uncertainty principle and its applications, The Wave Particle Duality, problems.

**UNIT-II: Schrödinger's Equation:** **9 Hrs**

Introduction, Schrödinger's Equation: Time dependent form, Probability current, Expectation Values, Operators, Schrödinger's Equation: Steady-state form, Eigen values and Eigen functions and probability density, Problems.

**UNIT-III: Applications of Quantum Mechanics: 9 Hrs**

Introduction, the particle in a box: energy quantization, wave functions, momentum Quantization, the Harmonic Oscillator-Energy level, the particle in a three-dimensional box quantum dots, tunneling effect; applications, problems.

**UNIT-IV: Vector atom model: 9 Hrs**

Introduction to atomic models; Rutherford's; Bohr's; Sommerfeld's; vector atom model; Quantization principles; momentum and spin; Quantum numbers –Total quantum number, Orbital quantum number, Magnetic quantum number (qualitatively). Space quantization, Stern-Gerlach experiment, Zeeman effect – theories of normal and anomalous Zeeman effect, Paschen back effect-Qualitative only

**Books Recommended:**


1. Perspectives of Modern Physics-Arthur Beiser (McGraw-Hill Int.Edition)
2. Modern physics – R. Murugeshan (S. Chand & Co. XIth Revised edition)
3. Text Book of Quantum mechanics – Kakani & Chandaliya ((S. Chand & sons)
4. Quantum Mechanics – Chatwal and Anand (Himalaya Publishing)
5. Quantum Mechanics- Ghatak and Loknatha
6. Ghatak, A, Introduction to Quantum Mechanics, Macmillan India Ltd, 2000
7. Schiff, L. I., Quantum Mechanics, III Edition, McGraw Hill, 1968


| B19PC5020 | Chemistry –V | L | T | P | C |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **1** | **1** | **0** | **2** |

**Prerequisites:**

Knowledge of absorbate and adsorbent, polarity of solvents, Brags law, electromagnetic radiation, interaction of electromagnetic radiation with matter.

**Course Objectives:**

1. To impart basic knowledge about different Chromatographic techniques.
2. To introduce the principle involved in X-ray diffraction and crystallography.
3. To enhance the idea of different phase rules and diagrams of one and two component systems.
4. To introduce the basic aspects of spectroscopies such as Molecular spectroscopy (rotational spectroscopy, vibrational spectroscopy, and Raman spectroscopy) and photochemistry.

**Course Outcomes:**

On the successful completion of this course, the student shall be able to:

1. Understand the basic principles and different types of chromatographic techniques and evaluate $R_f$ value.

2. Define laws of crystallography and understand the importance of crystallography to solve the crystal structure.
3. Explain the Phase diagram of different component systems.
4. Illustrate the basic principles involved in different molecular spectroscopic techniques and give selection rules and brief the laws of photochemistry.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC5020 | CO1 | 2 | 1 | 1 | 1 | | | 1 | 2 | 1 | 2 |
| | CO2 | 3 | 2 | 2 | 1 | | | 1 | 2 | 2 | 2 |
| | CO3 | 2 | 1 | 1 | | | | | | | 2 |
| | CO4 | 2 | 1 | 1 | 1 | | | 1 | 1 | 2 | 2 |

**Course Contents:**

**UNIT-I** **9 Hrs**

**Chromatography**:

Introduction, classification of chromatographic techniques.

Column Chromatography: Principles, experimental procedures, Stationary and mobile Phases, Separation technique.

Paper Chromatography: introduction, Principles, Rf values, experimental procedures, choice of paper and solvent systems, developments of chromatogram - ascending, descending and radial. Two-dimensional chromatography, applications

Thin layer Chromatography (TLC): Advantages. Principles, factors effecting Rf values. Experimental procedures. Adsorbents and solvents. Preparation of plates. Development of the chromatogram. Detection of the spots. Applications.

Ion Exchange chromatography-separation of anions and cations,

HPLC: Basic principles and applications.

**UNIT-II** **9 Hrs**

**Basics of Crystallography:** Classification of solids, Laws of crystallography – (i) Law of constancy of interfacial angles (ii) Law of rationality of indices (iii) Law of symmetry. Symmetry elements of crystals. Definition of unit cell & space lattice. Bravais lattices, crystal system. X-ray diffraction by crystals. Derivation of Bragg equation and its application in the determination of crystal structure of NaCl (Numericals).

**Phase Rule:** Definition of terms: Phase, components and degrees of freedom – Derivation of Gibbs phase rule. One component system: Water and Sulphur system, Reduced phase rule.

Two component system: Simple eutectic system: Pb-Ag system, KI-water system freezing mixtures. Thermal analysis and cooling curves, Compound formation with congruent melting point Zn – Mg, $FeCl_3$ – Water system.

**UNIT-III** **9 Hrs**

**Molecular spectroscopy:** The basis of absorption and emission of radiation by molecular species, the wave properties of the light, the quantum theory of light, quantum theory of matter, molecular energies and the types of molecular motion.

Rotational spectroscopy – classical description of molecular rotation, quantum mechanics of molecular motion, rotational spectra, rotational energy levels (from Schrodinger equation), selection rules. determination of the bond length from rotational constants,
Vibrational spectroscopy – Quantum description of molecular vibrations, vibrational selection rules, harmonic and a harmonic vibration, vibration of polyatomic molecules.
Raman Spectroscopy – description of Raman scattering, Rayleigh scattering, Stokes and anti-Stokes scattering, polarizability of the molecules, rotational Raman spectra, Comparision of Raman and IR.

**UNIT-IV** **9 Hrs**

**Photochemistry:** Beer-Lamberts law. Primary and secondary processes in photochemical reactions. Photochemical and thermal reactions. Photoelectric cells.

**Organic Photochemistry:** Introduction, types of photochemical reactions-laws of photochemistry, photo dissociation - isomerization- cyclisation- dimerization and oxetane formation. Norrish-I and II reactions. Barton reaction- photo Fries rearrangement, Paterno Buchi reaction.

**Laws of Photochemistry**: Grotthuss-Draper law, Stark-Einstein law, Differences between photophysical and photochemical processes with examples. Comparison of photochemical and thermal reactions. Quantum yield of photochemical combination of (1) $H_2$ - $Cl_2$ (2) $H_2$ - $Br_2$
(3) dissociation of HI (4) dimerisation of anthracene. Photosensitization, photostationary equilibrium. Qualitative description of, Fluorescence, Phosphorescence, photosensitized reactions and energy transfer processes.

**Reference Books:**


1. Peter W. Atkins – Physical Chemistry, eighth Edition, New York, 2006, Chapters 10-15, page 320-5
2. Peter W. Atkins, Julio De Paula, Physical Chemistry for the Life Sciences, New York, 2011
3. Peter J. Larkin, IR and Raman Spectroscopy, Principles and Spectral Interpretation, Elsevier, 2011.
4. Basic concepts of Analytical Chemistry. S. M. Khopkar New Age International
5. Selected Topics in Inorganic Chemistry.Madan, Malik, Tuli S. Chand & Company.
6. Instrumental methods of Chemical analysis.B. K. Sharma Goel Publishing House.
7. Analytical Chemistry Willard, Meritind &Dean New Age Publications.
8. Instrumental methods of Chemical analysis H. H. Willard, L. L. Merrite, K. A. Dean& F. A. Kettle CBS Publishers.
9. Analytical Chemistry John.H. Chenady Saunders College, Publishing New York Tokyo.
10. Physical Chemistry R. P. Verma Pradeep Publication.
11. Kinetics of Chemical Reactions S. K. Jain Vishal publications, Jalandhar.New Delhi.
12. Physical Chemistry M. Kundan & S. K. Jain S. Chand & Company.
13. Text book of Physical Chemistry K. K. Sharma & C. K. SharmaVani Educational Books.


| B19PC5030 | Mathematics –V | L | T | P | C |
|---|---|---|---|---|---|
| Duration:14 Wks | | 1 | 1 | 0 | 2 |

**Prerequisites:**

Knowledge of trigonometry, geometry and calculus.

**Course Objectives:**

1. Learn to evaluate multiple integrals.
2. Learn to evaluate volume and surface integrals.
3. Understand the concepts in vector spaces and Linear Transformations.
4. Gain problems solving skills in solving vector spaces and linear transformations.

**Course Outcomes:**

1. Apply fundamental theorem to evaluate area, region and volume of geometrical bodies using Green's theorem, Stoke's theorem or Gauss divergence theorem.
2. Describe and manipulate vector spaces, subspaces and their bases.
3. Determine the kernel, image space and matrix representation of a linear transformation.
4. To become proficient in solving computational problems of linear algebra.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC5030 | CO1 | 3 | 3 | 2 | 3 | 2 | | | | 2 | 1 |
| | CO2 | 3 | 3 | 2 | 3 | 2 | | | | 3 | 3 |
| | CO3 | 3 | 3 | 1 | 3 | 2 | | | | 3 | 2 |
| | CO4 | 3 | 3 | 2 | 3 | 2 | | | | 3 | 3 |

**Course Contents:**

**Unit-I: Multiple Integral** **9 Hrs**

Applications of Integral Calculus: Computation of length of arc, Plane area and surface area and volume of solids of revolutions for standard curves in Cartesian and Polar forms.
Evaluation of double integrals and triple integrals, Evaluation of double integrals over the given region, By changing the order of integration, By change of variables, Application to area and volume – illustrative examples.

**Unit-II: Vector integration** **9 Hrs**

Line integrals, Definition and problems, Surface and volume integrals, Green's Theorem, Stoke's and Gauss divergence theorem.

**Unit-III: Linear Algebra – 1** **9 Hrs**

Vector spaces, General properties of vector spaces, Vector subspaces, Algebra of subspaces, and Linear combination of vectors. Linear span, linear sum of two subspaces, Linear independence and dependence of vectors, Basis of vector space.

**Unit-IV: Linear Algebra – 2** **9 Hrs**

Finite dimensional vector spaces, Dimension of a vector space, Dimension of a subspace. Linear transformations, Linear operators, Range and null space of linear transformation, Rank and nullity of linear transformations.

**Text Books:**


1. Shanthi Narayan, Integral Calculus, Reprint. New Delhi: S. Chand and Company Ltd., 2004.
2. G K Ranganath, Text book of B.Sc. Mathematics, Revised ed. New Delhi, India: S Chand and Company Ltd., 2011.


**Reference Books:**

1. Erwin Kreyszig, Advanced Engineering Mathematics, 8th edition. New Delhi, India: Wiley India Pvt. Ltd., 2010.
2. S Narayanan & M Pillay, Vector Algebra and Analysis, 4th edition.: SV Publisher, 1986.
3. Raisinghania Md, Saxena Hc, and DassHk, Simplified course in Vector Calculus, 1st ed. New Delhi, India: S. Chand and Company Ltd., 2002.

| B19PC5040 | Mathematics -VI | L | T | P | C |
|---|---|---|---|---|---|
| Duration:14 Wks | | 1 | 1 | 0 | 2 |

**Prerequisites:**

Knowledge of basics limits, continuity, differentiation, integration, matrices, determinants, and geometry.

**Course Objectives:**

1. Use computational tools to solve problems and applications of partial differential equations.
2. Get familiar with the theories on rings, integral domains and fields.
3. Introduce the basic concepts of abstract algebra
4. To understand the concepts of solid geometry and its applications in various fields.

**Course Outcomes:**

1. Formulation of PDE by eliminating arbitrary constants and functions, solve linear PDEs using Lagrange's auxiliary equation and solve nonlinear PDE's of first order by Charpit's method.
2. Familiarize with partial differential equations and its applications to standard problems like Heat, Wave and Laplace.
3. Explain the fundamental concepts of abstract algebra such as rings, fields and their role in modern mathematics and applied contexts.
4. Apply the concepts of solid geometry and to solve problems of various fields.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC5040 | CO1 | 3 | 3 | 2 | 3 | 2 | | | | 3 | 3 |
| | CO2 | 3 | 3 | 2 | 3 | 2 | | | | 3 | 3 |
| | CO3 | 3 | 3 | 2 | 3 | 2 | | | | 3 | 2 |
| | CO4 | 3 | 2 | 1 | 2 | 2 | | | | 3 | 3 |

**Course Contents:**

**Unit-I: Partial Differential Equations – 1** **9 Hrs**

Formation of partial differential equations by eliminating arbitrary constant and functions, Solution of non homogeneous PDE by direct integration, Solution of homogeneous PDE involving derivative with respect one independent variable only, Solution of Lagrange's linear PDE by the method of separation of variables.

**Unit-II: Partial Differential Equations – 2** **9 Hrs**

Homogeneous linear equations with constant coefficients, Rules for finding complementary function, Rules for finding particular integral, Non homogeneous linear equations, Non linear equations of the second order.

**Unit-III: Rings and Integral Domain** **9 Hrs**

Definition and basic properties, Fields, Integral domains, Divisors of zero and Cancellation laws, Integral domains, The characteristic of a ring, Some non – commutative rings, Examples, Matrices over a field, The real quaternions, Homomorphism of Rings – Definitionand elementary properties, Maximal and Prime ideals, Prime fields.

**Unit-IV: Solid Geometry** **9 Hrs**

The Plane: Equation of plane in terms of its intercepts on the axis, Equations of the plane through the given points, Length of the perpendicular from a given point to a given plane, Bisectors of angles between two planes, Combined equation of two planes, Orthogonal projection on a plane.

The Line: Equations of a line, Angle between a line and a plane. The condition that a given line may lie in a given plane, The condition that two given lines are coplanar, Number of arbitrary constants in the equations of a straight line. Sets of conditions which determine a line, The shortest distance between two lines. The length and equations of the line of shortest distance between two straight lines, Length of the perpendicular from a given point to a given line, Intersection of three planes, Triangular Prism.

**Text Books:**


1. M D Raisinghania, Ordinary and Partial Differential Equations, S Chand and Co. Pvt. Ltd., 2014.
2. Shanthi Narayan, Analytical Solid Geometry. New Delhi: S. Chand and Co. Pvt. Ltd., 2004.


**Reference Books:**


1. John B Fraleigh, A First course in Abstract Algebra, 3rd ed.: Narosa Publishing House., 1990.
2. R. Balakrishan and N. Ramabadran, A Textbook of Modern Algebra, 1st ed. New Delhi, India: Vikas publishing house pvt. Ltd., 1991.
3. Erwin Kreyszig, Advanced Engineering Mathematics, 8th ed.: New Delhi, India: Wiley India Pvt. Ltd., 2010.


| B19PC5051 | **Renewable Energy Resource** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **0** | **0** | **2** |

**Prerequisites:**

Basic concept s of energy and its applications.

**Course Objectives:**

1. To understand the various forms of conventional energy resources.
2. To learn the present energy scenario and the need for energy conservation
3. To explain the concept of various forms of renewable energy

4. To outline division aspects and utilization of renewable energy sources for both domestics and industrial application
5. To analyse the environmental aspects of renewable energy resources.

**Course Outcomes:**

On completion of this course the student will be able to:

1. Compare the prospects of Solar, Wind and bio energy systems,
2. Discuss the latest developments of solar energy resources and its utilization.
3. Estimation of wind energy for energy generation
4. Describe the applications of solar energy.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC5051 | CO1 | 3 | 3 | 2 | 3 | 2 | | | | 2 | 1 |
| | CO2 | 3 | 3 | 2 | 3 | 2 | | | | 3 | 3 |
| | CO3 | 3 | 3 | 1 | 3 | 2 | | | | 3 | 2 |
| | CO4 | 3 | 3 | 2 | 3 | 2 | | | | 3 | 3 |

**Course Contents:**

**UNIT I: Sources of Renewable Energy** **6 Hrs**

Solar, wind, Biomass availability, merits and demerits. Hydrogen as a source. Various forms of energy, Types of energy reservoirs, photo-thermal and photovoltaic systems, geothermal systems, wind energy

Solar cooker, Solar dryer, solar hot water systems- Principles, Working and its applications.

Solar lantern, Water Pumps and Street lights- Principles, Working and its applications.

**UNIT–II: SOLAR Energy & its utilization** **6 Hrs**

SOLAR Energy & its utilization: Origin of Solar Energy, Spectral distribution of Solar radiation, Attenuation of beam radiation, Basic earth solar angle and derived solar angle, GMT, LCT, LST, Day length, Estimation of average solar radiation, sunshine recorder Principle of conversion of solar energy into heat.

**UNITS–III: Energy storage & Fuel cells:** **6 Hrs**

Sensible heat storage liquids and solids, latent heat storage, thermo chemical storage, storage through charged batteries and its applications, Classification of solar collectors, Flat plate and concentrating collectors, construction, Thermal efficiency and coating, Heat losses, Solar cell and its efficiency, P.V. Panels.

Design and Principle of operation, Classification, Types, Advantages and disadvantages, Conversion efficiency, Types of electrodes, Work output and EMF of Fuel Cells, Applications of Fuel Cells.

**UNIT–IV: Wind Energy & Ocean Energy** **6 Hrs**

Estimation of energy obtainable from wind, Velocity and power duration curves, energy pattern factors, Theory of power Momentum transfer, power Coefficients, Principle of Wind turbine, Types of wind driven Machine Horizontal and vertical axis types and applications.

Energy from Sea waves, Ocean Thermal energy- temperature gradient in sea and their use for power generation and its applications.

**Books Recommended:**


1. J. T. MacMillan, R. Morgan & R. B. Murray: Energy Resources, 2nd edition, 2002.
2. S. P. Sukhatme: Solar Energy Principles & Thermal Collection & Storage, 2nd edn, TMH, New Delhi 2010.
3. G. D. Rai: Solar Energy Utilization, 5th edition, Khanna Publishers, New Delhi 2012.
4. G. D. Rai: Non-Conventional Energy sources, 4th edition, New Delhi 2010.
5. E. W. Golding: The Generation of Electricity (by wind) Prentice hall, New York 2007


| B19PC5052 | **Solid State Physics** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **0** | **0** | **2** |

**Prerequisites:**

Fundamentals of solid-state Physics.

**Course Objectives:**

1. To provide basic knowledge of the types of solids and their structure
2. To understand how structure effects different properties of the solids.
3. To impart the knowledge of different phenomenon's taking place in the solids.
4. To give the insight of different applications with the solids.

**Course Outcomes:**

On completion of this course the student will be able to:

1. Discuss the concepts of crystal structure.
2. Classify the solids based on their structure details.
3. Analyze the behavior of solids under different conditions like heat, optical and electrical treatments.
4. Compare the different models or theories.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **B19PC5052** | **CO1** | **3** | **2** | **2** | **2** | **2** | | | | **3** | **1** |
| | **CO2** | **3** | **3** | **2** | **2** | **1** | | | | **3** | **2** |
| | **CO3** | **3** | **3** | **2** | **2** | **1** | | | | **3** | **1** |
| | **CO4** | **3** | **3** | **2** | **2** | **1** | | | | **3** | **1** |

**Course Contents:**

**UNIT -I:** **6 Hrs**

**Statistical Physics:** The Maxwell-Boltzmann. Bose-Einstein and Fermi-Dirac energy distribution formulae (no derivation). A qualitative comparison of the three distribution formulae.

**Bonding in Crystals:** Inter atomic forces and types of Bond in a crystal, properties and characteristics of -Ionic bond, covalent bond, Metallic bond, Molecular bond and Hydrogen bond.

**UNIT -II:** **6 Hrs**

**Thermal properties of solids:** Dulong and Petit's law and its limitations. Einstein's theory of specific heat. Debye's theory of specific heat.

**Electrical properties of Metals:** Band theory of solids-review, Free electron theory of metals - Classical theory and Quantum Theory. Expression for electrical conductivity-Ohm's law. Weidman-Franz law, Density of states. Expression for the Fermi energy, Hall effect and magneto resistance in metals. Expression for Hall co-efficient in metals.

**UNIT -III:** **6 Hrs**

**Dielectric properties:** Dielectric materials and its properties, Methods of determining dielectric constant for solids and liquids.

**Superconductivity:** Elementary ideas and experimental facts. Meissner's effect. Magnetic properties of type-I and type-II superconductors, Critical magnetic field. Influence of external agents on superconductivity, Cooper pairs, BCS theory (qualitative), Applications of superconductivity. introduction to high-temperature superconductors.

**UNIT -IV:** **6 Hrs**

**X-rays:** Bragg's law and the Bragg spectrometer. A brief mention of the different types of crystals. Miller indices, structure of NaCl and CsCl crystals. Continuous x-ray spectra, Duane and Hunt limit. Characteristic x-ray spectra. Mosley law and its significance. Compton effect- expression for Compton shift.

**Lasers:** General principles. Three level laser-action The He-Ne laser- construction and working, Applications of Laser - Laser Cooling, Material Processing (Lasers in Welding, Drilling, and Cutting), Medicine, Laser-induced Fusion, Laser Soldering, scribing, Laser Heat Treatment, LIDAR

**Books for Reference:**


1. Hugh D. Young, Roger A Freedman and A. Lewis Ford: University Physics 13th edition
2. Arthur Beiser: Concepts of modern physics,6th edition, TMH, New Delhi.2008.
3. J.B. Blackmore: Introduction to solid state physics 2nd Edition reprint, Press Syndicate of the University of the Cambridge, United Kingdom, 1998
4. M A Wahab, solid state physics 2nd Edition, Narosa Publishing House, New delhi.2009.
5. A. J. Dekkar: Solid State physics, MACMILLAN & CO LTD, Reprint, 1967
6. MN Avadhanulu, An Introductions to LASERS-Theory & Applications, S Chand & Co,
7. A.K. Saxwna, Atomic and Molecular Spectra and Lasers, 1st Edition, CBS Publishers and
1. Distributors 2009
8. B B Laud, Lasers and Non-linear optics, 2nd Edition, New age International, New Delhi.2004
9. B S Saxsena, R C Guptha and P N Saxsena, Fundamentals of Solid-State Physics, 17th edition, Pragathiprakashana, Meerut 2000.


| B19PC5053 | **Semiconductor Physics** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **0** | **0** | **2** |

**Prerequisites:**

Fundamentals of semiconducting devices.

**Course Objectives:**

1. To explain the underlying physics of semiconductor materials.
2. To explore the internal behaviour of semiconductor devices.

**Course Outcomes:**

On completion of this course the student will be able to:

1. Derive expressions for conductivity and energy gap in semiconductors.
2. Explain Fermi level, carrier concentration and hall effect.
3. Explain the working of semiconductor devices like Zener diode, transistor, FET
4. Explain the working of optoelectronic devices like Solar cells, Photodiode, LED.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC5053 | CO1 | 3 | 2 | 2 | 2 | 1 | | | | 3 | 1 |
| | CO2 | 3 | 3 | 2 | 2 | 1 | | | | 3 | 2 |
| | CO3 | 3 | 3 | 2 | 2 | 1 | | | | 3 | 1 |
| | CO4 | 3 | 3 | 2 | 2 | 1 | | | | 3 | 1 |

**Course Content:**

**UNIT I: Band Theory:** **6 Hrs**

Concept of bands in solids, intrinsic and extrinsic semiconductor. depletion region, drift velocity, expression for electron and hole concentration in intrinsic semiconductor under thermal equilibrium, Derivation of the expression for electrical conductivity of intrinsic semiconductors, electron & hole mobilities, effective mass, Expression for the energy gap.

**UNITS–II: Effect of Temperature and Doping:** **6 Hrs**

Variation of conductivity with temperature Fermi level, Expression for Fermi level in extrinsic semiconductors- both P and N type. Diffusion current and total current, Life time of charge carriers, Variation of Fermi level with temperature and impurity concentration.

**UNIT–III: Semiconductor Devices:** **6 Hrs**

I-V Characteristics of diode, Zener diode, Transistor, working of transistor in CB, CC and CE configuration mode, Photo diode working and its applications.

**UNIT–IV: Applications of Semiconductor devices:** **6 Hrs**

Phenomena of Photo conductivity expression for Photo emf of P-N junction, Photo voltaic cells, LED and FET construction, working and its applications.

**Books Recommended:**

1. R K Puri and V K Babbar, Solid State Physics and Electronics, S Chand & Co, New Delhi 1997.

2. B S Saxsena, R C Guptha and P N Saxsena, Fundamentals of Solid-State Physics, 17th edition, P Prakashana, Meerut 2000.

| B19PC5061 | **Hetero Cyclic Chemistry & Chemistry of Natural Products** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **0** | **0** | **2** |

**Prerequisites:**

Knowledge of hydrocarbons, heteroatoms like S, N, and O, biomolecules like carbohydrates, proteins, vitamins.

**Course Objectives:**

1. Explain the fundamental concept of structure, bonding and properties in heterocyclic compound.
2. Discuss the structural elucidation of certain organic compounds.
3. Illustrate the chemical route synthesis of some biomolecules (carbohydrates) and natural product.
4. Explain the basic concept of drugs, types of drugs and name of common drugs.

**Course Outcomes:**

1. Analyze the different types, reactivity and aromatic character of heterocyclic compounds
2. Predict the structure and chemical route synthesis of some organic compounds.
3. Classify the different types of common drugs and its synthesis.
4. Discuss the topics include chemical strategy used to elucidate natural product pathways.

**Mapping of Course Outcomes with programme Outcomes**

| **Course Code** | **POs/ COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC5061 | **CO1** | **1** | **1** | **1** | **2** | | | | **1** | **1** | **1** |
| | **CO2** | **1** | **1** | **2** | **3** | | | | **1** | **1** | **1** |
| | **CO3** | **1** | **1** | **1** | **2** | | | | **2** | **1** | **3** |
| | **CO4** | **1** | **1** | **2** | **2** | | | | **2** | **1** | **2** |

**Course Contents:**

**UNIT-I** **6hrs**

**Heterocyclic Compounds:** Introduction, Nomenclature and classification five membered ring compounds with single hetero atom Ex: pyrrole, furan and thiophene, aromatic character and preparation from 1, 4 di carbonyl compounds, Paul Knorr synthesis. Properties: Acidic character of pyrrole –electrophilic substitution at 2, 5 positions, (nitration, sulphonation and halogenation) Diels alder reactions in furan. Pyridine: Structure- Basicity –aromaticity-comparison with pyrrole-one method of preparation and properties –reactivity towards Nucleophilic substitution reaction.

**UNIT-II** **6hrs**

**Terpenoids:** Occurrence, classification and isoprene rule. Structural elucidation and synthesis of citral. Structures of limonene, menthol, α-terpineol, camphor, β carotene and their uses.

**Alkaloids:** Introduction, classification and general characteristics. Structural elucidation and synthesis of nicotine. Structures and uses of ephedrine, caffeine, cocaine, atropine, quinine and morphine.

**Steroids:** Introduction, classification, synthesis of cholesterol.

**Antibiotics**- Definition, structure and synthesis of streptomycin and penicillin.

**UNIT-III** **6hrs**

**Carbohydrates:** Introduction, Definition, classification based on composition with examples-reducing and non-reducing sugars.

**Monosaccharides**

Structural elucidation of glucose in detail – evidence for cyclic structure of glucose (aldehyde test and mutarotation) determination of ring size (methylation, hydrolysis and oxidation reactions) pyranose structures (Haworth and chair conformational formule) Fischer and Haworth structures of fructose and galactose.

**Conversion reactions** – 1. Ascending (Kiliani's synthesis) 2. Descending (Wohl's degradation) 3. Aldose to ketose 4. Ketose to Aldose 5. Epimerization.

**Disaccharides:** Glycosidic bond, Structural elucidation of sucrose, structural formulae of maltose and lactose (Haworth structure).

**UNIT-IV** **6hrs**

**Drugs:** Chemotherapy and chemotherapeutic agents, definition of drugs, types of drugs, antipyretics, analgesics, anesthetics, sedatives, narcotics, antiseptics, antibacterials, antibiotics, antimalarials and sulpha drugs with examples. Synthesis of paracetamol, sulphanilamide, sulphaguanidine, Insectisides, Pesticides.

**Reference Books:**


1. Heterocyclic Chemistry Raj K. Bansal Tata Mcgraw Hill Publications.
2. A Text book of Organic Chemistry M. K. Jain S. Chand & Company.
3. A Text book of Organic Chemistry Bhal & Bhal S. Chand & Company.
4. A Text book of Organic Chemistry P. L. Soni S. Chand & Company.
5. Laboratory Manual of Organic Chemistry Raj K. Bansal New Age Publications.
6. Laboratory Manual of Organic Chemistry Jayaraman S. Chand & Company.
7. Chemistry of Natural products Aggarwal Goel Publishing House Meerut.
8. Organic Chemistry K. K. Sharma Shobhanlal & NaganCompany.
9. Organic Chemistry Puri & Sharma Shobhanlal & Nagan Company.
10. Medicinal Chemistry Ashuthosh Kar Tata Mcgraw Hill Publications.


| B19PC5062 | **Polymer Chemistry** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **0** | **0** | **2** |

**Prerequisites:**

Knowledge of momomers, polymers, rubbers, cellulose, inorganic polymers, polymer processing.

**Course Objectives:**

1. To realize the importance of monomer concept in polymers.
2. The foundation concepts of synthesis of various polymeric compounds.
3. Vital concepts in Biopolymers and their fundamental importance.
4. Reaction kinetics and foundation theory and relevant applications of the polymers.

**Course Outcomes:**

1. Assimilate the appreciate the foundation knowledge of polymer concepts, importance of polymers and molecular weight of the polymeric compounds.
2. Design and apply the knowledge of synthesis, applications of polymeric compounds.
3. Have realization of polymerization foundation in various processes.
4. Appreciate the physical basis in kinetics and mechanism of chain polymerization.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC5062 | **CO1** | **2** | **1** | **1** | | | | | | **1** | **1** |
| | **CO2** | **2** | **1** | **1** | **1** | **1** | | | | **1** | **1** |
| | **CO3** | **2** | **1** | **1** | **1** | **1** | | | | **1** | **1** |
| | **CO4** | **2** | **1** | **1** | **1** | **1** | | | **1** | **1** | **1** |

**Course Contents:**

**UNIT-I** **6hrs**

**Introduction to polymer Science**

History of macromolecular science. Concept of macromolecules. Degree of polymerization, Concept of molecular mass, polydispersity, number average and weight average, viscosity average molecular weight, molecular weight distribution in linear polymers (step growth and chain polymers), Nomenclature of polymers. Basic concepts in polymer science. Different ways in classification of polymers depending on – The origin (natural, Semisynthetic, synthetic etc.), The structure (linear, branched, network, hyperbranched, dendrimer.), The type of atom in the main chain (homochain, hetercohain).

The formation (condensation, addition). Homopolymers, copolymers. The behaviour on application of heat and pressure (thermoplastic andThermosetting). The form and application (plastics, fiber. elastomers and resin). Stereochemistry of polymers, Introduction to two types of polymerization Reactions viz. condensation and addition polymerization (without detailed mechanism and derivations), Monomer structure and polymerizability.

Concept of functionality. Writing the structure of the polymer formed for a given monomer and its classification. Raw materials for monomers with specific example viz. acrylonitrile, vinyl, chloride, methyl methacrylate, isoprene, styrene, hexamethylene diamine and adipic acid, caprolactum, ethylene glycol and their Polymerization reactions.

**UNIT-II** **6hrs**

**Inorganic polymers:** Definition – examples, general properties, comparison with organic polymers, **Silicones:** Definition, nomenclature, preparation (linear, cross- linked and cyclic). Factors affecting the nature of silicon polymers, properties (chemical and thermal stabilities, chemical properties) uses

of silicon polymers, silicon fluids/oils – uses, silicon elastomers – rubbers, silicon resins (preparation and uses). Synthesis, structural aspects and applications of siloxanes. Borazines, phosphazenes, and polysulphates.

**UNIT-III** **6hrs**

**Kinetics and Mechanism of Chain Polymerization Processes:**

Chain reaction (Addition) polymerization, Free radical addition polymerization mechanism of vinyl polymerization, generation of free radicals, initiation, propagation, termination, chain transfer inhibition of retardation, configuration of monomer units in vinyl polymer chains.

Kinetics of free radical addition polymerization – experimental determination of rate constants, derivations for rate expressions and expressions for kinetic chain length and hence degree of polymerization. Thermodynamics of free radical polymerization, effect of temp and pressure, enthalpies, entropies, free energies, activation energies polymerization. Ionic and coordination chain (addition) polymerization common features of two types of ionic polymerization, Mechanism of cationic polymerization, expressions for overall rate of polymerization and the number average degree of polymerization. Mechanism of anionic, polymerization, expressions for overall rate of polymerization and the average degree of polymerization.

**UNIT-IV** **6hrs**

**Biopolymer Interactions**

Synthesis of Biopolymers, Forces involved in biopolymer interaction. Electrostatic charges and molecular expansion, hydrophobic forces, dispersion force interaction. Multiple equilibria and various types of binding processes in biological system. Hydrogen ion titration curve. Thermodynamics of biopolymers. Vant's Hoff's law of osmotic pressure, Theory of osmotic pressure and semipermiability. Behaviour of cells and molecular weight determination from osmotic pressure measurements. Significance of osmosis in biology. Problem solving.

**TRANSPORT OF IONS:** Ion transport through cell membrane, irreversible thermodynamic treatment of membranetransport.

**BIOSENSORS:** Definition, types, sensors for environmental, medical, food safety and biosecurity applications.

**Reference Books**:


1. F.W. Billmeyer, Jr. Textbook of polymer science, Wiley- Interscience, N.Y. (1971)
2. Introduction to polymer chemistry, R. Seymour, Wiley –Interscience (1981)
3. Physical chemistry of Macromolecules, by D.D. Deshpande, Vishal publications, (1985)
4. Principles of polymer chemistry by P.J. Flory.
5. Polymer Science –V R Gowarikar.
6. Principles of polymerization, G. Odian, Wiley – Interscience (1981)
7. Principles of polymerization, G. Odian, Wiley – Interscience (1981)
8. Organic polymer chemistry, K. J. Saunders, Chapman and Hall, London (1973).
9. High performance polymers, their origin and development, by Seymour R. B. and Kirshenbaum G. S. Elservier.
10. Condensation polymers by interfacial and solution methods, Paul W. Morgen, Interscience publishers.
11. Industrial plastics: Theory applications by T. L. Richardson.
12. Organic chemistry of synthetic high polymers, Robert W. Lenz, Interscience publisher

| B19PC5063 | Industrial Chemistry | L | T | P | C |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **0** | **0** | **2** |

**Prerequisites:**

Knowledge of fuels, paints, glasses, alloys, fertilizers, cements, adhesives and refractories.

**Course Objectives:**

1. Train students to demonstrate knowledge of energy sources and lubricates.
2. Emphasis knowledge on properties of glass, ceramics, cements, additives and refractories and applications
3. Expand fundamental understanding on surface coating, properties, and application
4. Aim to provide knowledge on fertilizers, cosmetics, perfumes, and pesticides.

**Course Outcomes:**

1. Demonstrate knowledge of energy sources, lubricates and determination.
2. Create knowledge on properties of glass, ceramics, cements, additives and refractories and applications
3. Explore surface coating, properties, and application
4. Acquire knowledge on fertilizers, cosmetics, perfumes, and pesticides.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC5063 | **CO1** | **2** | **1** | **1** | | | | | | **1** | **1** |
| | **CO2** | **2** | | | **1** | **1** | | | | **1** | **1** |
| | **CO3** | **2** | | | **1** | **1** | | | | **1** | **1** |
| | **CO4** | **2** | | | **1** | **1** | | | | **1** | **1** |

**Course Contents:**

**UNIT-I** **6hrs**

**Fuel Chemistry:** Review of energy sources (renewable and non-renewable). Classification of fuels and their calorific value, Bomb calorimetric estimation of calorific value.

**Coal**: Uses of coal (fuel and non-fuel) in various industries, its composition, carbonization of coal. Coal gas, producer gas and water gas composition and uses.

**Lubricant**s: Classification of lubricants, lubricating oils (conducting and non-conducting) Solid and semisolid lubricants, synthetic lubricants. Properties of lubricants (viscosity index, cloud point, pore point) and their determination.

**UNIT-II** **6hrs**

**Glass**: Properties, types, manufacture of soda glass. Composition and applications of borosilicate, metallic glass, optical glasses and polycarbonate glass, safety glass, fire and bullet proof glasses.
**Ceramics:** Raw materials and their roles, varieties of clay, production of ceramic ware, glazing, ceramic insulators.
**Cement:** Raw materials grades, manufacture of Portland cement.
**Alloys:** Classification of alloys, Ferrous and Non-Ferrous alloys, Specific properties of elements in alloys
**Refractories:** Classification, properties of refractories and its failures. Applications of refractories.

**UNIT-III** **6hrs**

**Surface Coatings:** Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings. Paints and pigments-formulation, composition and related properties. Oil paint, modified oils, Pigments, Fillers, Thinners, Enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Dyes, Wax polishing, Water and Oil paints, additives, electrolytic and Metallic coatings (electroless), metal spraying and anodizing.

**UNIT-1V** **6hrs**

**Fertilizers**: Fertilizers: Different types of fertilizers. Manufacture of the following fertilizers: Urea, Ammonium nitrate, Calcium ammonium nitrate, Ammonium phosphates; Polyphosphate, Super phosphate.
**Cosmetics and Perfumes** -A general study including preparation and uses of the following: Hair dye, hair spray, Shampoo, Sun-tan lotions, face powder, lipsticks, talcum powder, nail enamel, creams (cold, vanishing and shaving creams).
**Pesticides**: General introduction to pesticides (natural and synthetic), benefits and adverse effects, changing concepts of pesticides, structure activity relationship, synthesis and technical manufacture and uses of representative pesticides in the following classes: Organochlorines (DDT, Gammexene,); Organophosphates (Malathion, Parathion); Carbamates (Carbofuran and carbaryl); Quinones ( Chloranil) , Anilides (Alachlor and Butachlor).

**Reference Books:**


1. O. P. Vermani, A. K. Narula: Industrial Chemistry, Galgotia Publications Pvt. Ltd., New Delhi.
2. E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK
3. W. D. Kingery, H. K. Bowen, D. R. Uhlmann: Introduction to Ceramics, Wiley Publishers, New Delhi.
4. J. A. Kent: Riegel s Handbook of Industrial Chemistry, CBS Publishers, New Delhi.
5. B.K. Sharma: Industrial Chemistry, Goel Publishing House, Meerut.
6. Hakishan, V.K. Kapoor: Medicinal and Pharmaceutical Chemistry, VallabhPrakashan Pitampura, New Delhi.
7. R. Cremlyn: Pesticides, John Wiley.
8. Industrial Chemistry B. K. Sharma.


| B19PC5071 | Complex Analysis | L | T | P | C |
|---|---|---|---|---|---|
| Duration:14 Wks | | 2 | 0 | 0 | 2 |

| Prerequisites: |
|---|

Knowledge of linear algebra, differential equation and real analysis

**Course Objectives:**

1. To analyze the function of complex variable and its analytic property with a review of elementary complex function.
2. To identify and construct complex-differentiable functions.
3. To use the general Cauchy integral theorem and formula.
4. To understand the Taylor and Laurent expansion with their use in finding out the residue and improper integral.

**Course Outcomes:**

1. Analyze the conjugate and modulus of a complex number.
2. Apply the concepts of Cauchy-Reimann equations in Cartesian and polar forms to solve the problems.
3. Apply Cauchy integral theorem and its consequences to solve the problems.
4. Demonstrate the knowledge of the power series expansion of an analytic function and singularity and residue of complex function.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC5071 | CO1 | 3 | 2 | 2 | 2 | | | | | 3 | 1 |
| | CO2 | 3 | 3 | 2 | 2 | | | | | 3 | 2 |
| | CO3 | 3 | 3 | 2 | 2 | | | | | 3 | 1 |
| | CO4 | 3 | 3 | 2 | 2 | | | | | 3 | 1 |

**Course Contents:**

**Unit-I: Complex Analysis – 1** **6 Hrs**

Recapitulation of Complex numbers, The complexplane, conjugate, and modulus of a complex number. Polar form, Euler's formula. Hyperbolic functions - Simple problems.

**Unit-II: Complex Analysis – 2** **6 Hrs**

Functions of complex variables: Limit, Continuity and Differentiability-Simple problems. Analytic functions, Cauchy-Reimann equations in Cartesian and polar forms. Sufficient conditions for analyticity (in Cartesian form). Properties- Harmonic and orthogonal system and problems. Construction of analytic function, Given real and imaginary parts.

**Unit-III: Complex analysis – 3** **6 Hrs**

The complex line integral: Examples and properties (definitions of the concepts like neighborhood of a point, closed contour, etc. at appropriate places should be mentioned). Cauchy's theorem (statement) and itsconsequences. Cauchy's integral formulae for the function and derivatives (statement). Applications to the evaluation of simple line integrals. Cauchy's inequality. Liouville's theorem-Fundamental theorem of algebra.

**Unit-IV: Complex analysis – 4** **6 Hrs**

Power series expansion of an analytic function, Taylor's theorem (statement) and series, Laurent's theorem (statement) and Series. Singularity and residue, Formula for the residue at a pole and Cauchy's Residue theorem (statement) -Simple problems.

**Text Books:**


1. S Shanthinarayan, Complex Analysis, S Chand Co. Pvt. Ltd., 2012.
2. R V Churchil& J W Brown, Complex Variables and Applications, 5th edition. TMH 1989.
3. L V Ahlfors, Complex Analysis, 3rd edition.: Mc Graw Hill. 1979.


**References:**


1. A R Vashista, Complex Analysis, Krishna Prakashana Mandir, 2012.
2. Richard R Goldberg, Methods of Real Analysis, Indian ed. New Delhi, India: O&IBH Publishing Co. 1970.
3. G K Ranganath, Text book of B.Sc. Mathematics, Revised ed. New Delhi, India: S Chand Company Ltd., 2011.


| B19PC5072 | Fluid Dynamics | L | T | P | C |
|---|---|---|---|---|---|
| Duration:14 Wks | | 2 | 0 | 0 | 2 |

**Prerequisites:**

Knowledge of calculus and intermediate physics.

**Course Objectives:**

1. Explain the relative angular velocity, acceleration, rectilinear motion, work, power and energy.
2. State projectile, trajectory and inclined plane.
3. Explain conservation of linear momentum, impact of the sphere.
4. State central force and orbit, Kepler's laws on planetary motion, moment of inertia of simple bodies.

**Course Outcomes:**

1. Apply relative angular velocity, acceleration and solve problems on work, power and energy.
2. Analyze projectile, trajectory and solve problems on it.
3. Apply conservation of linear momentum, analyze the impact of spheres and solve problems on it.
4. Apply Kepler's laws on planetary motions and analyze the moment of inertia of different geometrical objects.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC5072 | CO1 | 3 | 3 | 3 | 2 | 1 | | | 1 | 3 | 3 |
| | CO2 | 3 | 3 | 2 | 2 | 1 | | | 1 | 3 | 2 |
| | CO3 | 3 | 2 | 1 | 2 | 1 | | | 1 | 3 | 2 |
| | CO4 | 3 | 2 | 2 | 2 | 2 | | | 2 | 3 | 2 |

**Course Contents:**

**Unit-I** **06 Hrs**

Velocity, Relative velocity, Angular velocity, Aceleration, Rectilinear motion, Rectilinear motion with constant acceleration, Relative angular velocity, Work, Power, Energy.

**Unit-II** **06 Hrs**

Motion of a projectile, Nature of a trajectory, Results pertaining to the motion of a projectile, Range on an inclined plane, Maximum range on the inclined plane. Simple problems.

**Unit-III** **06 Hrs**

Impulsive force, Conservation of linear momentum, Impact of a sphere, Laws of impact, Impact of two smooth spheres, Direct impact of two smooth spheres, Direct impact of a smooth sphere on a plane, Oblique impact of a smooth sphere on a plane. Simple problems.

**Unit-IV** **06 Hrs**

Central force and central orbit, Equation of central orbit, finding law of force and speed for a given orbit, Determination of the orbit when law of force is given, Kepler's Laws on planetary motion. Simple problems. Moment of inertia of simple bodies, Theorems of parallel and perpendicular axes, Moment of inertia of triangular lamina, Circular lamina, Circular ring, Right circular cone, Sphere - Simple problems.

**Text Books:**

1. An Introduction to Fluid dynamics by G K Batcher, Cambridge University Press.
2. Elementary Fluid Dynamics by D J Acheson, Clarendon Press.

**Reference Books:**

1. Fluid Dynamics an introduction by Rieutord, Michel, Springer Publications.
2. Physical Fluid Dynamics by D J Tritton.
3. A First Course in Fluid Dynamics by A R Paterson, Cambridge University Press.

| B19PC5073 | Number Theory | L | T | P | C |
|---|---|---|---|---|---|
| Duration:14 Wks | | 2 | 0 | 0 | 2 |

**Prerequisites:**

Knowledge of abstract algebra and commutative algebra.

**Course Objectives:**

1. Understand the theory of congruence's.
2. Understand the functions of several variables.
3. Familiarize with graphs.
4. Familiarize with the concept of limits and continuity in higher dimensions.

**Course Outcomes:**

1. Discuss the theory of congruence's.

2. Discuss functions of several variables.
3. Produce and interpret graphs of functions of two and three variables.
4. Demonstrate limits and continuity in higher dimensions.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC5073 | CO1 | 3 | 3 | 2 | 1 | 1 | | | | 3 | 2 |
| | CO2 | 3 | 3 | 2 | 2 | 1 | | | | 3 | 2 |
| | CO3 | 3 | 3 | 2 | 2 | 1 | | | | 3 | 2 |
| | CO4 | 3 | 3 | 2 | 2 | 1 | | | | 3 | 2 |

**Course Contents:**

**Unit-I** **06 Hrs**

The theory of congruence's, Properties of congruence's, Binary and decimal representation of integers, Linear congruence's and the chinese remainder theorem. Fermatas Theorem, Wilson's Theorem, Euler's Phi-Function, Euler's Theorem, Some properties of Phi-Function, Finite continued fractions.

**Unit-II** **06 Hrs**

Functions of several variables: Definition of function of *n* independent variables, Domains and ranges, functions of two variables, Definition of interior and boundary points, Definitions of open, Closed, Bounded and unbounded regions in a plane.

**Unit-III** **06 Hrs**

Graphs, Level curves and contours of functions of two variables, Level curves, Graph, Surface, Functions of three variables, Level surface, Interior and boundary points for space regions, Open and closed regions.

**Unit-IV** **06 Hrs**

Limits and continuity in higher dimensions: Limits and continuity, Two path test for non-existence of limit, Continuity of composites, Functions of more than two variables, Extreme values of continuous functions on closed and bounded sets.

**Text Books:**


1. Thomas calculus, by Maurice D. Weir, Joel Hass and Frank R. Giordano, 11th Edition, Pearson Publications, 2008.
2. Elementary Number theory by David M Burton, 6th Edition-Tata McGraw Hill.


**Reference Book:**


1. Number Theory by H.S. Hall, S.R. Knight, Maxford Books, 2008.


| Course Code | Course Title | Course Type | L | T | P | C | Hrs/Week |
|---|---|---|---|---|---|---|---|
| B19PC5080 | **Soft Skill Training** | RULO | 1 | 1 | 0 | 2 | 3 |

**Note:** Soft Skill Training courses are organised by the **Placement and Training Centre**. The students have to undergo Soft Skill Courses conducted by the said Centre.

| B19PC5090 | **Physics lab- V** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **0** | **0** | **2** | **2** |

**Prerequisites:**

Fundamentals of Electronics, concepts of light.

**Course Objectives:**

1. To make the students gain practical knowledge to co-relate with the theoretical studies.
2. To achieve perfectness in experimental skills and the study of practical applications will bring more confidence and ability to develop and fabricate engineering and technical equipments.
3. Design of circuits using new technology and latest components.
4. Develop practical applications of engineering materials and use of principle in the right way to implement the modern technology.

**Course Outcomes:**

On completion of this course the student shall be able to:

1. Determination of the few physical constants through experiments
2. Demonstrate the various experiments related to electronics such as Oscillators, multiplier, logic gates and Transistor.
3. Verify various theorems by experiments
4. Estimate e/m value of an electron.

**Mapping of Course Outcomes with programme Outcomes**

| **Course Code** | **POs/ COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **B19PC5090** | **CO1** | **3** | **3** | **3** | **2** | **2** | | **2** | **2** | **2** | **3** |
| | **CO2** | **3** | **3** | **3** | **2** | **2** | | **2** | **2** | **3** | **3** |
| | **CO3** | **2** | **2** | **1** | **3** | **2** | | **2** | **3** | **3** | **2** |
| | **CO4** | **3** | **2** | **3** | **1** | | | | | **2** | **2** |

**Course Contents:**

Any **eight** of the following experiments:

1. Ionization potential of xenon.
2. The e/m of an electron using a bar magnet (Thomson effect).
3. Estimation of mass of an electron.
4. Determination of Planck constant using a photo cell/ Solar cell.
5. Basic logic gates.
6. Hartley Oscillator.
7. Cockroft-Walton Voltage multiplier.

8. Transistor characteristics -CE mode
9. Study of Spectra of Hydrogen Spectra using Gas Discharge tube Determination of Rydberg Constant.
10. The e/m of an electron by helical coil method or Helmholtz coil method.

**Text books:**


1. Thiruvadigal, J. D., Ponnusamy, S.Sudha.D. and Krishnamohan M., "Physics for Technologists", Vibrant Publication, Chennai, 2013
2. R. K. Shukla and Anchal Srivastava, "Practical Physics", 1st Edition, New Age International (P) Ltd, New Delhi, 2006.


**Reference Books:**


1. G.L. Souires, "Practical Physics:", 4th Edition, Cambridge University, UK, 2001.
2. D. Chattopadhyay, P. C. Rakshit and B. Saha, "An Advanced Course in Practical Physics", 2nd ed., Books & Allied Ltd., Calcutta, 1990.
3. Advanced Practical Physics – B.L. Worshnop and H.T. Flint (KPH)
4. Practical Physics – S. L. Gupta &V. Kumar (PragatiPrakashan).


| B19PC5X10 | **Physics lab- VI** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **0** | **0** | **2** | **2** |

**Prerequisites:**

Fundamentals of Electronics, concepts of light.

**Course Objectives:**

1. To make the students gain practical knowledge to co-relate with the theoretical studies.
2. To achieve perfectness in experimental skills and the study of practical applications will bring more confidence and ability.
3. To develop and fabricate engineering and technical equipments.
4. Design of circuits using new technology and latest components.
5. To develop practical applications of engineering materials and use of principle in the right way to implement the modern technology.

**Course Outcomes:**

On completion of this course the student shall be able to:

1. Determination of the few physical constants through experiments
2. Demonstrate the various experiments related to electronics such as Oscillators, multiplier, logic gates and Transistor.
3. Verify various theorems by experiments.
4. Estimate dielectric constant of given material.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **B19PC5X10** | **CO1** | **3** | **3** | **3** | **2** | **2** | | **2** | **2** | **2** | **3** |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **CO2** | **3** | **3** | **3** | **2** | **2** | | **2** | **2** | **3** | **3** |
| | **CO3** | **2** | **2** | **1** | **3** | **2** | | **2** | **3** | **3** | **2** |
| | **CO4** | **2** | **2** | **1** | **2** | **1** | | | | **2** | **2** |

**Course Contents:**

Any **eight** of the following experiments:

1. Determination of wavelength of Laser light by grating.
2. RC coupled amplifier two stage.
3. Bridge rectifier with C and Pi filter.
4. Zener diode: To study the Characteristics and Voltage regulator.
5. Energy gap of a semiconductor by four probe method.
6. Determination of range of electron in Al using GM counter.
7. Determination of Dielectric constant of given liquid.
8. To determine value of Boltzmann constant using V-I characteristic of PN diode.
9. Fermi energy of copper by Meter Bridge.

**Text books:**


1. Thiruvadigal, J. D., Ponnusamy, S.Sudha.D. and Krishnamohan M., "Physics for Technologists", Vibrant Publication, Chennai, 2013
2. R. K. Shukla and Anchal Srivastava, "Practical Physics", 1st Edition, New Age International (P) Ltd, New Delhi, 2006.


**Reference Books:**


1. G.L. Souires, "Practical Physics:", 4th Edition, Cambridge University, UK, 2001.
2. D. Chattopadhyay, P. C. Rakshit and B. Saha, "An Advanced Course in Practical Physics", 2nd ed., Books & Allied Ltd., Calcutta, 1990.
3. Advanced Practical Physics – B.L. Worshnop and H.T. Flint (KPH)
4. Practical Physics – S. L. Gupta &V. Kumar (PragatiPrakashan).


| B19PC5X20 | Chemistry Lab-V | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **0** | **0** | **2** | **2** |

**Prerequisites:**

Knowledge of principles of gravimetry and paper chromatography.

**Course Objectives:**

1. Intended to impart analytical skills with an emphasis on application oriented quantitative analysis such as gravimetric and chromatographic separation.
2. Define and understand the concept of gravimetric analysis.
3. Determine amount and predict the percentage of analyte precipitate.
4. Understanding the idea of Chromatograpic technique and separation of cations using Paper chromatography.

**Course Outcomes:**

1. Interpret different gravimetric analysis methods.

2. Acquire training in the quantitative analysis of metal ions and anions using gravimetric method.
3. Develop skills in Chromatography technique.
4. Compute the result of analysis and to document its reliability.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC5X20 | CO1 | 1 | 2 | 2 | 1 | | | 2 | | 3 | 1 |
| | CO2 | 1 | 2 | 1 | 3 | | | 3 | | 3 | 1 |
| | CO3 | 1 | 2 | 2 | 2 | | | 2 | | 3 | 1 |
| | CO4 | 1 | 1 | 2 | 1 | | | 2 | 2 | 3 | 1 |

**Course Contents:**

**Gravimetric Estimations:**

1. Gravimetric estimation of barium as barium sulphate.
2. Gravimetric estimation of iron as iron (III) oxide.
3. Gravimetric estimation of copper as copper (I) thiocyanate.
4. Gravimetric estimation of nickel as nickel dimethylglyoximate.
5. Gravimetric estimation of magnesium as magnesium -8-hydroxy oxinate.
6. Gravimetric estimation of sulphate as barium sulphate.
7. Gravimetric estimation of aluminum as aluminum oxide.
8. Gravimetric estimation of zinc as zinc oxide.
9. Gravimetric estimation of calcium as calcium oxide.
10. Paper chromatographic separation of $Fe^{3+}$ and $Ni^{2+}$ ions.
11. Paper chromatographic separation of $Na^{+}$ and $K^{+}$ ions.

**Reference Books**


1. A Textbook Quantitative analysis A. I. Vogel ELBS.
2. Instrumental methods of Chemical analysis.B. K. Sharma Goel Publishing House.
3. Advanced Practical Inorganic ChemistryGurudeep Raj Goel Publishing House.
4. Experimental Inorganic/Physical Chemistry Mounir A. Malati Horward Series in Chemical science.


| B19PC5X30 | Chemistry Lab-VI | L | T | P | C |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **0** | **0** | **2** | **2** |

**Prerequisites:**

Basic principles of conductometry, potentiometry, pH, colorimetry. Acids and bases. Chemical kinetics

**Course Objectives:**

1. Afford an adequate knowledge of the principles, instrumentation and applications of common analytical techniques.

2. Knowledge on various electro analytical techniques for the examination of analyte.
3. Develop the basic knowledge of potentiometry, pH metry, conductometry, Colorimetry etc.
4. Compare various factors that influence experimental values.

**Course Outcomes:**

1. Explain the theoretical principle, instrumental techniques and their applications.
2. Demonstrate experimental skills in laboratories.
3. Operate various electro-analytical instruments during conduction of experiments.
4. Analyze and interpret the experimental data.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC5X30 | CO1 | 1 | 2 | 2 | 3 | | | 2 | | 3 | 1 |
| | CO2 | 1 | 2 | 2 | 3 | | | 3 | | 3 | 1 |
| | CO3 | 1 | 2 | 1 | 2 | | | 3 | 2 | 3 | 1 |
| | CO4 | 1 | 3 | 3 | 2 | | | 2 | 3 | 3 | 1 |

**Course Contents:**

1. Determination of equivalent conductance of the given electrolyte (strong and weak) by using Meter Bridge.
2. Determination of solubility of sparingly soluble salt (like $BaSO_4$) by conductometric method.
3. Determination of Ka (dissociation constant of a weak acid) by conductometric method.
4. Determination of rate constant of saponification of ethyl acetate by conductivity measurements.
5. Conductometric titration of strong acid and strong base and weak acid and strong base. Determination of percentage composition of a given mixture containing two miscible liquids by Abbe's refractometer.
6. Potentiometric titration of ferrous ammonium sulphate against potassium dichromate.
7. pH titration of strong acid against strong base (by observing change in pH).
8. Potentiometric titration of mixture of HCl and $CH_3COOH$ using NaOH solution.
9. Colorimetric estimation of $Fe^{3+}$ ion using ammonium thiocyanate as complexing agent.
10. Colorimetric study of kinetics of oxidation of indigocarmine by chloramine-T.

**References for Practicals**:


1. A Textbook Quantitative analysis A. I. Vogel ELBS.
2. Instrumental methods of Chemical analysis.B. K. Sharma Goel Publishing House.
3. Advanced Practical Inorganic ChemistryGurudeep Raj Goel Publishing House.
4. Experimental Inorganic/Physical Chemistry Mounir A. Malati Horward Series in Chemical science.

## SIXTH – SEMESTER

| B19PC6010 | Nuclear Physics | L | T | P | C |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **1** | **1** | **0** | **2** |

**Prerequisites:**

Basic knowledge on fundamentals of nuclear Physics.

**Course Objectives:**

1. Introduce students to the fundamental principles and concepts governing nuclear physics and have a working knowledge of their application to real-life problems.
2. Relate the core concepts in physics to more advanced topics in nuclear and particle physics.
3. Provide students with opportunities to develop basic knowledge and understanding of radioactivity decay.

**Course Outcomes:**

1. Understand the fundamental principles and concepts governing classical nuclear and particle physics and have a working knowledge of their application to real-life problems.
2. Apply knowledge of core concepts in physics to more advanced topics in nuclear and particle physics.
3. Explain radioactive decay using physics laws.
4. Apply basic knowledge of radio decay to solve nuclear physics related problems and decay systems in nuclear elements

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC6010 | **CO1** | **3** | **3** | **2** | **2** | **1** | | | | **3** | **3** |
| | **CO2** | **3** | **3** | **2** | **1** | **1** | | | | **3** | **3** |
| | **CO3** | **3** | **3** | **2** | **1** | **1** | | | | **3** | **2** |
| | **CO4** | **3** | **2** | **2** | | **1** | | | | **3** | **2** |

**Course Contents:**

**UNIT-I** **9 Hrs**

**The Nucleus:** Properties of nucleus, Neutron discovery and Properties. The proton-neutron hypothesis. Nuclear forces and their characteristics. Yukawa's theory (qualitative).

**Radioactive decay:** Successive disintegration, radioactive equilibrium radioactive series, Range and energy of alpha-particle and their measurement. Theory of alpha-decay (qualitative), Geiger-Nuttal law. Beta Decay – Pauli's neutrino hypothesis K-electron capture, internal conversion, Nuclear isomerism. Mirror nuclei, Gamma decay (qualitative).

**UNIT-II** **9 Hrs**

**Accelerators:** Cockroft-Walton voltage multiplier. LINAC, Cyclotron, Betatron.

**Nuclear Detectors:** Bubble chamber. G. M. counter, Principle of semiconductor detector.

**Nuclear Models:** Liquid-drop model, Semi empirical mass formula. Shell model and magic numbers

**UNIT-III** **9 Hrs**

**Nuclear reactions:** Q-values. Threshold energy of an endoergic reaction, Reactions induced by proton, deutron and -particles.

**Nuclear Fission, Fusion and reactors:** Estimation of the Fission energy on the basis of the liquid-drop model, Thermo-nuclear reactions sources of stellar energy. The C-N cycle, Magnetic bottle, Nuclear reactors-types. The four-factor formula, Pressurized Heavy water reactor.

**UNIT-IV** **9 Hrs**

**Particle Physics and Cosmic Rays:** Mention of the basic interactions in nature, Particles and anti-particles. Types of interaction between elementary particles. Conservation laws. A qualitative introduction to quarks (quark model), standard model qualitative, Big bang theory qualitative Cosmic ray Discovery, Primary and secondary cosmic rays- their composition. Cosmic ray showers. Origin of cosmic rays.

**Books for Reference:**


1. A. Beiser: Concepts of modern physics, 6$^{th}$edition, TMH, New Delhi.2008.
2. Irving Kaplan: Nuclear Physics, 2$^{nd}$edition, Narosa Publishing House, 1987(Reprint2002).
3. K. S. Kranes: Introductory Nuclear Physics, Wiley India, 2008.
4. S. N. Ghoshal: Nuclear Physics, 1st edition,
1. S. Chand and Co, 1994(Reprint 2002).
5. D.C. Tayal: Nuclear Physics, 5th edition, Himalaya Publishing House, 2008
6. Robert Eisberg, Quantum Phyiscs of Atoms molecules, solids nuclei and particles, second
2. edition, 1999
7. A K Saxena, Narosa: Principles of Modern Physics Publishers, 4th edition, 2014
8. H. Semat and I.R. Albright: Introduction to atomic and nuclear physics.
9. K. S. Kranes: Introductory Nuclear Physics, Wiley India, 2008
10. M K PAL, Theory of Nuclear Structure, East-West Press Delhi (1983).


| B19PC6020 | **Chemistry-VII** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **1** | **1** | **0** | **2** |

**Prerequisites:**

Basic Knowledge of ligand, types of chemical bonding, periodic table, pi bond and sigma bond, laws of photochemistry.

**Course Objectives:**

1. To give students a firm grounding in Co-ordination chemistry.
2. To impart knowledge about radioactivity and nuclear chemistry.
3. To focus on basic concepts organic photochemistry and generate keen interest and thinking in understanding the mechanisms of Molecular Rearrangements.
4. To make the students more inquisitive in learning the mechanistic details in Organic Chemistry through the teaching of the named reactions.
5. To impart knowledge about different spectroscopic techniques.

**Course Outcomes:**

1. Understand the fundamentals of coordination chemistry, Isomerism and M-L bonding in transition metal complexes.
2. Acquire the knowledge about radioactivity and nuclear chemistry.
3. Illustrate the basic concepts in organic chemistry and enhance the knowledge of molecular rearrangements mechanisms.
4. Explain and illustrate the different spectroscopic techniques in organic chemistry with examples.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC6020 | **CO1** | **2** | **2** | **2** | **1** | | **1** | | **1** | | **1** |
| | **CO2** | **3** | **2** | **1** | **1** | | | | **2** | **1** | **1** |
| | **CO3** | **2** | **1** | **2** | **2** | | **1** | | **1** | **2** | **1** |
| | **CO4** | **2** | **3** | **1** | **2** | | **1** | **1** | **1** | **1** | |

**Course Contents:**

**UNIT-I** **9 Hrs**

**Coordination Chemistry:** Ligands, classification of ligands and chelation, nomenclature of co-ordination compounds, physical methods in the study of complexes – change in conductance, colour and pH. Stability of complexes – stability constant, a brief outline of thermodynamic stability of metal complexes, factors affecting the stability of complexes. Poly nuclear complexes, inner metallic complexes.

**Isomerism in co-ordination complexes:** Stereo-isomerism – Geometrical and optical isomerism exhibited by co-ordination compounds of co-ordination number 4 and 6.

**Metal-ligand bonding in transition metal complexes:** Salient features, formation of octahedral complexes on the basis of VBT, Important features of crystal field theory, crystal field splitting of d-orbitals in tetrahedral, octahedral and square planar complexes, Evidences for metal ligand covalent bonding in complexes.

**UNIT-II** **9 Hrs**

**Nuclear Chemistry:** Introduction to Nuclear forces (brief explanation), nuclear stability-n/p ratio, Mass defect, Binding energy, Inner structure of nucleus- Liquid drop model, Nuclear fission-(definition with suitable examples), Calculation of energy release in nuclear fission, modes of release of fission energy (uncontrolled and controlled).

Plutonium as a fissionable material (Plutonium bomb), nuclear fusion and its advantages over nuclear fission reactions, hydrogen bomb, nuclear transmutation-artificial radioactivity. Detection and measurement of radioactivity – G. M. counter. Cyclotron, Nuclear reactor, Breeder reactor, Q values of nuclear reactions.

Uses of radio isotopes – tracer technique, agriculture, medicine, food preservation and dating (explanation). Separation of uranium isotopes – Laser irradiation method (atomic and molecular routes). Applications of Radioactive metals. Nuclear programme in India.

**UNIT-III** **9 Hrs**

**Pericyclic reactions**: Introduction. Classification of pericyclic reactions, electro cyclic reactions-con rotation and dis rotation. Electro cyclic closure and opening in 4n and 4n+2 systems.

**Molecular rearrangements and named reactions:** Classification – inter molecular and intra molecular rearrangements- Mechanisms, evidences, migratory aptitude, inter or intra molecular of the following rearrangements: Pinacol-pinacolone, Benzilic acid, Beckmann, Baeyer-Villiger Cope and Claisen (sigmatropic) rearrangement.

**Named reactions:** chichibabin, stark enamine, Heck reaction, Suzuki coupling, Stille coupling and Sonogashira coupling, Click reaction.

**UNIT-IV** **9 Hrs**

**Spectroscopy of Organic compounds**

**UV-Visible spectroscopy:** Introduction to spectroscopy, types of transitions. Electromagnetic spectrum – electron energy levels, Chromophores and auxochormes, blue shift and red shift. Conjugation and solvent effects.

**IR spectroscopy:** Introduction, modes of vibrations, number of fundamental vibrations, factors influence on vibrational frequencies on force constant, reduced mass, and H bonding (free and H-bonded), alkane, alkene, alkyne and OH groups.

**NMR Spectroscopy:** Basic principles of proton magnetic resonance spectroscopy: quantum approach- Magnetic nature of electron and nucleons, Magnetic moment, magnetic spin quantum number -I, Larmor frequency, basic NMR equation, population of nuclei, Equivalent and non-equivalent protons Chemical shift ,TMS as reference,Spectra of simple organic molecules Ethanol,ethylbromide,Acetaldehyde,Tolouene applications.

**Reference Books:**


1. Principles of Inorganic Chemistry Puri, Sharma & Kalia Shobhanlal Nagin Chand Co.
2. A Text book of Inorganic Chemistry Gurudeep Raj.
3. Concise Inorganic Chemistry J. D. Lee B-Block Well Science Ltd.
4. A Text book of Inorganic Chemistry Sathya Prakash & others
5. A Text book of Organic Chemistry M. K. Jain S. Chand & Company.
6. A Text book of Organic Chemistry Bhal & Bhal S. Chand & Company.
7. Organic Synthesis special techniques V. K. Ahluwalia & Renu Aggarwal Narosa ublishing


| B19PC6030 | **Numerical Methods** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **1** | **1** | **0** | **2** |

| **Prerequisites:** |
|---|

Differential equations and linear algebra.

**Course Objectives:**

1. Provide students an introduction to the field of numerical analysis.
2. Apply problem solving skills through the introduction of numerical methods.
3. Provide a ground for applying knowledge acquired in previous mathematics courses; and give students an opportunity to develop and present an independent project.

**Course Outcomes:**

1. Effectively write mathematical solutions and their interpretation in a clear and concise manner.
2. Identify the steps required to carry out a piece of research on a topic within Numerical Analysis.
3. Use information and communication technology to discuss problems relevant to Numerical analysis.
4. Demonstrate the ability to study the solution of a differential equation and develop a practical interpretation of the numerical results.

**Mapping of Course Outcomes with Programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC6030 | CO1 | 3 | 3 | 2 | 3 | | | | | 3 | 2 |
| | CO2 | 3 | 3 | 3 | 3 | | | | | 3 | 3 |
| | CO3 | 3 | 2 | 3 | 2 | | | | | 3 | 2 |
| | CO4 | 3 | 2 | 3 | 3 | | | | | 3 | 3 |

**Course Contents:**

**Unit-I: Numerical Solution of algebraic and system of equations 9 Hrs**

Solution of Algebraic and Transcendental Equations: Bisection method, Iteration method, the method of False Position, Newton Raphson method. Solution of linear systems – Matrix inversion method – Gaussian Elimination method – power method – Method of factorization – Iterative methods.

**Unit-II: Finite Difference and Interpolation 9Hrs**

Finite differences: Forward difference, Backward difference and Shift Operators – Separation of symbols – Newton's Formulae for interpolation – Lagrange's interpolation formulae - Numerical differentiation – Numerical integration: Trapezoidal rule, Simpson's one-third rule and Simpson's three-eighth rule.

**Unit-III: Numerical Solution of First order Differential Equations 9Hrs**

Numerical solution of ordinary differential equations – Taylor's series – Picard's method – Euler's method – Modified Euler's method – RungeKutta methods - second order (with proof) and fourth order (without proof).

**Unit-IV: Numerical Solution of Second order 9Hrs**

Differential Equations and simultaneous DE: Numerical solution of ordinary differential equations of second order and simultaneous differential equations – Taylor's series – Picard's method – Euler's method – Modified Euler's method – RungeKutta method of fourth order.

**Text Books:**


1. S SSastry, Introductory methods of Numerical Analysis, 3rd ed. New Delhi, India: Prentice Hall of India, 1999.
2. Francis Scheid, Schaum's Outline of Numerical Analysis, Revised ed.: Mc. Graw Hill., 2006.
3. G K Ranganath, Text book of B.Sc. Mathematics, Revised ed. New Delhi, India: S Chand and Company Ltd., 2011.


**Reference Books:**


1. Erwin Kreyszig Advanced Engineering Mathematics, 8th Ed. New Delhi, India: Wiley India Pvt. Ltd., 2010.
2. M K Jain, S R K Iyengar, and R K Jain, Numerical Methods for Scientific and Engineering Computation, 4th Ed. New Delhi, India: New Age International, 2003.


| B19PC6041 | **Physics of Clouds** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **0** | **0** | **2** |

**Prerequisites:**

Basic Knowledge on atmosphere.

**Course Objectives:**

1. To provide basic knowledge to understand the composition, formation, classification of clouds based on atmospheric thermodynamics.
2. To understand the growth rate, evaporation of droplet by Bergeron process.
3. To understand the role of Collisions and Coalescences process in the droplet growth.
4. To understand the phenomenon of Cloud electrification, precipitation and seeding.

**Course Outcomes:**

1. Describe the process of formation of clouds.
2. Explain the nucleation and growth of cloud particles.
3. Compare different mechanisms of droplet growth.
4. Explain the electrical phenomenon related to lightening.

**Mapping of Course Outcomes with programme Outcomes**

| **Course Code** | **POs/ COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC6041 | **CO1** | **3** | **3** | **2** | **2** | **1** | | | | **3** | **3** |
| | **CO2** | **3** | **3** | **2** | **1** | **1** | | | | **3** | **3** |
| | **CO3** | **3** | **2** | **2** | **1** | **1** | | | | **3** | **3** |
| | **CO4** | **3** | **2** | **2** | | **1** | | | | **3** | **3** |

**Course Contents:**

**UNIT I: Fundamental concepts:** **6 Hrs**

**Clouds:** Introduction, Definition, identification, classification, altitude and composition.

**Atmospheric Thermodynamics:** Vapor pressure, Clauius-Clapeyron equation, saturation vapor pressure, ways for reaching saturation and mechanisms for cooling the air.

**Fundamental Concepts of Cloud:** Liquid water content, parameters of macroscale cloud, cloud drop size distribution, actual drop size distribution.

**UNIT II:** **6 Hrs**

**Formation of Cloud Droplets:** General aspects, saturation vapor pressure over a curved droplet, saturation vapor pressure over a solution, combining the curvature and solute effect, atmospheric aerosols, cloud condensation nuclei.

**Droplet Growth by Diffusion:** growth of an individual droplet by diffusion of water vapor, growth rate in term of mass or radius, other questions needed to solve for growth rate, evaporation of droplet, Bergeron process.

**UNIT III:** **6 Hrs**

**Roplet growth by Collisions and Coalescences:** Droplet terminal fall speed, growth due to collection smaller, uniform droplet, collision efficiency, growth equation in terms of radius, growth due to collision with smaller droplets of non-uniform size.

**Growth of Ice Crystals:** Formation of ice crystals, diffusional growth of ice crystals branching versus faceting, collision-coalescence versus the Bergeron process.

**UNIT IV:** **6 Hrs**

**Precipitation:** Types of precipitation, rainfall rate and drop-size distribution. The Marshall-Palmer drop-size distribution.

**Weather Modification:** Examples of experiments, cloud seeding, and methodology.

**Cloud Electrification:** Lightning, electrical properties of the fair-weather atmosphere, electrical properties of a thunderstorm, Benjamin Franklin's famous kite experiment, cloud-to-ground lightning, Intra-cloud lightning, other forms of lightning, thunder, lightning rods, lightning safety.

**Reference Books:**


1. A Short Course in Cloud Physics; R. R. Rogers
2. The Physics of Clouds; B. J. Mason
3. Microphysics of Clouds and Precipitation; H. R. Fletcher and Klett.
4. Lectures on atmospheric thermodynamics.


| B19PC6042 | **Astro Physics** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **0** | **0** | **3** |

**Prerequisites:**

Understand the space applications.

**Course Objectives:**

1. To provide basic knowledge to understand the stellar Physics.
2. To understand the formation of Milky Way.

3. To understand the solar system.
4. To understand the cosmology and big bang theory.

**Course Outcomes:**

1. Describe the aspects of stellar Physics.
2. Explain the formation of galaxy and origin of solar system.
3. Compare different solar systems.
4. Explain the aspects of cosmology.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC6042 | CO1 | 3 | 3 | 2 | 1 | 1 | | | | 3 | 3 |
| | CO2 | 3 | 3 | 2 | 1 | 1 | | | | 3 | 3 |
| | CO3 | 2 | 2 | 2 | 1 | 1 | | | | 3 | 3 |
| | CO4 | 3 | 2 | 2 | | 1 | | | | 3 | 3 |

**Course Contents:**

**UNIT I: Stellar physics:** **6 Hrs**

Electromagnetic spectrum, Transmission of radiations through atmosphere, Black body radiation and Wien's law, Physical properties of astronomical objects, Spectral classification of stars, H-R diagram, luminosity classification of stars, distance measurement by Parallax method.

**UNIT–II: Milky Way Galaxy and Sun:** **6 Hrs**

The Milky Way galaxy, inter –stellar medium, inter-stellar molecules, origin of solar system, condensation theory, arguments for and against the theory.

**UNIT–III: Solar System** **6 Hrs**

The Solar system, Surface of Sun, Sunspot, Sunspot cycle, The Sun: Photosphere, chromospheres and corona. Kepler's laws of Planetary motion, early history of planets, Structure, Composition and Atmosphere of our Solar system (all nine planets), Comets, Asteroids, Meteors, Meteoroids, prospectus for life on Mars.

**UNIT–IV: Cosmology** **6 Hrs**

The Big-Bang universe, the steady state cosmology, the oscillating cosmology, the Hubble law and cosmological test.

**Books Recommended:**


1. Astrophysics (Stars and Galaxies) – K.D. Abhyankar (University Press Hyderabad)
2. Observational Astrophysics – Robert C. Smith (Cambridge University Press)
3. Astrophysics- A Modern Perspective- K.S. Krishna Swamy (New Age International)
4. Stars- Life, Death and Beyond – A. K. kimbhavi, J. V. Narlikar (IUCAA-Pune)
5. An Introduction to astrophysics- Baidynath Basu (PHI)
6. Astronomy – Fundamentals and Frontiers – Robert jastrow and M. H. Thompson (Chap. 9, 12, 14, 15, and 19) Edition, 2nd ed. Publication, Link New York: John Wiley & Sons.


| B19PC6043 | **Digital Electronics and Communication** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|

| Duration:14 Wks | | 2 | 0 | 0 | 2 |
|---|---|---|---|---|---|

**Prerequisites:**

Basics of the digital electronics and communication.

**Course Objectives:**

1. To Convert values from decimal, binary, octal, hexadecimal, and binary-coded decimal number systems to each other and back to the other systems.
2. To Simply combinational logic circuits with K map
3. To demonstrate and compare different analog modulation schemes.
4. To provide an overview of Satellite communication and its applications in communication

**Course Outcomes:**

1. Convert values from decimal, binary, octal, hexadecimal, and binary-coded decimal number systems to each other and back to the other systems.
2. Implement logic circuits using universal logic gates.
3. Construct the spectrum of transmission and reception of amplitude modulated and demodulated signals.
4. Explain the block diagram of satellite and TV communication systems.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC6043 | CO1 | 3 | 3 | 2 | 1 | 1 | | | | 3 | 3 |
| | CO2 | 3 | 3 | 2 | 1 | 1 | | | | 3 | 3 |
| | CO3 | 2 | 2 | 2 | 1 | 1 | | | | 3 | 3 |
| | CO4 | 3 | 2 | 2 | 1 | 1 | | | | 3 | 3 |

**Course Contents:**

**Unit I: Number Systems and Logic Gates** **6 Hrs**

Decimal numbers, Binary numbers, Binary arithmetic, Octal Numbers, Hexadecimal numbers, Inter-conversions of number systems, Binary coded decimal (BCD), Gray code, Excess-3 code.

**Logic Gates**: AND gate, OR gate, NOT gate, NAND gate, NOR gate, EX-OR and EX-NOR gates, Universal properties of NAND gates.

**Unit II**: **Boolean Algebra** **6 Hrs**

Boolean operations, logic expressions, Laws of Boolean algebra, De-Morgan's theorems, Simplification of Boolean expressions using Boolean algebra Techniques, SOP and POS form of Boolean expressions for logic network, Simplification of Boolean expressions using K-Map (up to 4variables).

**Unit III: Modulation and Demodulation:** **6 Hrs**

Introduction, Types of Modulation, Expression for Amplitude Modulation voltage, AM waves, Frequency spectrum of AM waves, Power Output in AM waves, Expression for frequency modulated voltage, Principle of demodulation, linear diode AM detector or demodulator.

**Unit IV: Communication Electronics:** **6 Hrs**

Introduction, Historical development of Satellite, Communication Satellite, system communication satellite, Orbiting Satellite, Satellite frequency band. Block diagram of Radio transmitter and TRF Radio receiver, Explanations of function of each block, Super heterodyne radio receiver, Explanations of function of each block, Physical basis of T.V., Block diagram of T.V. Receiver.

**Books Recommended:**


1. Modern Digital Electronics- R.P. Jain, Tata McGraw Hill Pub. Company (Third edition)
2. Digital Fundamentals-Thomas L. Floyd, Universal Book Stall
3. Digital Principles and Applications- A. P. Malvino, (MGH International Edns (Fourth Edn)
4. Digital Electronics with Practical Approach- G. N. Shinde, Shivani Pub., Nanded
5. Electronics and Radio Engineering – M. L. Gupta
6. Monochrome and Colour T. V. –Gulhati.


| B19PC6051 | **Electro-Analytical Chemistry** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **0** | **0** | **2** |

**Prerequisites:**

Basic knowledge of electorchemistry, cells, batteries, corrosion, electodes, anode, cathode, electrochemical series, standard hydrogen electrode potential, EMF.

**Course Objectives:**

1. Explain the fundamental concept, principles and laws of electrochemistry,
2. Discuss related to the types of electrodes and study of electrode reactions pathway.
3. Classify the types of corrosion and its controls.
4. Describe the concept of electrochemical sensor, electrochemical energy storage and conversion devices.

**Course Outcomes:**

1. Analyze the basic concepts of electroanalytical techniques.
2. Classify the types of electrochemical reaction and its mechanism.
3. Apply the knowledge of corrosion science and its control essential for the commercially available materials.
4. Design the electrode with suitable materials for various application in the field of electrochemical sensors, electrochemical energy storage and conversion devices.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POS/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC6051 | **CO1** | **1** | | **1** | **1** | | | | **1** | **3** | **1** |
| | **CO2** | **1** | **2** | **2** | **1** | | | | | **1** | **1** |
| | **CO3** | **1** | | **2** | **1** | | | | **3** | **2** | **1** |
| | **CO4** | **1** | | **1** | **2** | | | | **2** | **3** | **3** |

**Course Contents:**

**UNIT-I** **6 Hrs**

**Basic electro chemistry**: Electrochemistry Reversible and irreversible cells. Concept of EMF of a cell. Measurement of EMF of a cell. Nernst equation and its importance. Types of electrodes. Standard electrode potential. Electrochemical series.

**Polarography**: Definition, advantage of dropping mercury electrode, factors affecting on limiting current, Half wave potentials and significance, Ilkovic equations, Applications of Polarography

**Amperometric Titrations:** Basic principle involved in the Amperometry, Amperometric Titrations and applications, Advantages and disadvantages of Amperometric Titrations.

**UNIT-II** **6 Hrs**

**Electro analytical methods**: Potentiometry, Conductometry, Colorimetry, cyclic voltammetry and pulse voltammetry.

**Electrochemical sensors**: Potentiometric Sensors and voltammetric sensors, Sensors for determination of-Amino Acids, Hydrogen, Glucose and urea

**UNIT-III** **6 Hrs**

**Electro Chemical Energy Storage and Conversion Devices:**

**Batteries:** Definition, Types, primary batteries- dry cell, Secondary batteries- Lead acid, Ni-Cd, Lithium Ion Batteries.

Super capacitors- Electrical double layer capacitor, pseudo capacitors and hybrid capacitors.

**Fuels cells**: Fuel cell working principle, classification of fuel cells-Hydrogen-Oxygen and Methanol-Oxygen, solid oxide fuel cell.

**Photovoltaic Cells:** Definition, synthesis of semiconductor grade silicon, doping of silicon, construction and working of PV cell.

**UNIT-IV** **6 Hrs**

**Corrosion**: definition, Types of Corrosion: Dry Corrosion (Direct Chemical attack), Wet Corrosion. Electrochemical analysis- Equilibrium potential methods, Anodization potential methods. Tafel plots and Impedence –Charge transfer resistance. Corrosion Control.

**Reference Books:**


1. "Fundamentals of Electroanalytical Chemistry" by Monk (recommended)
2. Engineering Chemistry B. K. Sharma
3. Engineering Chemistry Jayaprakash&Venugopal Engineering Chemistry Jain and Jain.


| B19PC6052 | **Chemistry of Bio Molecules** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **0** | **0** | **2** |

**Prerequisites:**

Amino acids, proties, peptides, carbohydrates, lipids etc.,

**Course Objectives:**

1. Understand the significance of biomolecules in various biological functions.

2. Develop the knowledge on various methods to synthesis amino acids form available starting materials.
3. Explain the stuctue and functions of various biomoleucles such as nucleic acids, enzymes and vitamins.
4. Discuss the role of hemoglobin, myoglobin, alkali and alkaline earth metal ions in living system.

**Course Outcomes:**

1. Classify the different type of biomolecules, explain their structure and functions.
2. Predict the role of biomolecules in various biochemical mechanisms.
3. Outline the significance of amino acids, enzymes, lipids, nucleic acids and carbohydrates.
4. Build the importance of essential and trace elements in the biological processes.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC6052 | CO1 | 3 | 2 | 2 | 1 | | 2 | | 1 | 2 | 3 |
| | CO2 | 3 | 2 | 2 | 2 | | 1 | 1 | | 2 | 3 |
| | CO3 | 2 | 3 | 2 | 1 | | | | 2 | 2 | 3 |
| | CO4 | 2 | 3 | 2 | 2 | | | 1 | 1 | 3 | 3 |

**Course Contents:**

**UNIT-I** **6hrs**

**Introduction to Biomolecule.**

**Carbohydrates:**

Introduction and definition, Types of naturally occurring sugars. Deoxy sugars, amino sugars, branched chain sugars, methyl ethers and acid derivatives of sugars. Structure, degradation and biological functions of starch, cellulose and chitin.

**Lipids:**

Introduction, isolation and properties of lipids. Oils and fats: definitions and significances of hydrogenation, iodine value, saponification value and auto-oxidation of oils and fats. Phospholipids: lecithins, cephalins and phosphatidyl serine. Sphingolipids: sphingosine, sphingomyelin and cerebrocides.

**UNIT-II** **6Hrs**

**Amino acids and proteins:**

**Introduction:** Definition of Amino acids, classification of Amino acids into alpha, beta, and gamma amino acids. Natural and essential amino acids - definition and examples, classification of alpha amino acids into acidic, basic and neutral amino acids with examples.

**Methods of synthesis**: General methods of synthesis of alpha amino acids (specific examples – Glycine, Alanine, valine and leucine) by following methods: a) from halogenated carboxylic acid b) Malonic ester synthesis c) strecker's synthesis.

**Physical properties:** Zwitter ion structure - salt like character - solubility, melting points, amphoteric character, definition of isoelectric point.

**Chemical properties:** General reactions due to amino and carboxyl groups - lactams from gamma and delta amino acids by heating peptide bond (amide linkage). Structure and nomenclature of peptides and proteins.

**UNIT-III** **6hrs**

**Nucleic Acids, Enzymes and Vitamins**

**Nucleic Acids**

Purine and pyrimidine bases. Structure of nucleosides and nucleotides. Methods of formation of internucleotide bonds (DCC, phosphotriester approach). Structure of DNA (Watson-Crick model) and RNAs. Biological importances of DNA and RNAs. Protein-nucleic acid interaction chromatin and viral nuclear capsid.

**Enzymes**

**Ch**aracteristic features, classification (EC code number not required) active site, specificity, Fisher and Koshland models. Enzyme kinetics-factors affecting rate of enzymatic reactions, Michaels Menten equation (derivation not required). Competitive and non-competitive inhibition. Cofactors.

**Vitamins**

Definition, classification and deficiency manifestation of water soluble and fatsoluble vitamins. Coenzyme functions of B complex vitamins.

**UNIT-IV**

**Bioinorganic Chemistry** **6 hrs**

Essential and trace elements in biological processes Metalloporphyrins with special reference to hemoglobin and myoglobin Biological role of alkali ($Na^+$, $K^+$) and alkaline earth metal ions ($Mg^{2+}$, $Ca^{2+}$). Nitrogen fixation.

**Reference Books:**


1. Biochemistry, J. David Rawn, Neil Pattuson publishers, North Carolina, (USA) 1989.
2. Organic Chemistry. Vol I and Vol II, I. L. Finar, 6th edn. ELBS & Longman (London), 1975.
3. Inroduction to Lipids, D. Chapman, McGraw-Hill, 1969.
4. Advanced general Organic Chemistry, S. K. Ghosh, DK and Allied publishers (UBS), Calcutta, 1998.
5. Text book o Biochemistry, E. S. West, W. R. Todd, H. S. Mason & J. T. Van Bugen, 4th Edn. Amerind publishing co. (New Delhi), 1974.
6. Medicinal Chemistry Ashuthosh Kar Tata Mcgraw Hill Publications.


| B19PC6053 | **Solid State Chemistry** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **0** | **0** | **2** |

**Prerequisites:**

Knowledge of band theory of solids, valance band, conduction band.

**Course Objectives:**

1. Explain basic concept of electronic structure, electrical and magnetic behaviors in solids.
2. Disuses the topic related defect, superconductivity, etc., in solids.
3. Prediction of crystal structure in solids and understanding the basic concept of X-ray diffraction theory, etc.,

**Course Outcomes:**

1. Analyze the fundamental concepts of nature of bonding and electronic structure in solids.
2. Predict the electrical and magnetic behavior in the solid.

3. Discussion related to the defects in solid and understanding the principle and theory of superconductivity.
4. Identify the crystal structures and defects in solids using various instrumental techniques.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC6053 | CO1 | 3 | 2 | 3 | 3 | | | | 1 | 1 | 1 |
| | CO2 | 3 | 2 | 2 | 3 | | | | 1 | 1 | 1 |
| | CO3 | 3 | 3 | 2 | 2 | | | | 2 | 2 | 1 |
| | CO4 | 2 | 2 | 1 | 2 | | | | 1 | 2 | 1 |

**Course Objectives:**

**UNIT-I** **6 Hrs**

**Electronic structure of solids:** Bonding in solids: Ionic, covalent, metallic and molecular solids. Free electron theory, Fermi sphere, Fermi-Dirac statistics, Ohm's law, limitations of the free electron theory. Electrons in a weak periodic potential (Independent electron model), energy levels in extended, repeat and reduced zone schemes.

**Electrical and Magnetic Properties of Solids:** Metals: calculation of density of states, origin of resistivity, weak paramagnetism. Semiconductors: Intrinsic and extrinsic- p and n-types, Hall effect, Junctions and their applications- metal-metal, metal-semiconductor, semiconductor-semiconductor types and transistors.

Insulators- dielectric properties, piezo and inverse piezoelectric effects, ferroelectricity, ferroelectric transitions in $BaTiO_3$, ionic conductivity applications of band theory to TiO and NiO: Limitations of the Independent electron model, modeling electron correlation.

**UNIT-II** **6 Hrs**

**Dynamics of Atoms in a Solid:** Dispersion curves of an elastic structureless medium, Longitudinal and Transverse modes, Optical and Acoustic modes of a crystal, total vibrational energy of a crystal. Case study of calcite.

**Defects in Solids:** Point defects, Line defects and Plane defects, Stacking faults and grain boundaries

**Superconductivity:** Superconductivity, Meisner effect, Type I and type II superconductors, Features of superconductors, Frolich diagram, Cooper pairs, Theory of low temperature superconductivity, Junctions using superconductors.

**UNIT-III** **6 Hrs**

**Geometric Crystallography:** Symmetry elements, Bravais lattices, Screw axes and glide planes, point groups, and space groups and nomenclature. Law of Interfacial angle (Euler's construction).

**Diffraction theory and Single crystal X-ray diffraction:** X-rays, Bragg's law, assignment of lines, diffraction pattern of a primitive cubic lattice, space group extinctions, Scaterring factor and structure factor, intensities from atomic positions for BCC and FCC lattices; Ewald's sphere of reflection, Reciprocal Lattice concept, Electron density function, Fourier synthesis, Fourier transform of the structure factor, Phase problem and Patterson synthesis.

**UNIT-IV** **6 Hrs**

**Experimental Methods:**

Rotation, Oscillation, Weissenberg and Precession methods. Debye-Scherrer method (Powder method), Determination of lattice parameters from these methods.

**Electron diffraction:** Experimental technique, Wierl equation, Radial-Distribution method**.**

**Neutron diffraction:** Principle and Theory, advantages and uses.

**Reference Books:**


1. Introduction to Solids, L. V. Azaroff, McGraw Hill Book Co., New York, 1960.
2. Solid State Physics, N. W. Ashcroft and N. D. Mermin, Holt Saunders International Ltd., New York (1976).
3. Physical Chemistry, G. M. Barrow, McGraw Hill (2nd ISE) (1966).
4. An Introduction to X-ray Crystallography, M. M. Woolfson, Cambridge University Press-Vikas Publishing House, New Delhi (1980).
5. Principles of the Solid State, H. V. Kheer, Wiley Eastern Ltd., New Delhi (1993).
6. Dynamics of Atoms in Crystals, W. Cochran, Edward Arnold, London, 1973. (pages 24-37)
7. Vibrational Spectroscopy of Solids, P.M.A. Sherwood, University Press, Cambridge, 1972. (pages: 1-45)
8. Phase Transitions, C.N.R. Rao and K.J. Rao, Cambridge University Press
9. X-ray Structure determination: A practical guide, George H Stout and Lyle H Jenson, Macmillan Publishing Co. Inc and Collier Macmillan Publishers.


| **B19PC6061** | **Fuzzy Mathematics** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **0** | **0** | **2** |

**Prerequisites:**

Basic knowledge of set theory.

**Course Objectives:**

1. Students will study the fuzzy sets, basic operation on fuzzy sets and inverse fuzzy operations.
2. Students will study fuzzy subsets and its properties.
3. Student will read and analyze the concept of fuzzy rings

**Course Outcomes:**

1. Analyze the concept of fuzzy set and fuzzy logic using fuzzy operations.
2. Apply the concept of fuzzy sum, fuzzy product and Cartesian product on real world problems.
3. Analyze the concept of algebra of fuzzy relations and logic connectives.
4. Analyze the concept of fuzzy invariant subgroups and fuzzy subrings.

**Mapping of Course Outcomes with Program Outcomes**

| Course Code | POs/ Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC6061 | CO1 | 3 | 3 | 2 | 3 | | | | | 2 | 3 |
| | CO2 | 3 | 3 | 2 | 2 | | | | | 3 | 3 |
| | CO3 | 3 | 2 | 3 | 3 | | | | | 3 | 2 |
| | CO4 | 3 | 3 | 3 | 2 | | | | | 3 | 3 |

**Course Contents:**

**Unit – I** **6 Hrs**

Introduction, Fuzzy subsets, Lattices and Boolean Algebras, L fuzzy sets, operations on fuzzy, level sets, properties of fuzzy subsets.

**Unit – II** **6 Hrs**

Algebraic product and sum of two fuzzy subsets-properties satisfied by Addition and Product, Cartesian product of fuzzy subsets.

**Unit – III** **6 Hrs**

Introduction, Algebra of fuzzy relations and logic connectives.

**Unit – IV** **6 Hrs**

Some more connectives, Introduction, fuzzy subgroup, homomorphic image and Preimage of subgroupoid. Fuzzy invariant subgroups and fuzzy subrings.

**Text Books:**

1. S. Nanda and N. R. Das Fuzzy Mathematical concepts, Narosa Publishing House, New Delhi, 2010.

**Reference Books:**

1. M.Ganesh, Introduction to Fuzzy Sets & Fuzzy Logic, Prentice Hall of India Pvt. Ltd., 2006.
2. John N. Mordeson and PremchandS.Nair, Fuzzy Mathematics.

| B19PC6062 | Topology | L | T | P | C |
|---|---|---|---|---|---|
| Duration:14 Wks | | 2 | 0 | 0 | 2 |

**Prerequisites:**

Set theory and properties of set theory.

**Course Objectives:**

1. The aim of the course is to provide for the students an introduction to theory of metric and topological spaces with emphasis on those topics that are important to further studies.
2. The course focuses on Homotopy, Homology theories and Topological groups and Lie groups.

**Course Outcomes:**

1. Analyze different axioms of Topology.
2. Learn Homotopy Theory.
3. Analyze fundamental groups of $S_1$ and $S_n$.
4. Analyze Topological groups and Lie groups.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **B19PC6062** | **CO1** | **3** | **3** | **2** | **2** | **2** | | | | **3** | **3** |
| | **CO2** | **3** | **2** | **3** | **2** | **3** | | | | **2** | **3** |
| | **CO3** | **3** | **3** | **2** | **3** | **2** | | | | **3** | **3** |
| | **CO4** | **3** | **3** | **2** | **3** | **2** | | | | **3** | **2** |

**Course Contents:**

**Unit-I** **6 Hrs**

General Topology: Introduction, metric topology, separation axioms, compactness, Connectedness, product topology, introduction to manifolds, sub manifolds.

**Unit-II** **6 Hrs**

Homotopy Theory. Covering spaces, homotopy maps, homotopy equivalence, Contractible spaces, deformation retraction.

**Unit-III** **6 Hrs**

Fundamental Groups: Universal cover and lifting problem for covering maps, Fundamental groups of S1 and Sn. Introduction to Homology Theory.

**Unit-IV** **6 Hrs**

Topological Groups: Introduction, integration on locally compact spaces, Haar Measure, Character groups, group action. Lie groups and lie algebras: Basic theory, linear groups.

**Suggested texts:**

1. C.O. Christenson and W.L. Voxman. Aspects of Topology.
2. J.R. Munkres. General Topology.
3. I.M. Singer and J.A. Thorpe. Lecture Notes in Elementary Topology and Geometry.
4. K. Chandrasekharan. A Course on Topological Groups.

**Reference Books:**

1. W. Fulton and J. Harris. Representation Theory.
2. F.W. Warner. Foundations of Differentiable Manifolds and Lie Groups.

| **B19PC6063** | **Discrete Mathematics and Graph Theory** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **0** | **0** | **2** |

**Prerequisites:**

Sets, relations, trees, graphs and Boolean algebra.

**Course Objectives:**

1. Study the set theory, logic, recurrence relations and functions and to know the application of Boolean algebra to switching theory.
2. Uunderstand and apply the fundamental concepts in graph theory.
3. Apply graph theory-based tools in solving practical problems.

**Course Outcomes:**

1. Apply operations on discrete structures such as sets, relations, functions and Recurrence relations.
2. Apply Boolean algebra to switching theory and their minimization techniques and Phase structure, grammars and languages, Finite State Machine, Recognition in regular languages.
3. Apply principles and concepts of graph theory in practical situations
4. Apply the theory and applications of graphs, fundamental theorems and their proofsand computer applications such as networks of communication, data organizations, computational devices and the flow of computation.

**Mapping of Course Outcomes with Programme Outcomes**

| Course Code | POs/ Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC6063 | CO1 | 3 | 3 | 2 | 2 | 3 | | | | 3 | 3 |
| | CO2 | 3 | 2 | 3 | 2 | 2 | | | | 2 | 3 |
| | CO3 | 3 | 3 | 2 | 3 | 3 | | | | 3 | 2 |
| | CO4 | 3 | 3 | 3 | 2 | 2 | | | | 3 | 3 |

**Course Contents:**

**Unit-I: Discrete numeric functions and Generating functions: 6Hrs**

Introduction, Manipulation of numeric functions, Asymptoticbehavior of numeric functions, Generating functions. Recurrence relations and Recursive Algorithms. Introduction, Recurrence relations, Linear recurrence relation with constant coefficients, Homogeneous solutions, particular solutions.

**Unit-II: Boolean algebra: 6 Hrs**

Application of Boolean algebra to switching theory. Languages - Recognition and generation - Phase structure grammars and languages – Finite State Machine - Recognition in regular languages.

**Unit-III: Grpah Theory -1 6 Hrs**

Graph,finite, Infinite graphs, Incidence and degree , Isolated vertex, Pendent vertex, Null graph, Isomorphism, Sub-graphs, Walks, Paths, Circuits, Connected and disconnectedgraphs, Components, Euler graphs, Operation on graphs, Hamiltonian paths, Circuits, Trees and some properties of trees, Rootedand binary tree, Spanning tree and fundamental circuits.

**Unit-IV: Grpah Theory -2 6 Hrs**

Cutsets, Properties, Fundamental cut sets, Connectivity, Seperability, Planar graphs, Kuratowskiís graphs, Different representation of planar graphs, Geometric dual, Ring sum of two circuits, Subspace, Orthogonal vectors, Matrix representation, Incidence matrix, Cutset matrix, Circuit matrix, Adjacency matrix.

**Text Books:**


1. Elements of Discrete Mathematics 3rdedition by C.L. Liu, Tata Macgraw Hill Publishers (2008).
2. Discrete Mathematical Structures with Applications to Computer Science by J.P. Trembley and R. Manohar, TataMagrawHill Publishers
3. Kenneth H. Rosen, Discrete Mathematics and its Application, Fifth edition, Tata McGraw-Hill Publishing company PVT. Ltd., New Delhi, 2003.

**Reference Books:**


1. NarsingDeo: Graph Theory & Applications (PHI), India.
2. Frank Harrary: Graph Theory Narosa Publications, India.


| Course Code | Course Title | Course Type | L | T | P | C | Hrs / Week |
|---|---|---|---|---|---|---|---|
| B19PC6070 | **MOOC / SWAYAM/ Internship** | RULO | 0 | 0 | 2 | 2 | 3 |

**MOOC/ SWAYAM:**

Globally, MOOC (Massive Open Online Course) platforms are gaining much popularity. Considering the popularity and relevance of MOOCs, Government of India has also launched an indigenous platform, SWAYAM. SWAYAM (Study Webs of Active Learning for Young Aspiring Minds) is basically an integrated MOOCs platform for distance education that is aimed at offering all the courses from school level (Class IX) to post-graduation level. The platform has been developed collaboratively by MHRD (Ministry of Human Resource Development) and AICTE (All India Council for Technical Education) with the help of Microsoft and is capable of hosting 2,000 courses. There are many other international agencies, foreign universities offering OOC courses.

A student shall register and successfully complete any of the courses available on SWAYAM. Student shall inform the MOOC/SWAYAM coordinator of the school about the course to which he/she has enrolled. The minimum duration of the course shall be not less than 40 hours and of 4 credits. The student should submit the certificate issued by the SWAYAM to the MOOC/SWAYAM coordinator of the school, the grades obtained in the course shall be forwarded to concerned authority of the University

| Course Code | Course Title | Course Type | L | T | P | C | Hrs / Week |
|---|---|---|---|---|---|---|---|
| B19PC6080 | **Soft Skill Training** | RULO | 1 | 1 | 0 | 2 | 3 |

**Note:** Soft Skill Training courses are organised by the **Placement and Training Centre**. The students have to undergo Soft Skill Courses conducted by the said Centre.

| B19PC6090 | **Physics Lab–VII** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **0** | **0** | **2** | **2** |

| **Prerequisites:** |
|---|

Number system, combinational circuits, sequential circuits.

**Course Objectives:**

1. To impart the practical knowledge
2. To train the students to do the experiments in a systematic way, collect the data and analyze it.
3. To motivate the students to think in more practical way by giving the hands-on training.

**Course Outcomes:**

After completion of the course a student will be able to:

1. Conduct the experiments related to different Physics laws and theories.
2. Employ the different tools and techniques to get the data/readings related to the experiments.
3. Verify the fundamental physics behind many scientific discoveries through hands on experimentation.
4. Study of X-ray Photographic plates.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC6090 | **CO1** | **3** | **2** | **2** | | **1** | | | | **3** | **3** |
| | **CO2** | **3** | **2** | **2** | **1** | **1** | | | | **3** | **3** |
| | **CO3** | **2** | **2** | **2** | **1** | **1** | | | | **3** | **3** |
| | **CO4** | **2** | **2** | **2** | **1** | **1** | | | | **2** | **2** |

**Prerequisites:**

Any **EIGHT** of the following experiments

1. Verification of inverse square law for gamma-rays.
2. Half-life of K 40.
3. Absorption coefficient of gamma-rays.
4. Study of solar cell-I V Characteristics, F F& efficiency.
5. Phase measurement in LCR circuit using CRO.
6. Four probe- Resistivity measurements.
7. Verification of Maximum power transfer theorem.
8. Negative feed-back amplifier.
9. Study of X-ray photograph – determination of interplanar distance.
10. Characteristics of a GM-tube.

**Text books:**


1. Thiruvadigal, J. D., Ponnusamy, S.Sudha.D. and Krishnamohan M., “Physics for Technologists”, Vibrant Publication, Chennai, 2013
2. R. K. Shukla and Anchal Srivastava, “Practical Physics”, 1st Edition, New Age International (P) Ltd, New Delhi, 2006.


**Reference Books:**


1. G.L. Souires, “Practical Physics:”, 4th Edition, Cambridge University, UK, 2001.

2. D. Chattopadhyay, P. C. Rakshit and B. Saha, "An Advanced Course in Practical Physics", 2nd ed., Books & Allied Ltd., Calcutta, 1990.
3. Advanced Practical Physics – B.L. Worshnop and H.T. Flint (KPH)
4. Practical Physics – S. L. Gupta &V. Kumar (PragatiPrakashan).

| B19PC6X10 | Mathematics-V Lab | L | T | P | C |
|---|---|---|---|---|---|
| Duration:14 Wks | | 0 | 0 | 2 | 2 |

**Prerequisites:**

Definition of linear transformations, evaluation of double and triple integrals.

**Course Objectives:**

1. Interpret derivatives of vector valued functions as velocity and acceleration functions.
2. Learn to evaluate multiple integrals.
3. Explain the definition and properties of vector space and its base.

**Course Outcomes:**

1. Determine and apply divergence, curl and scalar potential associated with scalar and vector fields.
2. Apply Fundamental theorem to evaluate Area, Region and Volume of geometrical bodies using Green's theorem, Stoke' s theorem or Gauss divergence theorem.
3. Describe and manipulate vector spaces, subspaces and their bases.
4. Determine the kernel, image space and matrix representation of a linear transformation.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC6X10 | CO1 | 3 | 2 | 2 | 2 | | | | | 3 | 3 |
| | CO2 | 3 | 2 | 3 | 2 | | | | | 2 | 2 |
| | CO3 | 3 | 3 | 2 | 3 | | | | | 3 | 3 |
| | CO4 | 3 | 2 | 2 | 2 | | | | | 3 | 3 |

**Course Contents:**

1. Verification of Green's theorem.
2. Verification of Gauss Divergent theorem.
3. Verification of stokes theorem
4. Expressing a vector as a linear combination of given set of vectors
5. Examples on linear dependence and independence of vectors
6. Evaluation of basis and dimension
7. Verifying whether a given transformation is linear or not

8. Finding a matrix of linear transformation
9. Finding a linear transformation of a matrix.
10. Verification of Rank nullity theorem.
11. To demonstrate the physical interpretation of gradient, divergence and curl.
12. To write gradient, divergence, curl and laplacian in cylindrical coordinates
13. To write gradient divergence, curl and laplaction in spherical co ordinates.
14. Evaluation of the line integral with constant limits.
15. Evaluation of the line integral with variable limits.
16. Evaluation of the double integral with constant limits.
17. Evaluation of the double integral with variable limits.
18. Evaluation of the triple integral with constant limits.
19. Evaluation of the triple integral with variable limits.
20. Evaluation of surface area of revolution.
21. Evaluation of volume of revolution.

**Text Books:**


1. SCILAB: A Practical Introduction to Programming and Problem Solving [Print Replica] Kindle Edition by Tejas Sheth (Author).

2. The Maxima Book Paulo Ney de Souza Richard J. Fateman Joel Moses Cliff Yapp 19th September 2004.


| B19PC6X20 | Numerical Methods – Lab | L | T | P | C |
|---|---|---|---|---|---|
| Duration:14 Wks | | 0 | 0 | 2 | 2 |

**Prerequisites:**

Basic concepts of numerical methods.

**Course Objectives:**

1. Provide students an introduction to the field of numerical analysis.
2. Aside from developing competency in the topics and emphases listed, the course aims to develop and apply problem solving skills through the introduction of numerical methods.
3. Provide a ground for applying knowledge acquired in previous mathematics courses and give students an opportunity to develop and present an independent project.

**Course Outcomes:**

1. Acquire proficiency in using *Maxima* to study Numerical analysis.
2. Use *Maxima* to solve the system of equations
3. Be familiar with the built-in functions to find the largest eigen value using power method.
4. Acquire proficiency in using *Maxima* to study the solution of integrals using interpolation.

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B19PC6X20 | CO1 | 3 | 3 | 2 | 2 | | | | | 2 | 3 |
| | CO2 | 3 | 2 | 2 | 3 | | | | | 3 | 2 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **CO3** | **3** | **2** | **3** | **2** | | | | | **3** | **2** |
| | **CO4** | **3** | **3** | **2** | **2** | | | | | **3** | **3** |

**Course Contents:**

1. Solving algebraic equation using the Bisection method
2. Solving algebraic equation using the Regular – Falsi method
3. Solving algebraic equation using Newton – Raphson method
4. Solving system of equation using Jacobi method
5. Solving system of equation using Gauss – Seidel method
6. Solving for largest Eigenvalue by power method
7. Solving ordinary differential equation by modified Euler's method.
8. Solving ordinary differential equation by Runge - Kutta methods of $4^{th}$ order.
9. Evaluating integrals using Trapezoidal Rule.
10. Evaluating integrals using Simpson's $\frac{1}{3}$ rd rule.
11. Evaluating integrals using Simpson's $\frac{3}{8}^{th}$ rule.
12. Finding values of functions using interpolation.

**Text Books:**


1. SCILAB: A Practical Introduction to Programming and Problem Solving [Print Replica] Kindle Edition by Tejas Sheth (Author).
2. The Maxima Book Paulo Ney de Souza Richard J. Fateman Joel Moses Cliff Yapp 19th September 2004


| **B19PC6X30** | **Project** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **0** | **0** | **2** | **2** |