POORNIMA UNIVERSITY

SCHOOL OF SCIENCE & HUMANITIES

DEPARTMENT OF SCIENCE & HUMANITIES

TEACHING SCHEME & SYLLABUS

BACHELOR OF SCIENCE

(PCM)

(BATCH-2020-23)

INDEX

POORNIMA UNIVERSITY

Your Dreams Our

VISION

To create knowledge based society with scientific temper, team spirit and dignity of labor to face global competitive challenges.

Mission

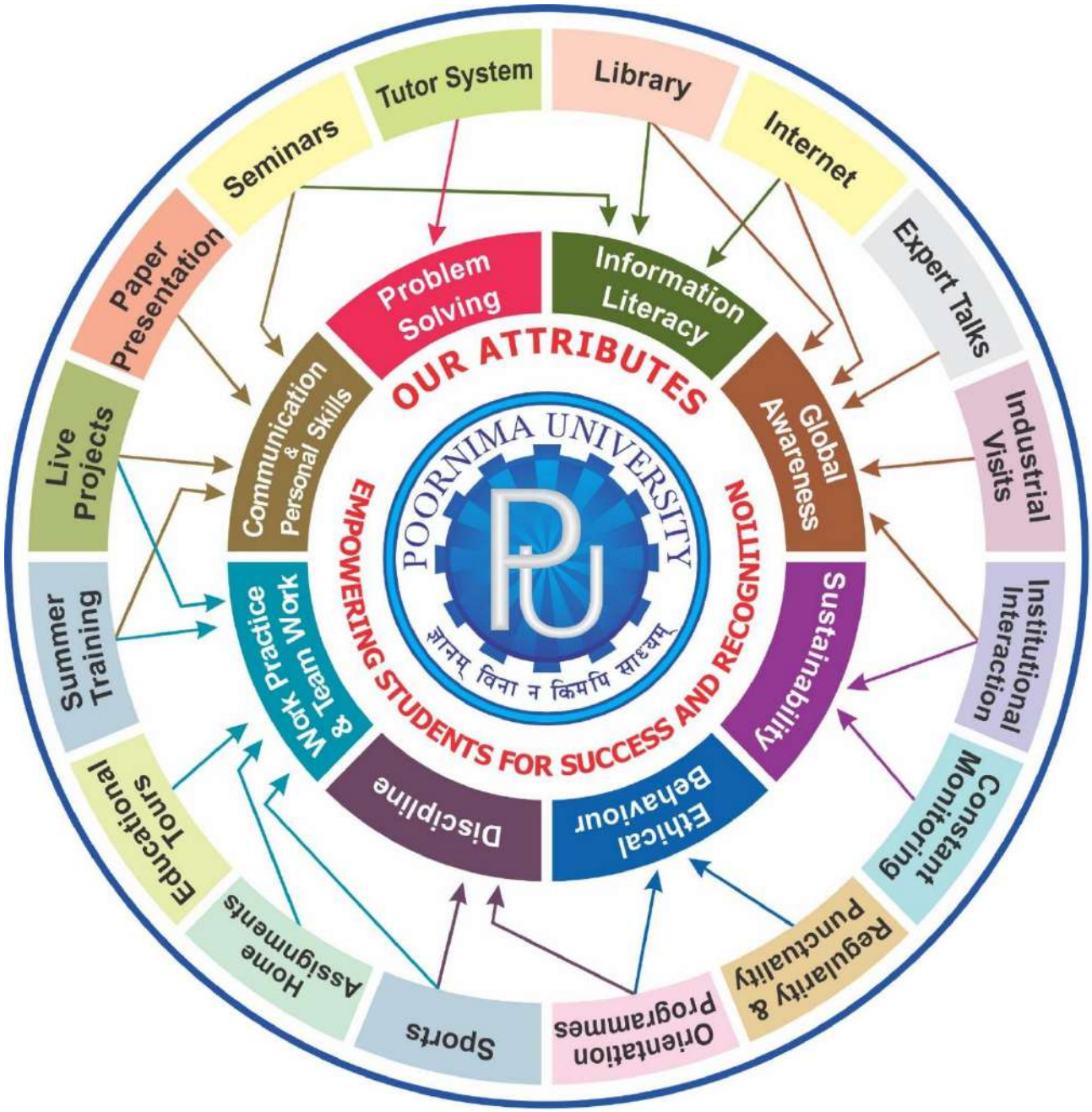
To evolve and develop skill based systems for effective delivery of knowledge so as to equip young professionals with dedication and commitment to excellence in all spheres of life.

Quality Policy

To provide Quality Education through Faculty development, updating of facilities and continual improvement meeting University norms and keeping stake holders satisfied.

Knowledge Wheel

At Poornima, the academic atmosphere is a rare blend of modern technical as well as soft skills and traditional systems of learning processes.



REVISED SYLLABUS OF BACHELOR OF SCIENCE (B.Sc.)

1. Title of the Programme

Bachelor of Science (B.Sc.)

2. Nature of the Program

B. Sc. is three years (full-time Program).

3. Preamble

The revised curriculum for B.Sc. is developed keeping in mind the national priorities and international practices. It also attempts to align the Program structure and course contents with student aspirations & recruiter expectations. This syllabus also attempts to align with National Goal of "***Make in India", "Start – Up and Stand – Up India" and "Digital India".***

4. Need for Revision of the Curriculum

There was a need for revision of the curriculum in view of the dynamism in the industry practices, evolution in technology and the evolving expectations of key stakeholders viz. students, the industry and faculty members at large. It also has relevance due to changed technological, social, cultural and economic environment of the nation.

4.1 Specifically, the triggers for the comprehensive revamp of the curriculum are

4.1.1 New Skills & Competencies desired due to dynamic technology environment: Jobs of today were perhaps not created about 5 years ago. This aspect has a direct linkage with contents and structure of syllabus across the Knowledge, Skills and Attitude (KSA) dimensions, which calls for frequent and meaningful updating of the curriculum.

4.1.2 Concerns expressed by the Industry: The industry has expressed concerns about the need for improvement in the communication skills, inter-personal skills, domain knowledge basics, business environment awareness, technology proficiency, and attitude of the B.Sc. graduates. Newer and innovative evaluation methods are necessary to address these concerns of the industry.

4.1.3 Application Orientation: There is a pressing need to imbibe application oriented thinking, based on sound knowledge of Scientific and Technical fields, principles and concepts. Science education needs to move out of the classrooms and instead focus on group activity, field work, experiential learning, etc. This can be achieved only through a radical change in the evaluation pattern and course delivery methodology.

4.1.4 Changing mind-set of the Learner: The profile of the students for the B. Sc. Program, their learning styles and the outlook towards higher education has undergone a gradual

transformation. The expectations of the students from the B. Sc. Program have changed over the last decade.

4.1.5 Integrate a basket of skill sets: SSH-School is expected to imbibe varied aspects of 'learning beyond the syllabus through innovative curriculum design, contemporary syllabus, effective delivery and comprehensive evaluation.

4.1.6 Entrepreneurial aspirations and preparedness for the same: The youth now aspires to become masters of their own and wish to start up their new ventures. These will create further growth opportunities.

Specifically, the following skill sets are in focus:-

(a) Reading & Listening Skills

(b) Problem Definition & Problem Solving Skills

(c) Application of Technology Tools

(d) Mastery of Analytics (Quantitative Aspects)

(e) Sensitization to Cross-Functional skills

(f) Sensitization to Cross-Cultural skills

(g) Sensitization to Global perspectives

(h) Peer-based Learning - Working in groups

(i) Learning by application and doing – Experiential learning

(j) Team building basics and its orientation

5. Programme Specific Outcomes

PSO 1: Advancement in Science: The ability to comprehend and implement the knowledge of various aspects of Science i.e. Physics, Chemistry and Mathematics

PSO 2: Technical skills: The proficiency to understand, apply and analyze the concepts of various technical fields like Fundamentals of computer, programming in C, MATLAB and renewable energy.

PSO 3: Career Skills: The skills to apply analyze and evaluate industry best practices by developing innovative projects and acquaintance of attitude required to work professionally, for higher studies and research, and to be an entrepreneur.

6. Program Outcome:

PO1: Disciplinary knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of B.Sc. program.

PO2: Scientific reasoning and Problem solving: Ability to analyze, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and

experiences Capacity to extrapolate from what one has learned and apply their competencies to solve real life situations

PO3: Analytical reasoning and Research related skills: Define problems, formulate hypotheses, test, analyze, interpret and draw conclusions from data and report the results of an experiment or investigation

PO4: Critical thinking: identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.

PO5: Digital literacy: Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.

PO6: Reflective thinking: Possess knowledge of Critical sensibility to lived experiences, with self awareness and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.

PO7: Environment and sustainability: Appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.

PO8: Moral and ethical awareness: Ability to embrace ethical values in conducting one's life, formulates a position about an ethical issue from multiple perspectives, and use ethical practices in all work.

PO9: Leadership qualities: Capability for mapping out the tasks of a team or an organization, and setting direction to work effectively and respectfully with diverse teams; and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team.

PO10: Communication Skills: Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; present complex information in a clear and concise manner.

PO11: Project management and finance: Ability to work independently, identify appropriate resources required for a project, and manage a project.

PO12: Lifelong learning: Ability to acquire knowledge and skills in learning activities throughout life aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place.

The B. Sc. Program prepares a student for a career in diverse sectors of the industry domestically and globally. The B.Sc. Program facilitates learning in theory and practice on

disciplinary knowledge and professional skills, oral presentations, portfolios, extended writing, and field trips. However, the demand for technical skills is not limited to the industry. Technical talent is much sought by the Government Sector, NGOs, non-corporate sector as well. Students also expect to become entrepreneurs. Their aspirations also require a broad based learning encompassing the end to end processes involved in developing entrepreneurial skills. Schools, Faculty and Students need to move away from the excessive focus on industry and look at needs and demands of broader sections of the society also.

Specifically the objectives of the B.Sc. Program are :-

(a) To equip the students with requisite knowledge, skills & right attitude necessary to provide effective leadership in a global environment.

(b) To develop competent science professional with strong ethical values, capable of assuming a pivotal role in various sectors of the Indian Economy & Society, aligned with the national priorities.

(c) To develop proactive thinking so as to perform effectively in the dynamic socio-economic and business ecosystem.

(d) To harness entrepreneurial approach and skill sets.

7. Highlights of the Curriculum

The Curriculum intends to add immense value to all stakeholders by effectively addressing their requirements in more than one way by:-

(a) Enhancing the brand value of the Technical Program of Poornima University, Jaipur.

(b) Providing the much-needed flexibility to carve a niche for themselves.

(c) Emphasizing the centrality of the student and teacher-student relationship in the learning process.

(d) Focusing on 'Continuous Evaluation' i.e. continuous evaluation throughout the Program.

(e) Empowering the Schools through cafeteria approach – by providing Generic Core, Subject Core, Generic Elective, and Subject Elective Courses. This shall provide in-built flexibility in the curriculum to help the Schools to offer tailor made courses preferred by students, from a wider basket of courses.

(f) More weightage is given on Continuous Evaluation Pattern.

(g) Emphasizing Experiential-learning aspect through Lab Credit Courses.

(h) Supplementing traditional classroom teaching/learning with focus on group activity, fieldwork, experiential learning, self-study, projects, Industry Exposure Programs etc.

(i) A thorough revamp of Systems and Operations Specializations to make them more meaningful and attractive to B.Sc. students.

(j) Providing opportunity to students to choose courses from other electives to explore cross-functional issues.

(j) Emphasizing on Research, Inter-personal, Analytical, Cross-Cultural, Entrepreneurial Skills, and Global aspects of managerial careers throughout the curriculum.

8. Pattern

The Program comprises of 6 Semesters for B.Sc., adopts the Choice Based Credit System (CBCS) and Grading System.

9. Choice Based Credit System

9.1 Choice Based Credit System (CBCS) offers wide ranging choice for students to opt for courses based on their aptitude and their career goals. CBCS works on the fundamental premise that students are mature individuals, capable of making their own decisions.

9.2 CBCS enables a student to obtain a degree by accumulating required number of credits prescribed for that degree. The number of credits earned by the student reflects the knowledge or skill acquired him / her. Each course assigned a fixed number of credits based on the contents to learn & the expected effort of the student. The grade points earned for each course reflects the student's proficiency in that course. CBCS is a process of evolution of educational reforms that would yield the result in subsequent years and after a few cycles of its implementation.

10. Key Features of CBCS

10.1 Enriching Learning Environment. A student is provided with an academically rich, highly flexible learning system blended with abundant provision for skill practice and activity orientation that he/she could learn in depth without sacrificing his/her creativity. There is a definite movement away from the traditional lectures and written examination.

10.2 Learn at your own pace: A student can exercise the option to decide his/her own pace of learning- slow, normal or accelerated plan. Students can select courses according to their aptitude, tastes and preferences.

10.3 Continuous Learning & Student Centric Continuous Evaluation. CBCS makes the learning process continuous and the evaluation process is not only made continuous but also made learner centric. The evaluation is designed to recognize the capability and talent of a student.

10.4 Active Student-Teacher Participation. CBCS leads to quality education with active teacher-student participation. This provides avenues to meet student's scholastic needs and aspirations.

10.5 Industry Institute Collaboration. CBCS provides opportunities for meaningful collaboration with industry and foreign partners to foster innovation, by introduction of electives and half credit courses through the cafeteria approach. This will go a long way in capacity building of students and faculty.

10.6 Interdisciplinary Curriculum. Cutting edge developments generally occur at the interface of two or more discipline. Interdisciplinary approach enables integration of concepts, theories, techniques, and perspectives from two or more disciplines to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline.

10.7 Employability Enhancement. CBCS shall ensure that students enhance their skill/employability by taking up project work, entrepreneurship and vocational training.

10.8 Faculty Expertise. CBCS shall give the Schools the much-needed flexibility to make best use of the expertise of available faculty.

11. Program Structure in Choice Based Credit System

PROGRAM

SEMESTER			
COURSES			
CORE COURSES		***ELECTIVE COURSES***	
Generic Core	***Subject Core***	***Generic Elective***	***Subject Elective***

11.1 Time Schedule

11.1.1 An academic year is divided into two Semesters – Odd and Even. Odd Semester shall have I, III and V, whereas Even Semester shall have II, IV and VI. In each semester, courses are offered in 15 teaching weeks and the remaining 5 weeks are to be utilized for conduct of examinations and evaluation purposes.

11.1.2 For students, each week has 33 working hours spread over 5/6 days a week consisting of lectures, assignments, class participation, library work, special counseling, Sports, project work, field visit, youth welfare and social activities.

11.1.3 Course. A "Course" is a component of Program, i.e. in the new system; papers will be referred to as courses. Each course is identified by a unique course code. While designing curriculum, course can have defined weightage. These weightages are called credits.

11.1.4 Each course, in addition to having a syllabus, has learning objectives and learning outcomes.

A course may be designed to comprise lectures/ tutorials/ laboratory work/ field work/ project work/ vocational training /viva voce etc. or a combination of some of these.

11.2 Core Courses

The Curriculum comprises of Core Courses and Elective Courses. Core courses are the foundation courses of basic science education They are compulsory for all the students. Core courses are of two types: Generic Core & Subject Core.

11.2.1 **Generic Core.** This is the course, which should compulsorily be studied by a candidate as a core requirement to complete the requirement of a degree in a said discipline of study. Therefore, Generic Core courses are mandatory and fundamental in nature. These courses cannot be substituted by any other courses. Such courses are also known as Hard Core Courses. A Hard core course may be a Theory, Practical, Seminar, Field based or Project Work based subject, which is a compulsory component in the Program Structure.

11.2.2 **Subject Core:** A Core course may be a Subject Core if there is a choice or an option for the candidate to choose from a broad category (grouping) of subjects (specializations). These are also known as Soft Core Courses.

Following specializations shall be offered

S.No.	Course	Year of Starting
1	B.Sc. (PCM)	2017
2	Ph. D (in relevant Streams)	2012

For B. Sc. Course:

The Program's thrust is on giving the learners a thorough and sound background in theoretical and practical-oriented courses relevant to the current and emerging developments in the field of sciences.

In B.Sc Program there are different kinds of courses

- Core Course: There will be a Core Course in every semester. This is the course which is to be compulsorily studied by a student as a core requirement to complete the requirement of a Program in a said discipline of study.
- Open Elective Course: Elective courses are of interdisciplinary nature. Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study

- Ability Enhancement compulsory Courses (AECC): The Ability Enhancement (AE) Courses are based upon the content that leads to Knowledge enhancement (i) Environmental Science and (ii) English (iii) Human values and professional ethics (iv) Anandam
- Skill Enhancement Courses (SEC): These are the courses based upon the content that leads to Knowledge enhancement. SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, etc. These courses are fundamental of computers, Industrial Training & Seminar, Dissertation, etc.
- Social outreach, Discipline and extracurricular activities: These courses involve Talent enrichment Program and career-oriented courses.

11.3 Pre-requisites for successful implementation of CBCS

The success of the CBCS also requires certain commitments from both the students and the teachers.

11.3.1 The student should be regular and punctual to his/ her classes, studious in carrying out the assignments and should maintain consistency in his tempo of learning. He should make maximum use of the available library, internet and other facilities.

11.3.2 The teachers are expected to be alert and punctual and strictly adhere to the schedules of teaching, tests, seminars, evaluation and notification of results.

11.3.3 All teachers should notify the tentative schedule of teaching and tests of the entire semester, including the dates of tests, dates of score notification and all other schedules, which can be planned in advance.

11.3.4 The teachers are expected to adhere to unbiased and objective evaluation and marking of continuous evaluation scores (internal examinations) which will not only maintain the confidence of the students, but at the same time, ensure that merit is given due credit.

11.3.5 Transparency, objectivity and quality are the key factors that will sustain a good CBCS system.

11.3.6 At the post-graduate level, and in a professional Program, the syllabus is to be looked upon as the bare minimum requirement to be fulfilled and sufficient emphasis shall be laid on contemporary aspects, going beyond the syllabus.

12 Credits

12.1 The definition of ‘credits’ can be based on various parameters—such as the learning hours put in, learning outcomes and contact hours, the quantum of content/syllabus prescribed for the 1course. The credit system requires that a student progresses in the academic Programs not in terms of time (years or semesters), but in terms of courses.

12.2 Each course is assigned a certain credit, depending on the estimated effort put in by a student. When the student passes that course, he/she earns the credits associated with that course. In the Credit system, the emphasis is on the hours put in by the learner and not on the workload of the teacher. Each credit can be visualized as a combination of 2 components viz. Lecture (L) + Practical / Project Work (P) i.e. LP Pattern.

12.3 The effort of the learner for each Credit Point may be considered under two parts:-

(a) One part consisting of the hours actually spent in classroom / practical / Project work/ field work instructions.

(b) The other part consisting of notional hours spent by the Learner in self-study, in the library, peer interactions, case study, writing of technical report, research paper and assignments, projects etc. for the completion of that course.

12.4 Every course offered shall have three components associated with the teaching-learning process of the course, in example,

(a) Lecture – L: Classroom sessions delivered by faculty in an interactive mode.

(b) Practice - P: Practice session /Project Work consisting of Hands-on experience / Field Studies / Case studies that equip students to acquire the much required skill component.

12.5 In terms of credits, for a period of one semester of 15 weeks:-

(a) Every ONE-hour session per week of L amounts to 1 credit per semester

(b) A minimum of THREE hours per week of P amounts to 1.5-2 credit per semester,

12.6 The teaching / learning as well as evaluation are to be interpreted in a broader perspective as follows:-

(a) Teaching – Learning Processes: Classroom sessions, Group Exercises, Seminars, Small Group Projects, Self-study, etc.

(b) Evaluation: Tutorials, Class Tests, Presentations, Field work, Assignments, Term papers, etc.

12.7 Full Credit Course: A course with weightage of 3 credits is considered as a full course. (Except for Major Project/Dissertation which are full credit courses with 11 Credits each.)

12.8 Half Credit Course: A course with weightage of 2 credits is considered as a half course.

12.9 The B. Sc. Program is a combination of 1, 1.5, 2, 3 Credits courses.

13 Rationale for adoption of the Credit and Grading System

13.1 Learner's Perspective. The current practice of evaluation of student's performance at the end of a semester is flawed. The students are expected to express their understanding or mastery over the content included in their curriculum for a complete semester within a span

of three hours and their efforts over the semester are often completely ignored. It also promotes to an unhealthy practice of cramming before the examinations and focusing on marks rather than on learning.

13.2 **Evaluation Perspective**: The present system of evaluation does not permit the flexibility to deploy multiple techniques of assessment in a valid and reliable way. Moreover, the current practice of awarding numerical marks for reporting the performance of learners suffers from several drawbacks and is a source of a variety of errors. Further, the problem gets compounded due to the variations in the marks awarded in different subjects. The 'raw score' obtained by the learner, is, therefore, not a reflection of his true ability.

In view of the above lacunae, it is desirable that the marking system used for the declaration of results is replaced by the grading system. The system of awarding grades provides a more realistic picture of learner's ability than the prevailing marking system. Excellence in quality education can be achieved by evaluating the true ability of the learners with the help of continuous evaluation.

14 Salient Features of the Grading System

14.1 In this system, students (learners) are placed in ability bands that represent a range of scores. This ability range may be designated with alphabetical letters called as 'GRADE'.

14.2 Grading reflects an individual learner's performance in the form of a certain level of achievement.

14.3 The Grading system ensures natural classification in qualitative terms rather than quantitative terms since it expresses a range /band of scores to which a learner belongs such as O, A,B,C,D,E & F.

14.4 Grades can be interpreted easily and directly and can be used to prepare an accurate 'profile' of a learner.

14.5 A properly introduced grading system not only provides for a comparison of the learners' performance but it also indicates the quality of performance with respect to the amount of efforts put in and the amount of knowledge acquired at the end of the course by the learners.

15 Basics of Credit and Grading System

15.1 Grading is a method of reporting the result of a learner's performance subsequent to his evaluation. It involves a set of alphabets which are clearly defined and designated and uniformly understood by all the stake holders. Grading is carried out in a variety of ways. The classification of grades depends upon the reference point.

15.2 With ‘Approach towards Grading’ as the reference point, Grading may be classified as:

15.2.1 Direct grading. When the performance exhibited by the examinees is assessed in qualitative terms and the impressions so obtained by the examiners are directly expressed in terms of letter grades, it is called, ‘Direct Grading’.

15.2.2 Indirect grading. When the performance displayed by the examinees is first assessed in terms of marks and subsequently transformed into letter grades by using different modes, it is called, ‘Indirect Grading.’

15.3 With ‘Standard of Judgment’, as the reference point Grading may be classified as:-

15.3.1 Absolute grading: The method that is based on a predetermined standard which becomes a reference point for the learner’s performance is called ‘Absolute Grading’. This involves direct conversion of marks into grades irrespective of the distribution of marks in a subject.

15.3.2 Relative grading: Relative Grading is popularly known as grading on the curve. The curve refers to the normal distribution curve or some symmetric variant of it. This method amounts to determining in advance approximately what percentage of learners can be expected to receive different grades, such as O,A,B,C,D,E,F. In this grading system the grade is not determined by the learner’s performance but on the basis of group performance.

15.4 Absolute grading has several advantages such as

15.4.1 The procedure is simple and straightforward to use

15.4.2 Each grade is distinctly understandable

15.4.3 The learner has the freedom to strive for the attainment of the highest possible grade and it enables the learners to know their strengths and weaknesses.

15.5 The few limitations in Absolute Grading method are that:-

15.5.1 The distribution of scores is taken at its face value regardless of the errors of measurement creeping in due to various types of subjectivity.

15.5.2 Besides, the cut-offs of different categories are also arbitrarily decided.

15.6 It is proposed to use the Indirect and Absolute Grading System for the B.Sc. Program, i.e. the assessment of individual Courses in the concerned examinations will be on the basis of marks, but the marks shall later be converted into Grades by a defined mechanism wherein the overall performance of the Learners can be reflected after considering the Credit Points for any given course. However, the overall evaluation shall be designated in terms of Grade.

16 Session Duration

Each teaching-learning, evaluation session shall be of 60 minutes.

17. Registration

It is mandatory for every student, to register every semester, for the courses opted under CBCS system, for that semester. Such registration forms the basis for a student to undergo continuous evaluation, online evaluation and end-semester examination. Application forms for University examinations are to be filled up based on the choices finalized during the registration process and submitted to the University along with the prescribed examination fee.

18. Examination

Pattern of Examination: The evaluation scheme comprises of

(i) University Evaluation

(ii) Continuous Evaluation

18.1 for each full credit course

(a) 60 marks shall be evaluated by the University and

(b) 40 marks shall be evaluated by the respective Department

18.2 For each half credit course:-

(a) 60 marks shall be evaluated by the respective Department.

(b) 40 marks shall be evaluated by the University.

18.3 University Evaluation

There shall be University evaluation for each full credit course as per the time table announced by the University. The evaluation by the University for Full Credit Courses shall be in Written Mode (subjective – concept plus case study / application oriented type) for 100 marks.

18.4 **Instructions to External Paper Setters / Chairman/ Examiners**. The syllabus for each course is organized in 5 units. The end-semester University evaluation shall cover the entire syllabus prescribed for the course. For University evaluation (ESE-Written Examination – subjective type of 60 marks) of each full credit course, the question pattern shall be as follows:-

(a) Pattern of Question Paper. There shall be five questions each of 12 marks

(b) All questions shall be compulsory with internal choice within the questions. i.e. There shall be 2 questions from each unit of the curriculum with an internal option.

(c) A Question may be subdivided into sub-questions a, b, c… and the allocation of marks depend on the weightage of the topic.

ILLUSTRATIVE PATTERN OF QUESTION PAPER

Q. 1 (A)……..based on Unit 1

OR

Q.1 (B) ……..based on Unit 1.

Q.2. (A) ……..based on Unit 2

OR

Q.2 (B) ……..based on Unit 2

Q.3 (A) ……..based on Unit 3

OR

Q.3 (B) ……..based on Unit 3

Q.4 (A) ……..based on Unit 4

OR

Q.4 (B) ……..based on Unit 4

Q.5 (A) ……..based on Unit 5

OR

Q.5 (B) ……..based on Unit 5

18.5 Questions shall assess knowledge, application of knowledge, and the ability to synthesize knowledge. The paper setter shall ensure that questions covering all skills and all units are set. She/he shall also mandatorily submit a detailed scheme of evaluation along with

the question paper. Questions shall be of three categories of difficulty level – low difficulty, average difficulty and high difficulty.

18.6 The duration of written examination shall be 3 hours. Students shall be provided a single answer sheet of 16 pages.

Continuous Evaluation

18.7 A continuous assessment system in semester system (also known as internal assessment/comprehensive assessment) is spread through the duration of course and is done by the teacher teaching the course or by the department.

18.8 The continuous assessment provides a feedback on teaching learning process. The feedback after being analyzed is passed on to the concerned student for implementation and subsequent improvement. As a part of continuous evaluation, the learners shall be evaluated on a continuous basis by the Department to ensure that student learning takes place in a graded manner.

18.9 Continuous evaluation components should be designed in such a way that the faculty can monitor the student learning & development and intervene wherever required. The faculty must share the outcome of each continuous evaluation component with the students, soon after the evaluation, and guide the students for betterment.

18.10 Individual faculty member shall have the flexibility to design the continuous evaluation components in a manner so as to give a balanced assessment of student capabilities across Knowledge, Skills & Attitude (KSA) dimensions based on variety of assessment tools.

Suggested Components for Continuous Evaluation

18.11 Suggested components for Continuous Evaluation (CE) are:-

(a) Case Study / Case let / Situation Analysis – (Group Activity or Individual Activity)
(b) Class Test
(c) Open Book Test
(d) Field Visit / Study tour and report of the same
(e) Small Group Project & Internal Viva-Voce
(f) Learning Diary
(g) Scrap Book
(h) Group Discussion
(i) Role Play / Story Telling
(j) Individual Term Paper / Thematic Presentation
(k) Written Home Assignment
(l) Industry Analysis – (Group Activity or Individual Activity)

(m) Literature Review / Book Review

(n) Model Development / Simulation Exercises – (Group Activity or Individual Activity)

(o) In-depth Viva

(p) Quiz

(q) Student Driven Activities

(r) News-paper reading

18.12 There shall be a minimum of three continuous evaluation components per full credit course as well as for each half-credit course. The faculty shall announce in advance the units based on which each continuous evaluation shall be conducted. The Department shall however have the liberty to conduct additional components (beyond three). However, the total outcome shall be scaled down to 40 / 60 marks for full credit and 60 / 40 for half credit courses respectively. Marks for the continuous evaluation must be communicated by the Department to the Exam Department of the University as per the schedule declared by the University. Detailed record of the Continuous Evaluation shall be maintained by the Department. The same shall be made available to the University, on demand.

18.13 At the end of Continuous Evaluation (out of 40 / 60 marks) the student may get an opportunity to improve the marks if he / she gets less than (30% / 25%) of marks

54. Safeguards for Credibility of Continuous Evaluation: The following practices are encouraged to enhance transparency and authenticity of continuous evaluation:-

(a) Involving faculty members from other department

(b) Setting multiple question paper sets and choosing the final question paper in a random manner.

(c) One of the internal faculty members (other than the course teacher) acting as jury during activity based evaluations.

(d) Involvement of Industry personnel in evaluating projects / field based assignments.

(e) Involvement of alumni in evaluating presentations, role-plays, etc.

(f) 100% moderation of answer sheets, in exceptional cases.

19. **Summer Internship Project**

19.1 At the end of Fourth Semester each student shall undertake a Summer Internship Project (SIP) for 8 /10 weeks. It is mandatory for the student to seek advance written approval from the faculty guide and the Dean of the School about the topic and organization before

commencing the SIP. The SIP may or may not have a Functional Focus, i.e. the student may take up a SIP in his/her intended area of specialization or in any other functional area of management. Ideally the SIP should exhibit a cross-functional orientation. The student shall submit a written structured report based on work done during this period based on suggested guidelines and research methodology. SIP may be a research project – based on primary/ secondary data or may be an operational assignment involving working by the student on a given task/assignment/project/ etc. in an organization / industry. It is expected that the SIP shall sensitize the students to the demands of the workplace. The learning outcomes and utility to the organization must be specifically highlighted. The report should be well documented and supported by:-

(a) Introduction/ Executive Summary.

(b) Objectives of the Training.

(c) Company/ Organization profile (including Organization Chart)

(d) Research Methodology (Statement of Problem, Hypothesis (if any), Research Design.

(e) Technical prospective, Data Interpretation & Technology used by Industry.

(f) Relevant activity charts, tables, graphs, diagrams, etc.

(g) Suggestions & Recommendations

(h) Conclusions

(i) References in appropriate referencing styles. (APA, MLA, Harvard, Chicago Style etc.)

(j) Appendix (Questionnaire, Data Sheets etc.)

19.2 It should reflect the nature and quantum of work undertaken by the student. The report must reflect 8 /10 weeks of work and justify the same.

19.3 The student shall submit TWO hard copies & one soft copy (CD) of the project report before 10th September in Semester V. One hard copy is to be returned to the student by the Department after the External Viva-Voce. The Department shall conduct an internal viva-voce for evaluation of the SIP for 60 marks. The Panel shall comprise of the Internal Faculty Guide & One additional faculty nominated by the Dean.

19.4 There shall be an external viva-voce for the SIP for 40 marks. The examiner's panel for the same shall include one external faculty member nominated by the University and one internal faculty member nominated by the Dean. The external viva-voce shall be conducted for 15 minutes at least per student.

19.5 The Internal & the External viva-voce shall evaluate the project based on:-

(a) Actual work undertaken by the student

(b) Student understands of the organization and business environment

(c) Outcome of the project

(d) Utility of the project to the organization

(e) Basic analytical capabilities

19.6 Copies of SIP report and records of evaluation shall be maintained by the Department for a period of 3 academic years.

20. Dissertation

20.1 In Year III the student shall work under the supervision of the Faculty and carry out a minor and major project work / dissertation and Technical Seminar and submit a structured report in TWO hard copies & one soft copy (CD). The student is required to conduct advanced multidisciplinary research on a topic or present a seminar report related to one (or more) of contemporary technical topics. The topic is chosen in consultation with the student's supervisor.

20.2 The student will prepare and present a detailed research proposal prior to starting the work. It is mandatory for the student to seek advance written approval from the faculty guide and the Dean / HOD of the School about the topic before commencing the dissertation/ Project work. A dissertation outlining the entire problem, including a survey of literature and the various results obtained along with their solutions is expected to be produced. The student must submit the completed dissertation and make an oral / Power point presentation of the same. Through the dissertation, the student is expected to furnish evidence of competence in understanding varied aspects of the theme/topic selected and a deep understanding of the specialty area. The completion of the dissertation / project shall be certified by the Faculty Guide & approved by the Dean of the School.

20.3 The student can undergo desk research or industrial research and can follow the guidelines mentioned in the SIP for preparation of their final hard copy.

21 Assessment & Grade Point Average

The performance of a student will be evaluated in terms of two indices, viz.

a) Semester Grade Point Average (SGPA) which is the Grade Point Average for a semester

b) Cumulative Grade Point Average (CGPA) which is the Grade Point Average for all the completed semesters at any point in time.

21.1 **Semester Grade Point Average (SGPA)**. At the end of each semester, SGPA is calculated as the weighted average of GPI of all courses in the current semester in which the student has passed, the weights being the credit values of respective courses.

SGPA = Grade Points divided by the summation of Credits of all Courses.

$\sum$ {C * GPI} SGPA / $\sum$C for a semester

Where GPI is the Grade and C is credit for the respective Course.

21.2 **Cumulative Grade Point Average (CGPA):** Cumulative Grade Point Average (CGPA) is the grade point average for all completed semesters. CGPA is calculated as the weighted average of all GPI of all courses in which the student has passed up to the current semester.

Cumulative Grade Point Average (CGPA) for the Entire Course

CGPA = $\sum$ {C * GPI} / $\sum$C for all semesters taken together.

Where GPI is the Grade and C is credit for the respective Course.

22 **Assessment and Grade Point Average**

(a) The system of evaluation will be as follows

(i) Each Continuous Evaluation / Assessment and ESE (ETE) will be evaluated in terms of marks. The marks for Continuous Assessment and ESE (ETE) will be added to convert into a grade and later a grade point average. There is no grade independently for CA or ESE (ETE).

(ii) Result of a student will be declared for each semester after the ESE (ETE) only.

(iii) The student will get a Grade Sheet with total grades earned and a Grade Point Average, after earning the minimum number of credits towards the completion of a UG and PG program.

Marks	Grade	Grade Point
80-100	O : Outstanding	10
70-79	A+ : Excellent	9
60-69	A : Very Good	8
55-59	B+ : Good	7
50-54	B : Above Average	6
45-49	C : Average	5
40-44	P : Pass	4
0-39	F : Fail	0
-	Ab : Absent	0

23 Guidelines for Open Elective

23.1 **Open Elective Course:** Open Elective course can be chosen from a pool of courses and are:

- Very specific or specialized or advanced to the discipline / subject of study
- Supportive to the discipline/ subject of study
- Providing an expended scope
- Enabling an exposure to some other discipline/subject/domain
- Nurturing candidate's proficiency/skill.

23.2 **Guide Lines for Department**:

23.2.1 Each Department shall submit name of two courses, which will be considered in the list of University level open elective course before the starting of each Session i.e. month of March/ April every year to the COE.

23.2.2 Students are required to clear / pass "N" number of open elective courses as per given formula.

$$N = (\text{Year of Program} - 1) * 2.$$

Year of Program: 2/3/4/5 i.e. B.Tech = 4; B.Sc. = 3

23.2.3 Students can decide the pace of doing these courses i.e. they can opt minimum one and maximum two open elective per semester. However, the total such courses shall not exceed N during the whole program.

23.2.4 Students are required to give application in the prescribed format as given below to their respective HOD in the starting of session for open elective courses:

To, The Controller of Examination, PU					
Subject: Regarding Open Elective Courses.					
S. No	**Name of Student**	**Reg. No**	**Year/ Semester**	**Open Elective Course Name**	
				First	**Second**

Date :	**Signature of Student**
Approved by HOD **Date :**	**Signature of HoD**
Approved by Dean **Date :**	**Signature of Dean**

23.2.5 HOD of respective department is required to submit the list of open elective courses opted by the students to the Exam Cell in last week of April every year.

23.2.5 For Second semester open elective duration will be 2 Hours.

24 <u>Guidelines for MOOC COURSES:</u>

Applicable from the session 2020 – 21 for students aspiring for HONOURS Degree.

24.1 The UGC has issued UGC (Credit Framework for Online Learning Courses) Regulation, 2016. These shall apply to all universities established or incorporated by or under a Central Act, a Provincial Act, or a State/Union Territory Act and all institutions recognized by or affiliated to such Universities and all institutions deemed to be universities under Section 3 of the UGC Act, 1956.

24.2 All India Council for Technical Education (AICTE) has introduced Model Curriculum for Bachelor programs of 4 years/ 3 Years, and additional credits will be required to be done for the degree of Bachelor program with Honours. These additional credits will have to be acquired with online courses (MOOCs) as per AICTE.

24.3 This creates an excellent opportunity for students to acquire the necessary skill set for employability through massive online courses where the rare expertise of world famous experts from academics and industry are available.

24.4 Students are required to complete additional credits through MOOCs within 4 years/ 3years of time (whatever be applicable time for the completion of registered program) so as to become eligible for Honours degree as per norms.

24.5 It is necessary to complete minimum MOOCs credit course as mentioned below for becoming eligible for the Honours degree in the registered program.

S.No	Program Duration	Required credits for Honours
1.	2- Year	10- Credits
2.	3- Year	15- Credits
3.	4-Year	20- Credits

24..6 MOOC Course Credits shall be calculated as per details given below:

S. No	NPTEL/ SWAYAM Course duration (in weeks)	Equivalent Credits
1	4	2
2	8	3
3	12	4

24.7 Student are required to give the prior information about MOOCs courses to his respective HOD and COE, in which he/she wants to register for online certification.

24.8 After getting permission from respective HOD, a student can register for the MOOC certification courses.

24.9 After successful completion of the said MOOC course, the student shall submit the certificate of completion to the respective department. If he/ she fails to provide the certificates of MOOC courses before last teaching day of the semester then these certificates will not be considered later.

25 DETAILS OF COURSES

School of Science & Humanities offering the following courses.

S.No.	Course	Year of Starting
1	B.Sc. (PCM)	2017

2	Ph.D (in relevant Streams)	2012

26 ELIGIBILITY CRITERIA

Eligibility criteria for admitting in the following courses is given below.

S. No	Course	Eligibility
1.	B. Sc.	• Pass in 10+2 in Science stream
2.	Ph. D	• 55% in Post Graduation + Virtual Entrance Examination & Interview.

27. COMPONENT WISE MARKS DISTRIBUTION

Examination component and their marks distribution.

MARKS DISTRIBUTION				
S.No	**Exam Component**	**Theory (Th)**	**Practical (Pr)**	**Discp & TEP DTP/Practical**
		Max. Marks	**Max. Marks**	**Max. Marks**
A.	**Internal Evaluation (IE)**	40	60	50
	CIE-I	12	20	NA
	MSE	12	20	NA
	CIE-II	06	10	NA
	Attendance	10	10	NA
B.	**End Semester Exam (ESE)**	60	40	NA
	Total	**100**	**100**	**50**

IE – Attendance Marks both Theory & Practical Courses :

At the end of the semester, the marks for attendance (both for Theory & Practical) will be finalized by each course teacher/instructor/faculty on the basis of total attendance of his/her course as per the guideline indicated following table :

S. No	Total Attendance (TA in % Range)	Marks (Out of 10)
1	95% ≤ **TA**	10
2	90 % ≤ **TA** < 95%	09

3	85 % ≤ **TA** < 90%	08
4	80 % ≤ **TA** < 85%	07
5	70 % ≤ **TA** < 80%	06
6	60 % ≤ **TA** < 70%	05
7	50 % ≤ **TA** < 60%	04
8	40 % ≤ **TA** < 50%	03
9	30 % ≤ **TA** < 40%	02
10	20 % ≤ **TA** < 30%	01
11	**TA** < 20%	00

Minimum Passing Percentage Components

Minimum Passing Percentage				
S. No	Program	IE	ESE	Total
1	B.Sc	35%	45%	50%
2	Ph. D	-----	------	50%

27.1 It must be noted that at the end of each semester the marks of IE component stands fixed. They now remain unchanged and can't be improved upon. All the chances of improvement for IE will be given within the semester itself. Moreover the minimum passing percentage in IE component is optional.

27.2 If the student attains the minimum percentage in the ESE & Total Components of a particular course then that course will be considered as Clear and will be awarded the "PASS" status, if not the course attains "BACK" status. Additionally a course can be awarded "GPASS" Status if a student passes it by award of Grace marks.

27.3 Out of the total courses for which the student has registered in a particular semester, he/she will earn the credits for courses with status "PASS"/"GPASS" in that semester, irrespective of the grade obtained in them.

27.4 Moreover Discp & TEP Component credit will not be counted for promotion (neither in total nor in attained, as it has no Pass/Back/G Pass Status.

28. <u>Class Attendance & Debar Policy</u>

- Class Attendance and Debar Policy:
- Class attendance and Marks for all courses of study will be taken from Department.

- Apart from monthly communication for attendance, the tentative short attendance lists and final short attendance lists will be published by Chief Proctor.
- The students have to maintain a minimum of 75% attendance, combining all courses / activities in his/her program of study.
- For any medical issues / other participation consult department head/ department dean / proctor.

29. <u>Eligibility ESE</u>

- Eligibility for ESE (End Semester Examination)
- He/She has filled the relevant examination form in stipulated time period.
- If student satisfies the minimum attendance criterion
- If student is not guilty of any act of indiscipline

30. End Semester Examination-Supplementary & Back:

- End Semester Examination (ESE) will be held at the end of each semester. They can be further categorized as Main ESE and Back ESE.
- Generally ESE Main & Back will be held during 15 Nov – 15 Dec (odd semester) and 15 April 15 May (even semester) (considering no gap/break after odd semester).
- The ESE Theory will be held in two sessions (9-12 and 12:30-3:30).
- The student will be given 15-20 days duration to fill the exam form with normal fee, further with late fee etc., the last date being 10-15 days prior to last teaching day.
- If some student accidently forgot and wishes to fill after last date, he has to give the application for same, otherwise a undertaking stating that he will not sit in the exams.
- A minimum two day window may open just before the last teaching day to give chance to such students, based on the decisions of a committee.
- In no case the exam form will be filled on the day of commencement of theory exam or later.

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POORNIMA UNIVERSITY

School of Science & Humanities

B. Sc. (PCM), Batch: 2020-23

Teaching Scheme for First Year First Semester

Course Code	Course Name	Teaching Scheme (Hrs. per Week)			Marks Distribution			Credits
		Lecture (L)	Tutorials (T)	Practical (P)	IE	ESE	Total	
A.	**Core Courses**							
BSA01101	Mechanics	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA01102	Electromagnetism	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA01103	Inorganic Chemistry	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA01104	Organic Chemistry	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA01105	Calculus	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA01106	Vector Calculus and Matrices	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA01207	Chemistry Lab	**-**	**-**	**3**	**60**	**40**	**100**	**1.5**
BSA01208	Physics Lab	**-**	**-**	**3**	**60**	**40**	**100**	**1.5**
B.	**Department Elective**							
	NIL							
C.	**Open Elective**							
	NIL							
D.	**Humanities and Social Sciences including Management courses (HSSM) OR Ability Enhancement Compulsory Course (AECC)**							
BSA01209	Anandam Course	**-**	**-**	**1**	**60**	**40**	**100**	**2**
BSA01110	English	**2**	**-**	**-**	**40**	**60**	**100**	**2**
BSA01111	Human Values & Professional Ethics	**2**	**-**	**-**	**40**	**60**	**100**	**2**
BSA01212	Communication Skills-I	**-**	**-**	**3**	**60**	**40**	**100**	**2**
E.	**Skill Enhancement Courses (SEC) OR Project work, Seminar and Internship**							
	NIL							
F.	**Social Outreach, Discipline & Extra Curricular Activities**							
BSA01613	Talent Enrichment Programme (TEP-I)	**-**	**-**	**1**	**50**	**-**	**50**	**1**
	Total	**22**	**-**	**11**				**30**
	Total Teaching Hours	**33**						

POORNIMA UNIVERSITY

School of Science & Humanities

B. Sc. (PCM), Batch: 2020-23

Teaching Scheme for First Year Second Semester

Course Code	Course Name	Teaching Scheme (Hrs. per Week)			Marks Distribution			Credits
		Lecture (L)	Tutorials (T)	Practical (P)	IE	ESE	Total	
A.	**Core Courses**							
BSA02101	Optics	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA02102	Waves and Oscillations	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA02103	Organic Chemistry	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA02104	Physical Chemistry	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA02105	Numerical Analysis	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA02106	Differential Equations	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA02207	Chemistry Lab	**-**	**-**	**3**	**60**	**40**	**100**	**1.5**
BSA02208	Physics Lab	**-**	**-**	**3**	**60**	**40**	**100**	**1.5**
B.	**Department Elective**							
	NIL							
C.	**Open Elective**							
	NIL							
D.	**Humanities and Social Sciences including Management courses (HSSM) OR Ability Enhancement Compulsory Course (AECC)**							
BSA02209	Anandam Course	**-**	**-**	**1**	**60**	**40**	**100**	**2**
BSA02110	Environmental Studies	**2**	**-**	**-**	**40**	**60**	**100**	**2**
BSA02211	Environmental Studies Lab	**-**	**-**	**2**	**60**	**40**	**100**	**1**
BSA02212	Personality Grooming-I	**-**	**-**	**3**	**60**	**40**	**100**	**2**
E.	**Skill Enhancement Courses (SEC) OR Project work, Seminar and Internship**							
	NIL							
F.	**Social Outreach, Discipline & Extra Curricular Activities**							
BSA02613	Talent Enrichment Programme (TEP-II)	**-**	**-**	**1**	**50**	**-**	**50**	**1**
	Total	**20**	**-**	**13**				**29**
	Total Teaching Hours	**33**						

POORNIMA UNIVERSITY

School of Science & Humanities

B. Sc. (PCM), Batch: 2020-23

Teaching Scheme for Second Year Third Semester

Course Code	Course Name	Teaching Scheme (Hrs. per Week)			Marks Distribution			Credits
		Lecture (L)	Tutorials (T)	Practical (P)	IE	ESE	Total	
A.	**Core Courses**							
BSA03101	Thermodynamics and Statistical Physics	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA03102	Electronic Devices and Circuits	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA03103	Inorganic Chemistry	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA03104	Physical Chemistry	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA03105	Analytical Geometry	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA03106	Number Theory	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA03207	Chemistry Lab	**-**	**-**	**3**	**60**	**40**	**100**	**1.5**
BSA03208	Physics Lab	**-**	**-**	**3**	**60**	**40**	**100**	**1.5**
B.	**Department Elective**							
	NIL							
C.	**Open Elective**							
	* As per Annexure - I	**2**	**-**	**-**	**40**	**60**	**100**	**2**
D.	**Humanities and Social Sciences including Management courses (HSSM) OR Ability Enhancement Compulsory Course (AECC)**							
BSA03209	Anandam Course	**-**	**-**	**1**	**60**	**40**	**100**	**2**
BSA03210	Communication Skills-II	**-**	**-**	**3**	**60**	**40**	**100**	**2**
BSA03211	Personality Grooming-II	**-**	**-**	**3**	**60**	**40**	**100**	**2**
E.	**Skill Enhancement Courses (SEC) OR Project work, Seminar and Internship**							
	NIL:							
F.	**Social Outreach, Discipline & Extra Curricular Activities**							
BSA03612	Talent Enrichment Programme (TEP-III)	**-**	**-**	**-**	**50**	**-**	**50**	**1**
	Total	**20**	**-**	**13**				**30**
	Total Teaching Hours	**33**						

POORNIMA UNIVERSITY

School of Science & Humanities

B. Sc. (PCM), Batch: 2020-23

Teaching Scheme for Second Year Fourth Semester

Course Code	Course Name	Teaching Scheme (Hrs. per Week)			Marks Distribution			Credits
		Lecture (L)	Tutorials (T)	Practical (P)	IE	ESE	Total	
A.	**Core Courses**							
BSA04101	Quantum Mechanics	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA04102	Analog and Digital Electronics	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA04103	Inorganic Chemistry	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA04104	Organic Chemistry	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA04105	Statistics and Probability Theory	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA04106	Abstract Algebra	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA04207	Chemistry Lab	**-**	**-**	**3**	**60**	**40**	**100**	**1.5**
BSA04208	Physics Lab	**-**	**-**	**3**	**60**	**40**	**100**	**1.5**
B.	**Department Elective**							
	NIL							
C.	**Open Elective**							
	* As per Annexure - I	**2**	**-**	**-**	**40**	**60**	**100**	**2**
D.	**Humanities and Social Sciences including Management courses (HSSM) OR Ability Enhancement Compulsory Course (AECC)**							
BSA04209	Anandam Course	**-**	**-**	**1**	**60**	**40**	**100**	**2**
BSA04210	Professional Skills-I	**-**	**-**	**3**	**60**	**40**	**100**	**2**
BSA04211	Negotiation Skills	**-**	**-**	**3**	**60**	**40**	**100**	**2**
E.	**Skill Enhancement Courses (SEC) OR Project work, Seminar and Internship**							
	NIL							
F.	**Social Outreach, Discipline & Extra Curricular Activities**							
BSA04612	Talent Enrichment Programme (TEP-IV)	**-**	**-**	**-**	**50**	**-**	**50**	**1**
	Total	**20**	**-**	**13**				**30**
	Total Teaching Hours	**33**						

POORNIMA UNIVERSITY

School of Science & Humanities

B. Sc. (PCM), Batch: 2020-23

Teaching Scheme for Third Year Fifth Semester

Course Code	Course Name	Teaching Scheme (Hrs. per Week)			Marks Distribution			Credits
		Lecture (L)	Tutorials (T)	Practical (P)	IE	ESE	Total	
A.	**Core Courses**							
BSA05101	Mathematical Physics	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA05102	Atomic and Molecular Spectroscopy	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA05103	Organic Chemistry	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA05104	Physical Chemistry	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA05105	Real Analysis	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA05106	Optimization Techniques	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA05207	Chemistry Lab	**-**	**-**	**3**	**60**	**40**	**100**	**1.5**
BSA05208	Physics Lab	**-**	**-**	**3**	**60**	**40**	**100**	**1.5**
B.	**Department Elective**							
	NIL							
C.	**Open Elective**							
	* As per Annexure - I	**2**	**-**	**-**	**40**	**60**	**100**	**2**
D.	**Humanities and Social Sciences including Management courses (HSSM) OR Ability Enhancement Compulsory Course (AECC)**							
BSA05209	Anandam Course	**-**	**-**	**1**	**60**	**40**	**100**	**2**
BULCHU5201	Professional Skills-II	**-**	**-**	**2**	**60**	**40**	**100**	**1**
E.	**Skill Enhancement Courses (SEC) OR Project work, Seminar and Internship**							
BSA05411	Industrial Training & Seminar	**-**	**-**	**2**	**60**	**40**	**100**	**1**
F.	**Social Outreach, Discipline & Extra Curricular Activities**							
BSA05612	Talent Enrichment Programme (TEP-V)	**-**	**-**	**-**	**50**	**-**	**50**	**1**
	Total	**20**	**-**	**11**				
	Total Teaching Hours	**31**						**28**

POORNIMA UNIVERSITY

School of Science & Humanities

B. Sc. (PCM), Batch: 2020-23

Teaching Scheme for Third Year Sixth Semester

Course Code	Course Name	Teaching Scheme (Hrs. per Week)			Marks Distribution			Credits
		Lecture (L)	Tutorials (T)	Practical (P)	IE	ESE	Total	
A.	**Core Courses**							
BSA06101	Solid State Physics	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA06102	Nuclear Physics	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA06103	Inorganic Chemistry	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA06104	Physical Chemistry	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA06105	Complex Analysis	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA06106	Discrete Mathematics	**3**	**-**	**-**	**40**	**60**	**100**	**3**
BSA06207	Chemistry Lab	**-**	**-**	**3**	**60**	**40**	**100**	**1.5**
BSA06208	Physics Lab	**-**	**-**	**3**	**60**	**40**	**100**	**1.5**
B.	**Department Elective**							
	NIL							
C.	**Open Elective**							
	* As per Annexure - I	**2**	**-**	**-**	**40**	**60**	**100**	**2**
D.	**Humanities and Social Sciences including Management courses (HSSM) OR Ability Enhancement Compulsory Course (AECC)**							
BSA06209	Anandam Course	**-**	**-**	**1**	**60**	**40**	**100**	**2**
BULCHU6201	Leadership and management Skills	**-**	**-**	**2**	**60**	**40**	**100**	**1**
E.	**Skill Enhancement Courses (SEC) OR Project work, Seminar and Internship**							
BSA06411	Dissertation	**-**	**-**	**2**	**60**	**40**	**100**	**1**
F.	**Social Outreach, Discipline & Extra Curricular Activities**							
BSA06612	Talent Enrichment Programme (TEP-VI)	**-**	**-**	**-**	**50**	**-**	**50**	**1**
	Total	**20**	**-**	**11**				**28**
	Total Teaching Hours	**31**						

CORE THEORY SUBJECT

Code: BSA01101	MECHANICS	3.0 Credits [LTP: 3-0-0]

OBJECTIVE– The Objective is to enable student to identify a problem in the field of chemistry and to carry out literature survey, design an experiment, perform experiment, analyse data and write a report. To inculcate proficiency to identify appropriate research topic and presentation

COURSE OUTCOMES

Students will be able:

CO101.1: Produce about Inertial and non-inertial frames of references, Velocity and acceleration in different coordinate system and Transformation of velocity and acceleration between rotating frames.

CO101.2: Demonstrate Einstein's special theory of relativity.

CO101.3: Compare about central forces and about Kepler's laws of planetary motion and their applications

CO101.4: Prepare about conservation laws and about the centre of mass and potential energies of rigid body dynamics.

CO101.5: Point out the different constants of material Young's Modulus, Bulk Modulus, Modulus of Rigidity, Poisson's ratio and properties of matters.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	–	–	–	–	–	–	–	–	–
CO2	2	3	1	2	–	–	–	–	–	–	–	–
CO3	3	2	1	–	–	–	–	–	–	–	–	–
CO4	3	3	3	–	–	–	–	–	–	–	–	–
CO5	3	2	2	–	–	–	–	–	–	–	–	–

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development

A.OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Frames of Reference	8
2.	Special Theory of Relativity	7
3.	Centre of Mass	7
4.	Motion Under Central Forces	7
5.	Elastic Properties of Matter	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Frames of Reference**
	• Introduction of the Unit • Inertial and non-inertial frames of references • Transformation of displacement • Velocity and acceleration in different coordinate system • Galilean transformation • Transformation of velocity and acceleration between rotating frames • Pseudo forces • Coriolis force and its application • Motion relative to earth • Conclusion & Real life applications
2.	**Special Theory of Relativity**
	• Introduction of the Unit • Michelson Morley experiment • Postulates of special theory of relativity • Lorentz transformations • Length contraction • Time dilation • Addition of velocities • Variation of mass with velocity • Mass-energy relation • Relativistic energy-momentum relation • Conclusion & Real life applications
3.	**Centre of Mass**
	• Introduction of the Unit • Centre of mass of a two particle system • Motion of centre of mass and reduced mass conservation of linear momentum • Elastic and inelastic collision of two particles in laboratory and center of mass frames • Motion of a system with varying mass • Angular momentum conservation with examples • Charged particle scattering by nucleus • Conclusion & Real life applications
4.	**Motion Under Central Forces**
	• Introduction of the Unit • Motion under central forces • Gravitational interaction, general solution under gravitational interaction • Discussion of trajectories

	• Cases of elliptical and circular orbits • Kepler's laws • Conclusion & Real life applications
5.	**Elastic Properties of Matter**
	• Introduction of the Unit • Elastic constants: Young's Modulus, Bulk Modulus, Modulus of Rigidity • Poisson's ratio • Relations between the elastic constants, torsion of a cylinder • Bending of beams: Bending moment, Cantilever, Potential energy and oscillation of a loaded cantilever, cantilever loaded at one end (i) When weight of beam is negligible (ii) When weight is considered, Beam supported at both ends and loaded in the middle • Conclusion & Real life applications

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Elements of Mechanics	Gupta, Prakash and Agrawal	2004	Pragati Prakashan, Meerut
2.	Elements of Mechanics	J.C.Upadhyaya	2006	Himalaya Publishing House
3.	Mechanics	M. P. Saxena, R. P. Singh and S. S. Rawat	2006	CBH

Code: BSA01102 ELECTROMAGNETISM 3.0 Credits [LTP: 3-0-0]

OBJECTIVES: To give the student a broad introduction to fundamental laws and relations in electricity, electromagnetism and electric circuits as well as vector analysis.

COURSE OUTCOMES

Students will be able to:

CO102.1: Explain the basic field vectors and their physical significance
CO102.2: Point out about electric field lines, electric flux, Gauss's law and its applications.
CO102.3: Produce electric potential and its various applications, relation between electric field and electric potential.
CO102.4: Discuss the dielectric and polarization properties of matter
CO102.5: Compare various laws of Maxwell equation and electromagnetic waves.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	–	–	–	–	–	–	–	–	–
CO2	3	3	–	2	–	–	–	–	–	–	–	–
CO3	3	2	1	–	–	–	–	–	–	–	–	–
CO4	3	3	3	–	–	–	–	–	–	–	–	–
CO5	2	2	2	–	–	–	–	–	–	–	–	–

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Scalar and Vector Fields	6
2.	Dynamics of a Charged Particle	8
3.	Magnetostatics	8
4.	Electrostatics and Dielectrics	7
5.	Maxwell's Equations and Electromagnetic Waves	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Scalar and Vector Fields**
	• Introduction of the Unit • Scalar field and vector field • Gradient of a scalar function • Vector Flux • Divergence of a vector function • Line Integral of vector field • Curl of vector function • Physical significance of curl • Gauss divergence theorem • Stoke's theorem • Poisson's and Laplace's equations • Conclusion & Real life applications
2.	**Dynamics of a Charged Particle**
	• Introduction of the Unit • Magnetic forces • Invariance of charge • Electric field measured in different frames of reference • Field of a point charge moving with constant velocity • Interaction between a moving charge and other moving charges • Conclusion & Real life applications
3.	**Magnetostatics**
	• Introduction of the Unit • Lorentz Force • Properties of Magnetic Field • Ampere's circuital law and its application • Magnetic Vector Potential • Poisson's equation for vector potential • Magnetic field due to a current carrying wire and deduction of Biot-Savart's law • Electric current due to an orbiting electron • Bohr Magneton • Orbital gyro magnetic ratio • Electron spin and spin magnetic moment • Magnetic susceptibility • Magnetic field caused by magnetized matter • Magnetization current • Conclusion & Real life applications

4.	**Electrostatics and Dielectrics**
	• Introduction of the Unit • Electric Field in Matter • Dielectric Constant • Polar and Non Polar Molecules • Free and Bound Charge • Induced Dipole Moment and Atomic Polarizability • Polarization Charges and Polarization Vector • Electric Susceptibility and Displacement Vector • Electric Potential and Electric field due to a uniformly polarized sphere • Clausius- Mossotti relation in dielectrics • Conclusion & Real life applications
5.	**Maxwell's Equations and Electromagnetic Waves**
	• Introduction of the Unit • Maxwell's equations in differential and integral form. • Maxwell's displacement current • Maxwell's equations in free space • Poynting theorem • EM Wave equation • EM waves in a non-conducting dielectric medium • Plane monochromatic waves in a non-conducting medium • Energy flux in a plane electromagnetic wave • Radiation pressure • Conclusion & Real life applications

C. RECOMMENDED STUDY MATERIAL:

S.No	Reference Book	Author	Edition	Publication
1.	Electromagnetism	M.P. Saxena, S.S. Rawat and P. R. Singh	2015	CBH, Jaipur
2.	Electricity and Magnetism with Electronics	K.K. Tiwari	1996	S. Chand Publication, Delhi
3.	Electricity and Magnetism	A.S. Majahan and A.A. Rangwala	1997	TMH, Delhi

Code: BSA01103	INORGANIC CHEMISTRY	3.0 Credits [LTP: 3-0-0]

OBJECTIVE– The course helps to learn the students to understand the structure of atom, arrangement of elements in the periodic table and the properties and application of s& p - block elements, hydrogen and their compounds.

COURSE OUTCOMES

Students will be able to:

CO103.1: Analyze the atoms on the basis of atomic theory and periodic properties.
CO103.2: Identify the properties, interaction and energies of compounds with respect to their chemical bonding.
CO103.3: Predict the anomalous change in geometry of molecules on account of valence bond theory, VSEPR theory and Molecular orbital Theory.
CO103.4: Compare the trends in characteristic properties and synthesis of hydrides of s block and p block elements.
CO103.5: Categorize the properties of noble gases and its compounds with use in daily life applications.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	-	-	-	-	-	-	-	-	-
CO2	3	-	2	1	-		-	-	-	-	-	-
CO3	2	3	-	-	-	-	-	-	-	-	-	-
CO4	3	2	3	-	-	-		-	-	-	-	-
CO5	3	1	3	2	-	-	-	-	-	-	-	1

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	**Atomic Structure & Periodic Properties**	7
2.	**Ionic Bond, Metallic Bond & Weak Interactions**	7
3.	**Covalent Bond**	7
4.	**s-Block Elements & p-Block Elements**	8
5.	**Chemistry of Noble Gases**	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Atomic Structure & Periodic Properties**
	• Introduction of the Unit • Bohrs Theory and its limitation • Heisenberg uncertainty principle • Quantum number and its Significance • Aufbau Principle, Hund's multiplicity rule and Pauli's exclusion principle • Electronic configuration of elements • Effective nuclear charge and shielding • Atomic and ionic radii • Ionization energy, electrode potential (use of redox potential-reaction feasibility) • Electron affinity and electro negativity evaluation • Trends in periodic table • Applications in predicting and explaining the chemical behavior • Periodic properties • Conclusion & Real life applications
2.	**Ionic Bond, Metallic Bond &Weak Interactions**
	• Introduction of the Unit • Ionic bond-General characteristics • Radius ratio effect and coordination number • Lattice defects, lattice energy and Born-Haber cycle • Solvation energy and solubility of ionic solids • Polarizing power and polarizability • Fajan's rules • Metallic Bond- Free electron, valence bond and band theories • Weak Interactions- Hydrogen bonding, Vander walls Force • Conclusion & Real life applications
3.	**Covalent Bond**
	• Introduction of the Unit • Valence bond theory and its limitations • Valence shell electron pair repulsion (VSEPR) theory with suitable examples(NH_3, H_30^+ SF_4, CIF_3, ICl_2, H_2O) • Molecular orbital theory • Bonding, nonbonding and antibonding molecular orbital's • Linear combination of atomic orbital's (LCAO)-homonuclear and heteronuclear (CO and NO) diatomic molecules. • Multicenter bonding in electron deficient molecules, • Bond strength and bond energy • Percentage ionic character from dipole moment and electro negativity difference

	• Conclusion & Real life applications
4.	**s-Block Elements & p-Block Elements**
	• Introduction of the Unit • s-Block Elements -Comparative study, diagonal relationships • Solvation and complexation tendencies including their function in biosystems • Hydride- classification, preparation and characteristics • Introduction to alkyl and aryls • p-Block elements-Comparative study in periodicity, diagonal relationship • Hydrides of boron, diborane and higher boranes, borazine, borohydrides, fullerenes, carbides, fluorocarbons, silicates (structural principle), tetrasulphur tetranitride, • Basic properties of halogens, interhalogens and polyhalides • Conclusion & Real life applications
5.	**Chemistry of Noble Gases**
	• Introduction of the Unit • Chemical properties of Noble gases • Chemistry of Xenon • Structure and bonding in Xenon compound • Theories of Bonding in noble gases compound • Conclusion & Real life applications

C. RECOMMENDED STUDY MATERIAL:

S. No	Reference Book	Author	Edition	Publication
1	A New Concise Inorganic Chemistry	J. D. Lee	Latest	Chapman & Hall, London
2	Modern Inorganic Chemistry	R. C. Aggarwal	Latest	KitabMahal, Allahabad
3	Basic Inorganic Chemistry	F. A. Cotton, G. Wilkinson, and Paul L. Gaus	Latest	John Wiley & Sons, New York

Code: BSA01104	ORGANIC CHEMISTRY	3.0 Credits [LTP: 3-0-0]

OBJECTIVE– The course helps the students to understand the core concepts of organic chemistry and the nomenclature, synthesis, isomerism and physical properties of alkanes, alkenes, alkynes and cycloalkanes, Cycloalkenes & Dienes.

COURSE OUTCOMES

Students will be able to:

CO104.1: Demonstrate electronic displacements according to bonding, shapes, reactivity and energy consideration of reaction intermediate

CO104.2: Classify Hydrocarbons and discuss the methods of preparation of Hydrocarbons.

CO104.3: Categorize the stability and reactivity of hydrocarbons as per bonding and structure of hydrocarbons.

CO104.4: Compare the physical and chemical properties of Hydrocarbons.

CO104.5: Analyze the applications of various hydrocarbons and their derivatives.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	2	-	-	-	-	-	-	-	-
CO2	3	1	2	-	-	-	-	-	-	-	-	-
CO3	2	1	3	-	-	-	-	-	-	-	-	-
CO4	3	2	0	2	-	-	-	-	-	-	-	-
CO5	2	-	3	-	-	-	-	-	-	-	-	1

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	**Fundamentals of Organic Chemistry**	8
2.	**Alkanes**	7
3.	**Alkenes**	7
4.	**Alkynes**	7
5.	**Cycloalkanes, Cycloalkenes & Dienes**	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Fundamentals of Organic Chemistry**
	• Introduction of the Unit • Electronic displacements: inductive effect, electromeric effect, resonance and hyperconjugation • Cleavage of Bonds: homolysis and heterolysis • Structure, shape and reactivity of organic molecules: nucleophiles and electrophiles • Reactive Intermediates: carbocations, carbanions and free radicals , nitrene, carbene, benzyne, Assigning formal charge • Types of organic reactions, energy considerations. • Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereochemical studies) • Conclusion & Real life applications
2.	**Alkanes**
	• Introduction of the Unit • Alkanes:(Upto 5 Carbons) • IUPAC nomenclature of branched and unbranched alkyl group • Classification of carbon atoms in alkanes, Physical properties • Preparation: catalytic hydrogenation, Wurtz reaction, Kolbe synthesis, decarboxylation of carboxylic acid, Grignard reagent, Corey-house reaction • Reactions: free radical substitution: halogenations • Reactivity and selectivity • Conclusion & Real life applications
3.	**Alkenes**
	• Introduction of the Unit • Alkenes: (Upto 5 Carbons) • Preparation: elimination reactions: dehydration of alcohols and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (partial catalytic hydrogenation) and trans alkenes (birch reduction), Hofmanns elimination • Chemical reactions of alkenes –electrophilic and free radical additions. Epoxidation, mechanisms involved in hydrogenation, oxidation with $KMn0_4$, Substitution at the allylic and vinylic positions of alkenes, polymerization of alkenes • Reactions: cis-addition (alk. KMnO4) and trans-addition (bromine), addition of HX (Markownikoff's and anti-Markownikoff's addition), hydration, ozonolysis, oxymecuration–demercuration, Hydroboration-oxidation. • Industrial application of ethylene and propene • Conclusion & Real life applications
4.	**Alkynes**

	• Introduction of the Unit • Alkynes: (Upto 5 Carbons) • Preparation: Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides, acidity of alkynes • Reactions: formation of metal acetylides, addition of bromine and alkaline $KMnO_4$, • ozonolysis and oxidation with hot alkaline. $KMnO_4$,hydroboration- oxidation, metal ammonia reduction, polymerization • Conclusion & Real life applications
5.	**Cycloalkanes, Cycloalkenes & Dienes**
	• Introduction of the Unit • Cycloalkanes: Nomenclature, method of formation, chemical reactions • Baeyer strain theory and its limitations • Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings, Mohrs Sachse theory • The case of cyclopropane ring: banana bond • Cycloalkenes: Nomenclature, method of formation, chemical reactions • Dienes: Nomenclature and classification of dienes • Structure of allenes and butadiene, methods of formation, polymerization, chemical reactions, 1,2and 1,4- additions, Diels-Alder reaction • conjugated and cumulated dienes • Conclusion & Real life applications

C. RECOMMENDED STUDY MATERIAL:

S.No	Reference Book	Author	Edition	Publication
1	A Text Book of Organic Chemistry	O. P. Agarwal	Vol. I & II	Latest
2.	A Text Book of Organic Chemistry	B. S. Bahl and Arun Bahl	Latest	S. Chand
3.	Organic Chemistry	S. M. Mukherji, S. P. Singh and R. P. Kapoor	Vol. I, II & III	Wiley Eastern Ltd. (New Age International)
4.	Organic Chemistry	Morrison & Boyd	Latest	Prentice Hall

Code: BSA01105	CALCULUS	3.0 Credits [LTP: 3-0-0]

OBJECTIVE–This course is based on fundamentals such asCompute limits, derivatives, and integrals. Analyze functions using limits, derivatives, and integrals. Recognize the appropriate tools of calculus to solve applied problems.

COURSE OUTCOME

Students would be able to:

CO105.1: Solve mathematical problems using ordinary, partial differentiation equations.
CO105.2: Obtain Maxima and Minima of functions of two or more variables.
CO105.3: Calculate radius of curvature and asymptotes of curves using cartesian form and polar form.
CO105.4: Solve the integration, surface and volume of curves using Beta and Gamma functions.
CO105.5: Evaluate double and triple integrals using volume and surface area.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	-	-	-	-	-	-	-	-
CO2	3	1	2	2	-	-	-	-	-	-	-	-
CO3	3	1	2	2	-	-	-	-	-	-	-	-
CO4	3	2	1	2	-	-	-	-	-	-	-	-
CO5	2	3	1	2	-	-	-	-	-	-	-	-

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	2	-
CO3	3	-	-
CO4	3	2	-
CO5	3	2	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	**Differential Calculus I**	8
2	**Differential Calculus II**	6
3	**Geometrical Applications of Differential Calculus**	7
4	**Integral Calculus**	7
5	**Multiple Integrals and Its Applications**	8

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Differential Calculus I**
	• Introduction of Unit • Successive differentiation, • N^{th} derivative-Leibnitz's theorem (Without Proof) and its applications • Partial differentiation • Euler's theorem on homogeneous functions. • Total differentiation • Conclusion & Real life applications
2.	**Differential Calculus II**
	• Introduction of Unit • Maxima and minima for functions of two or more variables • Lagrange's method (without proof) • Derivative of length of an arc, Pedal equations • Conclusion & Real life applications
3.	**Geometrical Applications of Differential Calculus**
	• Introduction of Unit • Curvature, Radius of Curvature (Cartesian Curves only) • Asymptotes • Multiple points • Curve tracing for standard Curves (Cartesian and Polar Curves) • Conclusion & Real life applications
4.	**Integral Calculus**
	• Introduction of Unit • Beta and gamma Functions • Reduction formulae (simple Standard Formulae) • Rectification • Volume and surface of solid of revolution • Conclusion & Real life applications
5.	**Multiple Integrals and Its Applications**
	• Introduction of Unit • Double integral in cartesian and polar coordinates • Change of order of integration, • Triple integral • Dirichlet's integral • Applications of multiple integrals in volume and surface • Conclusion & Real life applications

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Calculus	H. Anton, I. Birens and S. Davis,	2002	John Wiley and Sons
2.	Calculus	G.B. Thomas and R.L. Finney,	2007	Pearson Education, India
3.	Differential and Integral Calculus	Chandrika Prasad and Gorakh Prasad	1992	Pothishala Pvt. Ltd., Allahabad

Code: BSA01106 VECTOR CALCULUS AND MATRICES 3.0 Credits [LTP: 3-0-0]

OBJECTIVE–This course helps students in exploring the differential geometry and in the study of partial differential equations. It is used extensively in physics and engineering, especially in the description of electromagnetic fields, gravitational fields and fluid flow and vectors should be treated as column vectors when combined with matrices (rather than row vectors).

COURSE OUTCOME

Students would be able to:

CO106.1: Manipulate vectors to perform geometrical calculations in three dimensions.
CO106.2: Obtain important features of del operator and its various forms in gradient, divergence and curl.
CO106.3: Use Green's theorem, Stokes theorem and the Divergence theorem to compute integrals
CO106.4: Analysis the basic concept of matrices and their various properties.
CO106.5: Obtain the solution of Eigen value and Eigen vectors and inverse of matrix using Cayley Hamilton theorem.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	2	-	-	-	-	-	-	-	-
CO2	3	2	1	2	-	-	-	-	-	-	-	-
CO3	2	3	1	2	-	-	-	-	-	-	-	-
CO4	2	2	2	3	-	-	-	-	-	-	-	-
CO5	3	2	1	2	-	-	-	-	-	-	-	-

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	2	-
CO2	3	2	-
CO3	3	-	-
CO4	3	-	-
CO5	3	2	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	**Vector Calculus I**	8
2	**Vector Calculus II**	7
3	**Vector Calculus III**	7
4	**Matrix**	8
5	**Eigen Values and Eigen Vectors**	6

B. DETAILED SYLLABUS

Unit	Unit Details
1	**Vector Calculus I**
	• Introduction of Unit • Scalar and Vector quantity, • Representation of vectors, Laws of vector additions, • Product of two vectors, Scalar and vector fields, • Derivative of a vector function, Velocity and accelerations • Conclusion & Real life applications
2	**Vector Calculus II**
	• Introduction of Unit • Del operator, Gradient, Divergence and Curl. • Directional derivative • Integration of vectors, • Line Integral • Conclusion & Real life applications
3	**Vector Calculus III**
	• Introduction of Unit • Surface and Volume Integration. • Green's, Gauss's and Stokes's theorem(without Proof) and their simple applications • Conclusion & Real life applications
4	**Matrix**
	• Introduction of Unit • Types of matrices and elementary operations on matrices • Rank of a matrix, Normal form • Consistency of system of linear simultaneous equations (Homogeneous and Non homogeneous) and its solutions • Conclusion & Real life applications
5	**Eigen Values and Eigen Vectors**
	• Introduction of Unit • Characteristic equation • Eigen values and Eigen vectors • Cayley - Hamilton theorem and its application to find inverse of matrix • Diagonalisation of matrix • Conclusion & Real life applications

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Vector Calculus	Speigel	5th Edition	Tata McGraw Hill, 1989.
2.	Vector Calculus	J.L Bansal	1989	JPH, Jaipur
3.	Theory and Problems of Matrix Operations	S Richard Bronson	1995	Tata McGraw Hill, 1989.

Code: BSA01207	CHEMISTRY LAB	1.5 Credits [LTP: 0-0-3]

OBJECTIVE– To provide experience in practical aspects of qualitative analysis of unknown organic compounds and detection of functional groups present. To provide students an experience in qualitative analysis of various cations and anions in a given mixture.

COURSE OUTCOMES

Students will be able to:

CO207.1: Design and carry out scientific experiments as well as accurately record and analyze the results of such experiments.
CO207.2: Impart the students a thorough knowledge of Systematic qualitative analysis of mixtures containing two acid and two basic radicals
CO207.3: Develop skills for quantitative estimation using the different branches of volumetric Analysis.
CO207.4: Develop skills required for the qualitative analysis of organic compounds
CO207.5: Learn and apply basic techniques used in the organic laboratory for preparation, purification and identification of organic compounds.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	-	-	-	-	-	-	-	-	-
CO2	2	2	3	-	-	-	-	-	-	-	-	-
CO3	2	3	3	-	-	-	-	-	-	-	-	-
CO4	2	3	2	-	-	-	-	-	-	-	-	-
CO5	2	2	3	-	-	-	-	-	-	-	-	-

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development

LIST OF EXPERIMENTS

Inorganic Chemistry	
1	To analyze mixture contains two acidic and two basic radicals in a given mixture.
2	To analyze mixture contains two acidic and two basic radicals in a given mixture.
3	To analyze mixture containing three acidic and three basic radicals.
4	To analyze mixture containing three acidic and three basic radicals.
5	To analyze mixture containing three acidic and three basic radicals.
6	Estimation of $KMnO_4$ by oxalic acid.
Organic Chemistry	
7	To detect the functional group from the given organic compound (Alcohol/carbonyl compound).
8	To detect the functional group from the given organic compound (Nitrogen containing compound).
9	To determine the melting point of given organic compound (Naphthalene).
10	To determine the melting point of given organic compound (Urea).
11	To determine the boiling point of given organic compound (Ethanol).
12	To determine the boiling point of given organic compound (Benzene).

Code: BSA01208	PHYSICS LAB	1.5 Credits [LTP: 0-0-3]

OBJECTIVE– The experiment of Mechanics of solid provides a broader practical approaches with high equipped lab instruments and set-up. The practical includes understanding of the properties of solid materials like young modulus of a beam, Maxwell needle, and Poisson's ratio of rubber tensile, Young's Modulus of Elasticity, Bulk Modulus of Elasticity, Modulus of Rigidity (η) etc.

COURSE OUTCOMES

Students will be able to:

CO208.1: Learn the constants of elasticity by the help of different methods.
CO208.2: Learn the concept of Poisson's ratio and surface tension of water
CO208.3: Learn conversion of Galvanometer to Ammeter and Voltmeter
CO208.4: Learn to evaluate of RLC and CR,DC circuits
CO208.5: Identify and calculate the magnetic field around a current carrying circular coil

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	–	2	–	–	–	–	–	–	3	2
CO2	2	3	–	–	–	–	–	–	–	–	2	3
CO3	2	3	–	–	–	–	–	–	–	–	2	3
CO4	–	3	–	2	–	–	–	–	–	–	–	3
CO5	3	3	–	–	–	–	–	–	–	–	3	3

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development/ Entrepreneur

LIST OF EXPERIMENTS

1	Study of bending of a beam and determination of Young's modulus
2	Modulus of rigidity by Dynamical method (Maxwell's needle)
3	Elastic constant by Searle's method
4	To determine the Poisson's ratio of a rubber tube
5	Determination of surface tension of water by Jaegger's method
6	Convert Galvanometer to ammeter into a given range.
7	Convert Galvanometer to voltmeter into a given range.
8	Study of phase relations in CR circuit

9	Study of phase relations in LCR circuit
10	Study of Faraday's Law
11	To determine the modulus of rigidity by statically method.
12	To study the magnetic field along the axis of a current carrying circular coil and find the radius of circular coil.

Code: BSA01209	ANANDAM COURSE	2Credits [LTP: 0-0-1]

OVERVIEW AND OBJECTIVES: The Anandam program aims to instill the joy of giving in young people, turning them into responsible citizens. Who will build a better society through daily action, it will build the habit of service in students across colleges and universities in Rajasthan. The students will have to undertake the course each semester starting with the 2020-21 academic year.

Course Outcomes

- Each student will be able to work as team member.
- Student will learn social activities.
- Students will be familiar with society.

DETAILED SYLLABUS

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register/ Personal Diary
- Share this Register/ Personal Diary day in the 30-minute Anandam time slot dedicated by the college.
- Undertake one group service project for 64 Hours every term (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion session held once a month.

Code: BSA01110 ENGLISH 2 Credits [LTP: 2-0-0]

OBJECTIVE: The main objective of Teaching English is to help student to acquire practical command of English. It means Indian students should be able to read, write, speak and understand simple idiomatic English.

COURSE OUTCOME

The student will be able to:

CO110.1: Understand the mechanism of language and linguistic creativity to communicate with each other.
CO110.2 Apply writing skills effectively for a variety of professional and social communication
CO110.3: Understand the importance of intonation, word and sentence stress for improving communicative competence and foster social and emotional Learning.
CO110.4: Apply writing skills effectively for a variety of professional and social communication.
CO110.5: Understand the structured conversation to make their point of views clear to the listeners by reading short stories written in English.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	–	–	–	–	–	–	–	–	–	3	–	3
CO2	–	–	–	–	–	–	–	–	–	3	–	2
CO3	–	–	–	–	–	–	–	3	–	2	–	–
CO4	–	–	–	–	–	–	–	–	–	3	–	2
CO5	–	–	–	–	–	–	–	–	–	3	–	2

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/ Entrepreneur

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time Required for the Unit (Hours)
1.	**Grammar and Usage**	8
2.	**Composition**	7
3.	**Poems**	7
4.	**Essays & Short Play**	7
5.	**Short Stories**	7

B. DETAILED SYLLABUS

Unit	Contents
1.	**Grammar and Usage**
	• Introduction of Unit • Sentence • Tense • Parts of speech • Conclusion & Real life applications
2.	**Composition**
	• Introduction of Unit • Letter writing • Application writing • Précis writing • Conclusion & Real life applications
3.	**Poems**
	• Introduction of Unit • The Solitary Reaper by William Wordsworth • God's Grandeur by Gerard Manley Hopkins • The Road Not Taken by Robert Frost • Conclusion & Real life applications
4.	**Essays & Short Play**
	• Introduction of Unit • Of Studies by Francis Bacon • On Doing Nothing by G.B. Priestley • The Monkey's Paw by W.W. Jacobs • Conclusion & Real life applications
5.	**Short Stories**
	• Introduction of Unit • The Three Dancing Goats by Anonymous • God and the Cobbler by R.K. Narayan • My lord, The baby by R.N.Tagore • Conclusion & Real life applications

C. RECOMMENDED STUDY MATERIAL

Sr.No	ReferenceBook	Author	Edition	Publication
1.	Technical Communication	Meenakshi Raman and Sangeetha Sharma	2008	Oxford University Press,
2.	Effective Technical Communication	M. Ashraf Rizvi	2005	Tata McGraw-Hill
3.	Learn Correct English: Grammar,	Shiv K. Kumar	Latest	Pearson, New Delhi,

	Usage and Composition	&HemalathaNagarajan		India
4.	Grammar of the Modern English Language	Sukhdev Singh & Balbir Singh	Latest	Foundation Books, New Delhi
5.	Communicative English for Engineers and Professionals	Nitin Bhatnagar and MamtaBhatnagar	Latest	Pearson(New Delhi)
6.	Communicative grammar and composition	Rajesh.K.Lidiya	2008	Oxford Univ Press, New Delhi.
Important Web Links				
1.	http://www.communicationskills.co.in/index.html			
2.	http://www.bbc.co.uk/worldservice/learningenglish			
3.	https://www.englishlearner.com/			
4.	http://www.englishclub.com/vocabulary/idioms-body.htm			
5.	https://dictionary.cambridge.org/			

Code: BSA01111 HUMAN VALUES & PROFESSIONAL ETHICS 2 .0 Credits [LTP: 2-0-0]

OBJECTIVE:

COURSE OUTCOMES

Students will be able to:

CO111.1: Distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
CO111.2: Identify dialog within themselves to know what they 'really want to be' in their life and profession.
CO111.3: Understand the meaning of happiness and prosperity for a human being.
CO111.4: Facilitate the students to understand harmony at all the levels of human living, and live accordingly.
CO111.5: Facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	–	–	–	–	–	–	–	–	–	2	3	2
CO2	–	–	–	–	–	–	–	–	–	2	3	3
CO3	–	–	–	–	–	–	–	–	–	2	3	3
CO4	–	–	–	–	–	–	–	–	–	2	3	2
CO5	–	–	–	–	–	–	–	–	–	2	2	3

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	2	-	-

Note: On the basis of mapping of COs with POs, this course is related toSkill Development/ Entrepreneur

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1	**Self-exploration**	**5**
2	**Understanding Harmony in the Human Being - Harmony in Myself**	**4**
3	**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship**	**5**
4	**Implications of the above Holistic Understanding of Harmony on Professional Ethics**	**5**
5	**Professional Ethics**	**5**

B. DETAILED SYLLABUS

Unit	Unit Details
1	**Self-exploration**
	• Introduction of the Unit • Course Introduction - Need, Basic Guidelines, Content and Process for Value Education • Understanding the need, basic guidelines, content and process for Value Education, Self-Exploration–what is it? • Its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities The basic requirements for fulfillment of aspirations of every human being with their correct priority. • Conclusion & Real life applications
2	**Understanding Harmony in the Human Being - Harmony in Myself**
	• Introduction of the Unit • Understanding human being as a co-existence of the sentient 'I' and the material 'Body' • Understanding the needs of Self ('I') and 'Body' • Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), • Understanding the characteristics and activities of 'I' and harmony in 'I', • Understanding the harmony of I with the Body. • Conclusion & Real life applications
3	**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship**
	• Introduction of the Unit • Understanding harmony in the Family- the basic unit of human interaction • Understanding values in human-human relationship • Meaning of Justice & program for its fulfillment to ensure Trust and Respect as the foundational values of relationship, • Understanding the meaning of Trust • Difference between intention and competence,

	• Understanding the meaning of Respect Difference between respect and differentiation; the other salient values in relationship • Understanding the harmony in the society (society being an extension of family): as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society • Conclusion & Real life applications
4	**Implications of the above Holistic Understanding of Harmony on Professional Ethics**
	• Introduction of the Unit • Natural acceptance of human values • Definitiveness of Ethical Human Conduct • Basis for Humanistic • Humanistic Constitution and Humanistic Universal Order • Competence in Professional Ethics & Case studies of typical holistic technologies, management models and production systems • Strategy for transition from the present state to Universal Human Order • Conclusion & Real life applications
5	**Professional Ethics**
	• Introduction of the Unit • Meaning of Professional ethics • Personal vs. Professional Ethics • Types of professional ethics • Objectives of professional ethics • Importance of Professional ethics • Professional ethics and codes of conduct • Conclusion & Summary of the Unit

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	A Foundation Course in Human Values and Professional Ethics	R R Gaur, R Sangal, G P Bagaria	2009	Excel Books
2.	Human Values	A N Tripathy	2003	New Age International Publishers
3.	Indian Ethos and Modern Management	B L Bajpai	2004	New Royal Book Co., Lucknow
4.	Science and Humanism	P L Dhar, RR Gaur	1990	Commonwealth Publishers

Code: BSA01212	COMMUNICATION SKILLS-I	2.0 Credits [LTP: 0-0-3]

OBJECTIVE– The objective of the programme is to recognize different styles of communication and how to improve understanding and build rapport with others. Appreciated the role of body language and voice tone in effective communication. Communicate their message in an effective and engaging way for the recipient.

COURSE OUTCOMES

Students will be able to:

CO212.1: Prepare and deliver a clear and fluent demonstrative, informative, and persuasive presentation and enlarge their vocabulary by keeping a vocabulary journal.
CO212.2: Gain broad, multi-faceted knowledge cutting across several disciplines outside the learner's normal academic subjects & develop effective speech composition and delivery.
CO212.3: Understand how to leverage grammar and formatting in email preparation & understand and know how to follow the stages of the writing process (prewriting/writing/rewriting) and apply them to technical and workplace writing tasks.
CO212.4: Understand the speaking tone, pace & common phrases that's appropriate for phone conversations.
CO212.5: Improve analytical abilities to think on a particular given topic & generate more ideas and a structured presentation of a topic.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	–	–	–	–	–	–	–	–	–	3	–	3
CO2	–	–	–	–	–	–	–	–	–	3	–	2
CO3	–	–	–	–	–	–	–	3	–	2	–	–
CO4	–	–	–	–	–	–	–	–	–	2	–	1
CO5	–	–	–	–	–	–	–	–	–	2	–	1

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related toSkill Development/ Entrepreneur

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1	**Speech Training & Vocabulary Building**	8
2	**Debates & Presentation Skills**	8
3	**Professional Email & Report Writing**	8
4	**Telephonic Conversation**	4
5	**Group Discussion**	4

B. DETAILED SYLLABUS

Unit	Unit Details	
1.	**Speech Training & Vocabulary Building**	**Method**
	• Introduction of the Course & the topic • Impromptu Speech Practice • JAM/Me V/S Myself etc. • Contemporary Vocabs • Situational Vocabs • Conclusion & Summary of the Unit	• Theory/Practical • Practical • Practical • Practical • Practical • Theory/Practical
2.	**Debates & Presentation Skills**	
	• Introduction of the topic • Format of Debates • Practice Sessions • Structure of Presentation • Using Tools & Techniques • Practice Session • Conclusion & Summary of the Unit	• Theory/Practical • Practical • Practical • Practical • Theory/Practical • Practical • Theory/Practical
3.	**Professional Email & Report Writing**	
	• Introduction of the topic • Email Etiquette • Practice Session • Format of a professional Report • Practice Session • Conclusion & Summary of the Unit	• Theory/Practical • Practical • Practical • Theory/Practical • Practical • Theory/Practical
4.	**Telephonic Conversation**	
	• Introduction of the topic • Important Phrases used in Telephonic Conversation • Practice Session	• Theory/Practical • Practical • Practical

	• Conclusion & Summary of the Unit	• Theory/Practical
5.	**Group Discussion**	
	• Introduction of the topic • Practice Sessions on News and Other Issues • Conclusion & Summary of the Unit	• Theory/Practical • Practical • Theory/Practical

CODE: BSA01613	Talent Enrichment Programme (TEP-I)	1 Credits

OVERVIEW AND OBJECTIVES: The objective of Social Outreach, Discipline & Extra Curricular Activities is to provide students with the opportunities to enhance job fetching skills and at the same time to cultivate the student's personal interests and hobbies while maintaining the good disciplinary environment in the University. TEP is integrated into the curriculum for holistic development of students through active participation in various activities falling in Technical and non technical categories**.**

Social Outreach, Discipline & Extra Curricular Activities shall be evaluated irrespective of period/time allocation (as in the case of Extra Curricular activity) in the teaching scheme as a **1 credit** course. The record related to discipline and related activities are maintained for each student and they shall be evaluated for the same also. It shall be counted in calculation of SGPA but it is not a backlog subject. However, the attendance of these classes shall be recorded and accounted in the total attendance.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	2	-	-	-	-	-	-	-	2
CO2	-	-	-	2	-		-	-	-	-	-	3
CO3	-	-	-	3	-	-	-	-	-	-	-	3
CO4	-	-	-	3	-	-		-	-	-	-	3
CO5	-	-	-	1	-	-	-	-	-	3	-	3

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Entrepreneur

Code: BSA02101	OPTICS	3.0 Credits [LTP: 3-0-0]

OBJECTIVE: The aim of the course is to acquire the knowledge in optics necessary for its understanding and application in the courses of Optical and biprism, polarization, Newton's ring grating, optical fiber.

COURSE OUTCOMES

Students will be able to:-

CO101.1: Exercise the method to produce coherent sources and phenomena of interference.
CO101.2: Demonstration the comprehensive knowledge of polarization and its applications**.**
CO101.3: Produce Holography and LASER assembly, types of LASER and it's wide application from medical to industry
CO101.4: Point out Fraunhofer diffraction and apply it for suitable applications
CO101.5: Prepare the arrangement of Fresnal diffraction and apply it for suitable applications.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	–	–	–	–	–	–	–	–	–
CO2	3	2	3	–	–	–	–	–	–	–	–	–
CO3	3	3	2	2	–	–	–	–	–	–	–	–
CO4	3	2	2	3	–	–	–	–	–	–	–	–
CO5	2	3	2	3	–	–	–	–	–	–	–	–

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	**Interference**	7
2.	**Polarization**	9
3.	**Laser and Holography**	6
4.	**Fraunhofer Diffraction**	7
5.	**Fresnel Diffraction**	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Interference**
	• Introduction of the Unit • Division of Amplitude and Division of Wavefront • Young's Double Slit Experiment • Phase Change on Reflection: Stoke's treatment • Interference in Thin Films: Parallel and Wedge-shaped Films • Fringes of Equal Inclination and Fringes of Equal Thickness • Newton's Rings: Measurement of Wavelength and Refractive Index • Michelson's Interferometer: (1) Idea of form of fringes (No Theory required), (2) Determination of Wavelength, (3) Wavelength Difference, (4) Refractive Index • Conclusion & Real life applications
2.	**Polarization**
	• Introduction of the Unit • Concept of polarization • Different kind of polarized lights • Malus law and Brewster's law • Double refraction • Quarter wave and half wave plate • Production and detection of different polarized lights • Specific Rotation: Half shade polarimeter and BiquartzPolarimeter • Determination of specific rotation of sugar solution by polarimeters • Conclusion & Real life applications
3.	**Laser and Holography**
	• Introduction of the Unit • Theory of LASER action • Einstein's coefficients • Threshold conditions for LASER Action • Method and Mechanism of production of He-Ne LASER • Holography versus photography • Principle of Holography • Applications of Holography in Microscopy and Interferometry • Optical Fibre: Principle, construction and Numerical Aperature • Conclusion & Real life applications
4.	**Fraunhofer Diffraction**
	• Introduction of the Unit • Diffraction due to (1) a Single Slit (2) a Plane Transmission Grating • Characteristics of plane transmission grating

	• Rayleigh's criterion of resolution • Resolving Power and Dispersive Power of a Plane Diffraction Grating • Comparison of grating and prism spectra • Conclusion & Real life applications
5.	**Fresnel Diffraction**
	• Introduction of the Unit • Fresnel's Assumptions • Fresnel's Half-Period Zones for Plane Wave • Explanation of Rectilinear Propagation of Light • Theory of a Zone Plate: Multiple Foci of a Zone Plate • Comparison of a Zone plate with a Convex lens • Diffraction due to (1) a Straight Edge and (2) a Rectangular Aperture (Slit) (3) a Small Circular Aperture and (4) an Opaque Circular Disc. • Conclusion & Real life applications

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Optics	N. Subramanyam and BrijLal	Latest	S. Chand Publication, Delhi
2.	Optics	Ajoy Ghatak	Latest	TMH, New Delhi
3.	Fundamentals of Optics	F. A. Jenkins and Harvey Elliott White	Latest	McGraw-Hill

Code: BSA02102	WAVES AND OSCILLATIONS	3.0 Credits [LTP: 3-0-0]

OBJECTIVE– The course aims to introduce the basic concepts required for a mathematical description of oscillations and waves, and to provide expertise for solving the differential equations which arise in simple mathematical models for oscillations and waves.

COURSE OUTCOMES
Students will be able to:

CO102.1: Produce the simple harmonic motion of different systems.
CO102.2: Point out the superposition of two Collinear Harmonic Oscillations.
CO102.3: Dramatize the system having two degrees of freedom.
CO102.4: Prepare equation of motion of waves and its properties.
CO102.5: Practice exercises of the waves in bounded medium and its properties with respect to position and time.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	–	–	–	–	–	–	–	–	–
CO2	3	2	3	–	–	–	–	–	–	–	–	–
CO3	3	2	2	3	–	–	–	–	–	–	–	–
CO4	3	3	2	1	–	–	–	–	–	–	–	–
CO5	–	2	3	3	–	–	–	–	–	–	–	–

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	**Simple Harmonic Motion**	7
2.	**Driven Harmonic Oscillator**	7
3.	**Coupled Oscillator**	6
4.	**Wave Motion**	9
5.	**Waves in the Bounded Medium**	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Simple Harmonic Motion**
	• Introduction of the Unit • Simple harmonic motion • Differential equation of simple harmonic motion, • Free Oscillations of Systems with One Degree of Freedom: (1) Mass-Spring system, (2) Simple Pendulum, (3) Torsional Pendulum, (4) LC Circuit (5) Compound pendulum: Centres of Percussion and Oscillation, • Energy curve and small oscillations in one dimensional potential well,Potential energy curve and small oscillations in one dimensional potential wellEnergy of oscillations • Damped harmonic oscillator, Mathematical formulation of damped harmonic oscillator, Energy of damped oscillator, Power dissipation, Relaxation time, Quality factor of damped harmonic oscillator • Conclusion & Real life applications
2.	**Driven Harmonic Oscillator**
	• Introduction of the Unit • Driven harmonic oscillator • Mathematical formulation of driven harmonic oscillator • Frequency response on amplitude and phase • Quality factor of driven oscillator • Resonance • Sharpness of resonance • Power absorption by forced oscillator • Series and parallel LCR circuit • Conclusion & Real life applications
3.	**Coupled Oscillator**
	• Introduction of the Unit • Equation of motion of two coupled simple harmonic oscillators • Normal modes • Motion in mixed modes • Dynamics of a linear chain of coupled oscillators with nearest neighbor interaction • Energy transfer between modes • Electrically coupled circuits (capacitive and inductive) • Reflected impedance • Effect of coupling and resistive load • Conclusion & Real life applications
4.	**Wave Motion**

	• Introduction of the Unit • Plane and Spherical Waves • Longitudinal and Transverse Waves • Plane Progressive (Travelling) Waves • Particle and Wave Velocities • Pressure waves in a gas column • Transverse wave in a stretched string • Elastic wave in a solid rod • Velocity of transverse vibrations of stretched strings • Velocity of longitudinal waves in a fluid in a pipe • Newton's formula for velocity of sound • Laplace's correction • Conclusion & Real life applications
5.	**Waves in the Bounded Medium**
	• Introduction of the Unit • Rigid boundary and absolutely free boundary • Changes w.r.t position and time • Standing (Stationary) waves in a string: Fixed and free ends • Normal modes of stretched strings • Longitudinal standing waves and normal modes • Open and closed pipes • Flow of energy in stationary waves • Phase and group velocities • Conclusion & Real life applications

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Vibrations and Waves	A. P. French	1987	CBS Pub. &Dist
2.	Fundamentals of Waves & Oscillations	K. Uno Ingard	1988	University Press
3.	An Introduction to Mechanics	Daniel Kleppner and Robert J. Kolenkow	1973	Tata McGrawHill

Code: BSA02103	ORGANIC CHEMISTRY	3.0 Credits [LTP: 3-0-0]

OBJECTIVE– The main objective of the course is to interpret the concept of aromaticity and the main properties of aromatic compounds. Also, introduce the concepts and implications of stereochemistry.

COURSE OUTCOMES
Students will be able to:

CO103.1: Distinguish between aromatic and antiaromatic compounds by comparing their structures along with their electrophilic aromatic substitution reactions.
CO103.2: Explain basic principles of stereochemistry as well as differentiate configuration and conformation, Flying wedge and Fischer projection formula
CO103.3: Categorize Nucleophilic Substitution (S_N1, S_N2 and S_Ni) reactions with energy profile diagram.
CO103.4: Explain the addition-elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reaction, relative reactivities of alkyl, allyl, vinyl and aryl halides.
CO103.5: Classify and prepare 1^o, 2^o and 3^o alcohols and demonstrate their reaction.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	1	-	-	-	-	-	-	-	-
CO2	3	-	1	1	-	-	-	-	-	-	-	-
CO3	2	1	1	-	-	-	-	-	-	-	-	-
CO4	3	2	-		-	-	-	-	-	-	-	-
CO5	2	2	-	-	-	-	-	-	-	-	-	-

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	**Aromaticity**	7
2	**Stereochemistry**	8
3.	**Alkyl Halides**	7
4.	**Aryl Halides**	7
5.	**Alcohols**	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Aromaticity**
	• Introduction of the Unit • Aromaticity:Nomenclature of benzene derivatives. The aryl group, aromatic nucleus and side chain. • Structure of benzene: Kekule structure. • Resonance theory and Molecular orbital theory • Stability and carbon-carbon bond lengths of benzene, resonance structure, MO diagram • Hückel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples • Electrophilic aromatic substitution: mechanism, role of sigma and pi-complexes. • Halogenation, sulphonation, mercuration, Friedel-Crafts reactions and Mechanism of nitration, chloromethylation. • Energy profile diagrams. Activating and dectivating substituents. • Directive influence - orientation and ortho/para ratio. • Side chain reactions of benzene derivatives. Birch Reduction. • Conclusion & Real life applications
2.	**Stereochemistry**
	• Introduction of the Unit • Concept of isomerism • Types of isomerism • Difference between configuration and conformation, • Flying wedge and Fischer projection formula • Optical isomerism- Elements of symmetry, molecular chirality, stereogenic centre, optical activity • Properties of enantiomers, chiral and achiral molecules with two stereogeniccentre • Diastereomers,threo and erythro isomers • Mesocompounds • Resolution of enantiomers • Inversion, retention and racemization. • Relative and absolute configuration, sequence rules ,D and L and R/S system of nomenclature. • Geometric isomerism-Determination of configuration of geometrical isomers, ; *cis– trans* and E / Z nomenclature • Geometric isomerism in oximes and alicyclic compounds • Conformational isomerism-Newman projection and saw house formula • Conformational analysis of ethane, n butane and cyclo hexane • Conclusion & Real life applications
3.	**Alkyl Halides**

	• Introduction of the Unit • (Upto 5 Carbons) Nomenclature • Preparation*:* from alkenes *and* alcohols, methods of formation of alkyl halides. • Reactions: hydrolysis, nitrite & nitro formation, nitrile &isonitrile formation. Williamson's ether synthesis: Elimination versus substitution • Types of Nucleophilic Substitution (SN1, SN2 and SNi) reactions with energy profile diagram • Polyhalogen compounds: Chloroform, carbon tetrachloride, DDT, BHC • Conclusion & Real life applications
4.	**Aryl Halides**
	• Introduction of the Unit • Aryl Halides Preparation:(Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer & Gattermann reactions • Methods of formation of aryl halides, nuclear and side chain reactions. The addition-elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl, allyl, vinyl and aryl halides • Reactions *(*Chlorobenzene*):* Aromatic nucleophilic substitution (replacement by –OH group) and effect of nitro substituent. Benzyne Mechanism: KNH_2/NH_3 (or $NaNH_2/NH_3$). • Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides • Conclusion & Real life applications
5.	**Alcohols**
	• Introduction of the Unit • Alcohols: • Classification and Nomenclature**.** • Monohydric Alcohols-Preparation*:* Preparation of 1^o, 2^o and 3^o alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters,Hydogen bonding, Acidic Nature • Reactions*:* With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk. $KMnO_4$, acidic dichromate, conc. HNO_3), Oppeneauer oxidation • Dihydric Alcohols*:* (Upto 6 Carbons) Methods of Formation, Chemical Reactions of Vicinal Glycols, oxidation of diols, Pinacol-Pinacolone, rearrangement. • TrihydricAlcohols : Methods of Formation, Chemical Reactions of Glycerols. • Conclusion & Real life applications

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1	A Text Book of Organic Chemistry	K. S. Tiwari, S. N. Mehrotra and N. K. Vishnoi	Latest	Vikas Publishing House
2.	Modern Principles of Organic Chemistry	M. K. Jain & S. C. Sharma	2015	Vishal Publishing Co
3	A Text Book of Organic Chemistry	B. S. Bahl and ArunBahl	Latest	S. Chand
4	Organic Chemistry	S. M. Mukherji, S. P. Singh and R. P. Kapoor	Vol. I, II & III	Wiley Eastern Ltd. (New Age International)
5	Organic Chemistry	Morrison & Boyd	Latest	Prentice Hall

Code: BSA02104	PHYSICAL CHEMISTRY	3.0 Credits [LTP: 3-0-0]

OBJECTIVE– Students will be able to explain the quantitative relationship between T, V, n & P as described by kinetic molecular theory and be able to classify matter by its state and bonding behavior. The course is helpful in the field of materials science and engineering using the knowledge of Phase diagrams.

COURSE OUTCOMES

Students will be able to:

CO104.1: Determine structure of compounds by X ray diffraction methods and compare the chemical behavior and physical properties of common substances.
CO104.2: Apply the concept of liquid crystals in applications of advanced technologies
CO104.3: Differentiate real gases from ideal gases at different temperature and pressure and explain methods of liquefaction of gases.
CO104.4: Interpret the stability regions using Phase diagrams of one component and two component system and compounds with congruent and incongruent melting point.
CO104.5: Identify problems in industrial processes with origin in colloidal chemistry.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	-	-	-	-	-	-	-	-	-
CO2	2	1	3	1	-	-	-	-	-	-	-	-
CO3	3	1	2	1	-	-	-	-	-	-	-	-
CO4	3	-	2	-	-	-	-	-	-	-	-	1
CO5	2	2	3	-	-	-	-	-	-	-	-	1

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	**Solid State**	**7**
2.	**Liquid State**	**7**
3.	**Gaseous State**	**8**
4.	**Phase Equilibrium**	**8**
5.	**Colloidal State**	**6**

B. DETAILED SYLLABUS

Unit	Unit Details
1	**Solid State**
	• Introduction of the Unit • Solid state: Definition of space lattice, Unit cell. • Laws of crystallography (i) law of constancy of interfacial angles (ii) law of rationality of indices (iii) law of symmetry. • Symmetry elements in crystals. X ray diffraction by crystals • Derivation of Braggs equation • Determination of crystal structure of NaCl, KCl and CsCl(Laue's method and powder method). • Conclusion & Real life applications
2	**Liquid State**
	• Introduction of the Unit • Liquid State: Surface tension of liquids, capillary action, surface tension and temperature, interfacial tension, surface active agents, the Parachor and chemical constitution (atomic and structural parachors). • Viscosity of liquids, experimental determination of viscosity coefficient, its variation with temperature. • Intermolecular forces, structure of liquids (a qualitative description). • Structural difference between solid, liquid and gases • Liquid crystals: Difference between liquid crystal, solid and liquid. Classification, structure of nematic and cholestric phases. Thermography and seven-segment cell. • Conclusion & Real life applications
3	**Gaseous State**
	• Introduction of the Unit • Gaseous State :Kinetic theory of gases, ideal gas laws • Behavior of real gases - the Vander Waal's equation • Critical phenomena - critical constants of a gas and their determination • PV isotherms of real gases, continuity of state, Vander Waals equation and critical state • Principle of corresponding states, reduced equation of state • Molecular velocities- Root mean square, average and most probable velocities • Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter • Liquefaction of gases (based on Joule-Thomson effect) • Conclusion & Real life applications

4	**Phase Equilibrium**
	• Introduction of the Unit • Phase Equilibrium:Phases, components and degrees of freedom of a system, • Gibbs Phase Rule and its thermodynamic derivation • Phase diagrams of one-component systems (water and sulphur) and two component systems involving eutectics, • Bi-Cd system, Pb- Ag system, desilverisation of Pb • Solid Solutions-congruent and incongruent melting points • Solid solutions-Compound formation with congruent melting point of Mg-Zn and incongruent melting point of NaCl $-H_2O$ system • Freezing Mixtures • Conclusion & Real life applications
5	**Colloidal State**
	• Introduction of the Unit • Colloidal state: Definition of colloids, classification of colloids • Solids in liquids (sols): properties- kinetics, optical and electrical • Stability of colloids, protective action, Hardy Schulze law. Gold number • Liquids in solids(gels): classification, preparation and properties, inhibition, general application of colloids • Liquid in liquid(emulsions): types of emulsions, preparation, Emulsifiers • Conclusion & Real life applications

C. RECOMMENDED STUDY MATERIAL:

S.No	Reference Book	Author	Edition	Publication
1.	Physical Chemistry	G.M. Barrow	International student edition	McGraw Hill
2.	Physical Chemistry through problems	SK Dogra& S Dogra	latest	Wiley Eastern Ltd
3.	Physical Chemistry	R.A.Alberty	latest	Wiley Eastern Ltd

Code: BSA02105	NUMERICAL ANALYSIS	3.0 Credits [LTP: 3-0-0]

OBJECTIVE–This course provides the numerical methods of solving the non-linear equations, interpolation, differentiation, and integration. To improve the student's skills in numerical methods by using the numerical analysis software and computer facilities.

COURSE OUTCOMES

Students will be able to:

CO105.1: Solve equal and unequal intervals for Interpolation problem.
CO105.2: Apply numerical methods to obtain approximate solutions to mathematical problems.
CO105.3: Solve the linear simultaneous equations using numerical methods
CO105.4: Solve the transcendental and algebraic equations using Secant, RegulaFalsi, Successive iteration method, Newton-Raphson etc.
CO105.5: Analyze the numerical methods to solve differential equations.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	2	-	-	-	-	-	-	-	-
CO2	3	2	1	2	-	-	-	-	-	-	-	-
CO3	3	2	2	1	-	-	-	-	-	-	-	-
CO4	3	2	1	2	-	-	-	-	-	-	-	-
CO5	3	2	2	1	-	-	-	-	-	-	-	-

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	2.1	-
CO2	3	-	-
CO3	3	2	-
CO4	3	2	-
CO5	3	2	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development

A OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	Interpolation	9
2	Numerical Differentiation and Integration	6
3	Numerical Solution of Linear Simultaneous Equations	6
4	Numerical Solution of Algebraic and Transcendental Equations	7
5	Numerical Solution of Ordinary Differential Equations	8

B. DETAILED SYLLABUS

Unit	Unit Details
1	**Interpolation**
	• Introduction of the Unit • Interpolation: Differences, relation between differences and derivatives. • Newton's formulae for forward and backward interpolation, • Sterling's formula, Divided difference, Newton's divided difference, • Lagrange's interpolation formula • Conclusion & Real life applications
2	**Numerical Differentiation and Integration:**
	• Introduction of the Unit • Numerical differentiation simple methods, • Numerical integration: Derivation of General Quadrature formulas, • Trapezoidal rule, Simpson's one third and Simpson's three eighth rule, • Gauss Quadrature Formulae • Conclusion & Real life applications
3	**Numerical Solution of Linear Simultaneous Equations**
	• Introduction of the Unit • Solution of linear simultaneous equations: • Direct methods - Gauss elimination • Gauss-Jordan • LU decomposition • Gauss-Seidel method • Conclusion & Real life applications
4	**Numerical Solution of Algebraic and Transcendental Equations:**
	• Introduction of the Unit • Solution of algebraic and transcendental equations using • Bisection method • Secant method • RegulaFalsi method • Successive iteration method, • Newton-Raphson method • Conclusion & Real life applications
5	**Numerical Solution of Ordinary Differential Equations**

	• Introduction of the Unit • Solution of ordinary differential equations of first order with initial condition using • Picard's method • Euler's and Modified Euler's methods • Runge-Kutta method of fourth order • Milne Predictor Corrector method • Conclusion & Real life applications

C. RECOMMENDED STUDY MATERIAL

Sr.No	Reference Book	Author	Edition	Publication
1.	Numerical Methods for Scientific and Engineering Computation	M.K. Jain, S.R.K. Iyengar and R.K. Jain	2000	New age International Publisher, India, 2007.
2.	Numerical Methods in Engineering & Science,	B. S. Grewal ,	2007	Khanna Publication
3.	Numerical Methods	Balaguruswamy	1992	TMH, India

Code: BSA02106	DIFFERENTIAL EQUATIONS	3.0 Credits [LTP: 3-0-0]

OBJECTIVE–This course is an introduction to ordinary differential equations. In this study a variety of models in physics and engineering, which use differential equations, we learn how to construct differential equations, corresponding to different ecological or physical systems.

COURSE OUTCOME

Students would be able to:

CO106.1: Identify the type of a given differential equation, select, and apply the appropriate analytical technique for finding the solution.
CO106.2: Solve the first order and higher degree differential equations solvable for *x, y, p, Clairaut's* form and orthogonal trajectories.
CO106.3: Solve linear differential equations with constant coefficients, linear simultaneous differential equations and Cauchy-Euler equation.
CO106.4: Determine the complete solutions to the linear equations of second order
CO106.5: Explain the order and degree of partial differential equations and their solutions

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	-	-	-	-	-	-	-	-
CO2	3	1	2	2	-	-	-	-	-	-	-	-
CO3	3	1	2	2	-	-	-	-	-	-	-	-
CO4	1	2	3	2	-	-	-	-	-	-	-	-
CO5	2	2	3	2	-	-	-	-	-	-	-	-

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	2	-
CO2	3	2	-
CO3	3	-	-
CO4	3	2.1	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development

A. OUTLINE OF THE COURSE

Unit no.	Title of the unit	Time required for the Unit (Hours)
1	First order and First Degree Differential Equations	8
2	First Order and Higher Degree Differential Equations	7
3	Higher Order and Simultaneous Linear Differential Equations	7
4	Second Order Linear Differential Equation with Variable Coefficients	8
5	Partial Differential Equations	6

B. DETAILED SYLLABUS

Unit	Unit Details
1	**First order and First Degree Differential Equations**
	• Introduction of the Unit • Degree and order of Differential equation, Formation of a differential equation. • Types of solutions, General, Particular, and Singular. • Variable separation, Homogeneous, • Linear equations and equations reducible to linear form. • Exact Differential equation and reducible to exact • Conclusion & Real life applications
2	**First Order and Higher Degree Differential Equations**
	• Introduction of the Unit • First order and higher degree equations solvable for x, y, p. • Clairaut's form and singular solutions. • Orthogonal trajectories. • Conclusion & Real life applications
3	**Higher Order and Simultaneous Linear Differential Equations**
	• Introduction of the Unit • Higher order linear differential equation with constant coefficients • Cauchy-Euler equation • Linear simultaneous differential equations • Conclusion & Real life applications
4	**Second Order Linear Differential Equation with Variable Coefficients**
	• Introduction of the Unit • Linear differential equation of second order: • Homogeneous equation, Exact equation • Change of dependent variable and independent variable method • Method of variation of parameters • Conclusion & Real life applications
5	**Partial Differential Equations**
	• Introduction of the Unit • Order and degree of a partial differential equation • Linear partial differential equation of first order: Lagrange's method • Standard forms and Charpit's method

	• Classification of second order partial differential equations into elliptic, parabolic and hyperbolic (simple concept only) • Conclusion & Real life applications

C. RECOMMENDED STUDY MATERIAL

Sr.No	Reference Book	Author	Edition	Publication
1.	Differential Equations,	Shepley L. Ross,	3rd Edition 1984	John Wiley and Sons, India
2.	Elements of Partial Differential Equations	I. Sneddon	1967	McGraw-Hill, International Edition India
3.	Schaum outline of Differential Equation,	Richard Bronson, Gabriel Costa,	third edition 2001	TMH India

Code: BSA02207	CHEMISTRY LAB	1.5 Credits [LTP: 0-0-3]

OBJECTIVE– The objective of the course is to develop the ability to perform accurate quantitative measurements with an understanding of the theory and use of contemporary chemical instrumentation, interpret experimental results, perform calculations on these results and draw reasonable, accurate conclusions.

COURSE OUTCOMES
Students will be able to:

CO207.1: Identify the physical and chemical properties of common organic functional groups.

CO207.2: Learn the concept of separating the mixture

CO207.3: Become familiar with instrumental analysis techniques in chemistry.

CO207.4: Understand the concept of surface tension and viscosity

CO207.5: Understand the states of matter

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	-	-	-	-	-	-	-	-	-
CO2	2	3	3	-	-	-	-	-	-	-	-	-
CO3	2	3	3	-	-	-	-	-	-	-	-	-
CO4	2	3	2	-	-	-	-	-	-	-	-	-
CO5	2	2	3	-	-	-	-	-	-	-	-	-

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development

LIST OF EXPERIMENTS

Organic Chemistry	
1	To determine the functional group and identify the given organic compound.
2	To determine the functional group and identify the given organic compound.
3	To determine the functional group and identify the given organic compound.
4	To crystallize s acetanilide from hot water
5	To purify the given organic mixture by Sublimation
6	To separate the mixture (1 solid+1 liquid) by distillation.
Physical Chemistry	
7	To determine the surface tension of the pure liquid (alcohol etc.) with the help of Stalagmometer.
8	To determine the viscosity of the given liquid with the help of viscometer.
9	To determine critical solution temperature and composition of phenol water system.
10	To determine the percentage composition of a given mixture (non-interacting system) by viscosity method/ surface tension method.
11	To determine the transition temperature of given substance.
12	To prepare colloidal solution of arsenius sulphide

Code: BSA02208	PHYSICS LAB	1.5 Credits [LTP: 0-0-3]

OBJECTIVE– The objective of the lab is to perform experiments which are related to optics & electronics subject in order to understand the practical's related to theories of the subject. The experiment of optics & electronics provides a broader practical approaches with high equipped lab instruments and set-up.

COURSEOUTCOMES
Students will be able to:

CO208.1: Learn the concept of interference by the help of Newton's ring & Michelson interferometer
CO208.2: Learn the phenomenon of polarisation and diffraction through biquartz polarimeter & Grating respectively
CO208.3: Learn the dispersive power of the material of the prism & resolving power of the telescope
CO208.4: Learn the concept of De-Sauty Bridge, phenomenon of charging & discharching & Lissajous figures.
CO208.5: Understand the characteristics of LR circuit with the source of constant emf and AC power source.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	–	–	–	–	–	–	–	–	3	2
CO2	2	–	–	–	–	–	–	–	–	–	2	–
CO3	3	2	–	–	–	–	–	–	–	–	3	2
CO4	2	3	–	–	–	–	–	–	–	–	2	3
CO5	3	3	–	–	–	–	–	–	–	–	3	3

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related toSkill Development/Entrepreneur

LIST OF EXPERIMENTS:

1.	Specific rotation of sugar solution by biquartz polarimeter
2.	Wavelength of sodium light by Michelson's Interferometer
3.	Wavelength of mercury light by plane transmission grating.
4.	Wavelength of sodium light by Newton's ring method.
5.	Dispersive power of material of prism by spectrometer
6.	Verification of Malus law
7.	Resolving power of a Telescope
8.	Measurement of capacitance by De-Sauty bridge
9.	Study of charging and discharging of CR circuit
10.	Study of phase and frequency by using CRO (Lissajous figures)
11.	To study the rise and decay of current in an LR circuit with a source of constant emf.
12.	To study the voltage and current behavior of an LR circuit with an AC power source. Also, determine power.

Code: BSA02209	ANANDAM COURSE	2 Credits [LTP: 0-0-1]

OVERVIEW AND OBJECTIVES: The Anandam program aims to instill the joy of giving in young people, turning them into responsible citizens. Who will build a better society through daily action; it will build the habit of service in students across colleges and universities in Rajasthan. The students will have to undertake the course each semester starting with the 2020-21 academic year.

Course Outcomes

- Each student will be able to work as team member.
- Student will learn social activities.
- Students will be familiar with society.

DETAILED SYLLABUS

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register/ Personal Diary
- Share this Register/ Personal Diary day in the 30-minute Anandam time slot dedicated by the college.
- Undertake one group service project for 64 Hours every term (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion session held once a month.

Code: BSA02110 ENVIRONMENTAL STUDIES 2.0 Credits [LTP: 2-0-0]

OBJECTIVE– The Environmental Studies prepares students for careers as leaders in understanding and addressing complex environmental issues from a problem-oriented, interdisciplinary perspective.

COURSEOUTCOMES
Students will be able to:

CO110.1: Understand the scope of environmental studies and explain the concept of ecology, ecosystem and biodiversity.
CO110.2: Implement innovative ideas of controlling different categories of Environmental Pollution.
CO110.3: Explain different environmental issues together with various Environmental Acts, regulations and International Agreements.
CO110.4: Summarize social issues related to population, resettlement and rehabilitation of project affected persons and demonstrate disaster management with special reference to floods, earthquakes, cyclones, landslides.
CO110.5: Determine the local environmental assets with simple ecosystems and identify local flora and fauna.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	2	2	-	-	-	1
CO2	-	-	-	-	-	-	3	2	-	-	1	1
CO3	-	-	-	-	-	-	2	3	-	-	1	1
CO4	-	-	-	-	-	-	3	2	-	-	1	1
CO5	-	-	-	-	-	-	2	3	-	-	1	1

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to Environmental Studies	**5**
2.	Environmental Pollution and its Control	**5**
3.	Environmental Policies & Practices	**5**
4.	Human Communities and the Environment	**5**
5.	Field Work	**4**

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction to Environmental studies**
	• Introduction of Unit • Multidisciplinary nature of environmental studies Concept of sustainability and sustainable development. • Ecosystem: Structure and function of ecosystem • Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies\ • Case studies of the following ecosystems: Forest ecosystem, Grassland ecosystem, Desert ecosystem • Aquatic ecosystems • Biodiversity and Conservation • Conclusion & Real Life Application
2.	**Environmental Pollution and its Control**
	• Introduction of Unit • Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution • Nuclear hazards and human health risks • Solid waste management: Control measures of urban and industrial waste. • Pollution case studies • Conclusion & Real Life Application
3.	**Environmental Policies & Practices**
	• Introduction of Unit • Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture • Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies. • Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. • International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD) • Conclusion & Real Life Application
4.	**Human Communities and the Environment**
	• Introduction of Unit • Human population growth: Impacts on environment, human health and welfare. • Resettlement and rehabilitation of project affected persons; case studies. • Disaster management: floods, earthquake, cyclones and landslides. • Conclusion & Real Life Application

5.	Field Work
	• Introduction of Unit • Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc. • Visit to a local polluted site-Urban/Rural/Industrial/Agricultural. • Study of common plants, insects, birds and basic principles of identification. • Study of simple ecosystems-pond, river, Delhi Ridge, etc. • Conclusion & Real Life Application

C. RECOMMENDED STUDY MATERIAL:

S. No	Reference Book	Author	Edition	Publication
1	Environmental Studies	ErachBarucha	Latest	UGC
2	Environmental Studies	Benny Joseph	Latest	Tata McgrawHill
3	Environmental Studies	R. Rajagopalan	Latest	Oxford University Press
4	Principles of Environmental Science and Engineering	P. Venugoplan Rao	Latest	Prentice Hall of India.
5	Environmental Science and Engineering	Meenakshi	Latest	Prentice Hall India.

Code: BSA02211	ENVIRONMENTAL STUDIES LAB	1 Credit	[LTP: 0-0-2]

OBJECTIVE:

COURSE OUTCOMES
Students will be able to:

CO211.1: Communicate scientific information precisely in both oral and written forms.
CO211.2: Demonstrate basic laboratory skills of proper handling of laboratory glassware, equipment and chemical reagents.
CO211.3: Test water quality parameters in given waste water sample by using different instruments.
CO211.4: Investigate the values of DO, BOD and COD in industrial waste water samples.
CO211.5: Detect levels of TS, TDS and TSS in waste water sample.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development

LIST OF EXPERIMENTS:

1	To determine the pH of the given sample of sewage.
2	To determine the conductivity of the given sample of sewage.
3	To determine the turbidity of the given sample of sewage.
4	To determine free chlorine of the given sample of water.
5	To determine available chlorine of the given sample of water.

6	To determine Total Solids of the given sewage sample.
7	To determine the Total Dissolved Solids of the given sewage sample.
8	To find out Total Settleable Solids of the given sewage sample.
9	To determine Total Suspended Solids of the given sewage sample.
10	To find out the Quantity of Dissolved Oxygen present in the given water sample by Winkler's Method.
11	To determine Biochemical Oxygen Demand exerted by the given wastewater sample.
12	To find out Chemical Oxygen Demand of the waste water sample.

Code: BSA02212 PERSONALITY GROOMING -I 2 Credit [LTP: 0-0-3]

OBJECTIVE– The objective of the programme is to build self-confidence, enhance self-esteem and improve overall personality of the participants. The programme aims at grooming the participants through sensitizing them about proper behavior, socially and professionally, in formal and informal circumstances.

COURSE OUTCOMES
Students will be able to:

CO212.1: Understand the art of Power Dressing and making a great first impression by polishing their Corporate/ Business manners.
CO212.2: Apply collaborative, inclusive and creative communication skills.
CO212.3: Recognize and use emotional intelligence to create and maintain productive workplace relationships and team environment.
CO212.4: Apply the understanding of harmony in existence in their profession and lead an ethical life.
CO212.5: Enhance their self-esteem, confidence and assertive behaviour to handle difficult situations with grace, style, and professionalism.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	–	–	–	–	–	–	–	–	–	2	–	2
CO2	–	–	–	–	–	–	–	–	–	3	–	3
CO3	–	–	–	–	–	–	–	3	–	2	–	-
CO4	–	–	–	–	–	–	–	–	–	3	–	2
CO5	–	–	–	–	–	–	–	–	–	–	–	1

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related toSkill Development/ Entrepreneur

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1	**Personality Grooming**	6
2	**Personality Traits & Interpersonal Skills**	8
3	**Enhancement of Emotional Intelligence**	8
4	**Attitude & Motivation**	8
5	**Introduction to Self Esteem**	2

B. DETAILED SYLLABUS

Unit	Unit Details	
1	**Personality Grooming**	**Method**
	• Introduction of the Course & the topic • Definition & Basics of Personality • The concept of success and failure • Personal Grooming & Dressing Sense • Causes of failure. SWOT analyses. • Team Building Activities • Conclusion & Summary of the Unit	• Theory • Theory • Practical • Practical • Practical • Practical • Theory/ Practical
2	**Personality Traits & Interpersonal Skills**	
	• Introduction of the topic • Personality Traits (OCEAN): Big-Five Personality characteristics such as Openness, Conscientiousness,Extroversion, agreeableness, and Neuroticism. • Psychometric Assessment (Open Source) • Skills Building Sessions • Elements of FIRO-B "Inclusion, Affection & Control" in both Wanted and Expressed Dimensions. • Group Feedback Prior to the session • Suggestions on the categorised information • Rapport Building • Establishing Complementary Transactions • Tips for Effective Interpersonal Skills • Skills Building Sessions • Conclusion & Summary of the Unit	• Theory • Theory/Practical • Practical • Practical • Theory/Practical • Practical • Practical • Practical • Theory • Practical • Theory/Practical
3	**Enhancement of Emotional Intelligence**	

	• Introduction of the topic • Emotional Intelligence : Awareness of the Basic Emotions such as Fear, Anger, Jealousy, Happiness, Affection, Sentiments, Disgust, Sadness & Surprise • Identifying Personal Levels of Emotional Labours • Experiencing Emotional Authenticity & Emotional Sensibility by application of Sensitivity Processes • Skill Building for Strengthening the Elements of Self-awareness, Self-regulation, Internal motivation, Empathy, Social skills • Conclusion & Summary of the Unit	• Theory • Theory/Practical • Theory/Practical • Theory/Practical • Practical • Theory/Practical
4	**Attitude & Motivation**	
	• Introduction of the topic • Listening Skills activities • Social Problem Solving • Managing Conflicts • Being a part of the group and expression of feelings • Conclusion & Summary of the Unit	• Theory • Practical • Practical • Practical • Practical • Theory/Practical
5	**Introduction to Self Esteem**	
	• Introduction of the topic • Term self-esteem • Symptoms - Advantages • Do's and Don’ts to develop positive self-esteem • Low self-esteem - Symptoms - Personality having low self- esteem • Conclusion & Summary of the Unit	• Theory • Practical • Practical • Practical • Theory/Practical

CODE: BSA02613	Talent Enrichment Programme (TEP-II)	1 Credits

OVERVIEW AND OBJECTIVES: The objective of Social Outreach, Discipline & Extra Curricular Activities is to provide students with the opportunities to enhance job-fetching skills and at the same time to cultivate the student's personal interests and hobbies while maintaining the good disciplinary environment in the University. TEP is integrated into the curriculum for holistic development of students through active participation in various activities falling in Technical and non-technical categories**.**

Social Outreach, Discipline & Extra Curricular Activities shall be evaluated irrespective of period/time allocation (as in the case of Extra Curricular activity) in the teaching scheme as a **1 credit** course. The record related to discipline, related activities are maintained for each student, and they shall be evaluated for the same. It shall be counted in calculation of SGPA but it is not a backlog subject. However, the attendance of these classes shall be recorded and accounted in the total attendance.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	2	-	-	-	-	-	-	-	2
CO2	-	-	-	2	-		-	-	-	-	-	3
CO3	-	-	-	3	-	-	-	-	-	-	-	3
CO4	-	-	-	3	-	-		-	-	-	-	3
CO5	-	-	-	1	-	-	-	-	-	3	-	3

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Entrepreneur

Code: BSA03101 THERMODYNAMICS AND STATISTICAL PHYSICS3.0 Credits [LTP: 3-0-0]

OBJECTIVE– The aim of the course is that the student can demonstrate the two fields of physics: "thermodynamics" and "statistical mechanics" as well as the relationship between them and ability to solve relevant problems within these two fields of physics.

COURSE OUTCOMES

Students will be able to:

CO101.1: Apply the basic concept of thermodynamics and acquire working knowledge of the zero and first law of thermodynamics
CO101.2: Produce the statistical nature of concepts and laws in thermodynamics, in particular: entropy, temperature, chemical potential, Free energies, and partition functions.
CO101.3: Construct working knowledge of the mechanism of production of low temperature and its applications.
CO101.4: Point out the distribution of molecular velocities and experimental verification of Maxwell velocity distribution.
CO101.5: Use the statistical physics methods, such as Boltzmann distribution, Gibbs distribution, Fermi-Dirac and Bose-Einstein distributions to solve problems in some physical systems.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	–	–	–	–	–	–	–	–
CO2	3	3	2	–	–	–	–	–	–	–	–	–
CO3	3	2	3	2	–	–	–	–	–	–	–	–
CO4	3	2	3	3	–	–	–	–	–	–	–	–
CO5	2	2	3	2	–	–	–	–	–	–	–	–

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	**Thermal Interaction**	7
2.	**Thermodynamic Relation**	7
3.	**Production of low temperatures and applications**	8
4.	**Distribution Law of Molecular Velocities**	6
5.	**Classical and Quantum Statistics**	8

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Thermal Interaction**
	• Introduction of the Unit • Zeroth law of thermodynamics • Various indicator diagrams (P-V diagram) • First law of thermodynamics, • Reversible and irreversible processes • Carnot's engine, • Carnot's cycle and efficiency of Carnot's engine, • Reversibility of Carnot's engine, Carnot's theorem. • Second law of thermodynamics (different statements and their equivalence) • Entropy, Principle of increase of entropy, Thermodynamic scale of temperature, • Thermodynamic scale as an absolute scale, • Third law of thermodynamics • Conclusion of the Unit
2.	**Thermodynamic Relation**
	• Introduction of the Unit • Maxwell's thermodynamic relations • Triple point • ClausiusClapyron latent heat equation (Derivation) • Effect of pressure on boiling point of liquids • Helmholtz free energy • Enthalpy andGibbs function, Internal energy • Thermodynamic potentials • Deduction of Maxwell's relations from thermodynamic potentials. • Conclusion of the Unit
3.	**Production of low temperatures and applications**
	• Introduction of the Unit • Joule Thomson expansion and JT coefficient for ideal as well as Vander Waals gas • Porous plug experiment • Temperature of inversion • Regenerative cooling • Cooling by adiabatic expansion and demagnetization • Liquid He, He I and He II • Peculiar properties of He II • Nernst heat theorem. (Derivation) • Conclusion of the Unit

4.	**Distribution Law of Molecular Velocities**
	• Introduction of the Unit • Distribution law of molecular velocities, • Most probable, Average and RMS velocities, • Energy distribution function (Derivation) • Experimental verification of Maxwell velocity distribution • Principle of equipartition of energy. • Mean free path and collision cross section • Distribution of mean free path (Derivation) • Transport of mass, • Momentum and energy and their interrelationship, (coefficient of viscosity ,thermal conductivity & diffusion) • Conclusion of the Unit
5.	**Classical and Quantum Statistics**
•	• Introduction of the Unit • Phase space • Micro and macro states • Thermodynamic probability • Relation between entropy and thermodynamic probability • Monatomic ideal gas • Specific heat capacity of diatomic gas and specific heat of solids • Postulates of quantum statistics, • In-distinguish-ability of wave function and exchange degeneracy • Bose Einstein statistics and its distribution function (Derivation) • Planck's distribution function and radiation formula (Derivation) • Fermi Dirac statistics and its distribution function. (Derivation) • Conclusion of the Unit

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Heat and Thermodynamics	**Singhal, Agarwal and Prakash**	Latest	PragatiPrakashan.
2.	Heat and Thermodynamics	**Brijlal and Subramaniam**	Latest	S. Chand & Sons.
3.	Thermodynamics and Statistical Mechanics	**S.L.Kakani**	Latest	S. Chand & Sons
4.	Kinetic Theory, Thermodynamics & Statistical Physics	**H.P. Sinha**	Latest	Ram Prasad & Sons, Agra,

Code: BSA03102 ELECTRONIC DEVICES AND CIRCUITS 3.0 Credits [LTP: 3-0-0]

OBJECTIVE– The aim of the course is that the student understand the basic semiconductor devices, their characteristics and application and analysis and design of simple diode circuits, PN junction behavior at the circuit level.

COURSE OUTCOMES
Students will be able to:

CO102.1: Apply the concepts of power supply and different network systems and apply them in electronics circuits practically. Understand the concepts of power supply and different network systems and apply them in electronics circuits practically.
CO102.2: Hypothesize the basics of semiconductor Physics and PN junction diode and apply them in electronics.
CO102.3: Compare the configuration of transistors like CE, CC, CB and implement them into electronics.
CO102.4: Point out the construction and working principle of Field effect transistor and MOSFET's
CO102.5: Construction, operation and characteristics of different types of power amplifier and their efficiencies.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	–	–	–	–	–	–	–	–
CO2	2	3	2	3	–	–	–	–	–	–	–	–
CO3	3	3	2	–	–	–	–	–	–	–	–	–
CO4	3	2	3	2	–	–	–	–	–	–	–	–
CO5	2	3	2	3	–	–	–	–	–	–	–	–

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	2	-
CO3	3	-	-
CO4	3	2	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	**Circuit Analysis**	5
2.	**Semiconductor and Rectification**	8
3.	**Bipolar Junction Transistor (BJT)**	8
4.	**Field Effect Transistors (JFET and MOSFETs)**	8
5.	**Power Amplifiers**	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Circuit Analysis**
	• Introduction of the Unit • Important definitions of circuits • Voltage Sources • Voltage and Current divider rules • Kirchhoff's Laws • Four Terminal Network • Reduction of complicated network • Network Theorems • Conclusion of the Unit
2.	**Semiconductor and Rectification**
	• Introduction of the Unit • Classification of Semiconductors: Intrinsic and Extrinsic • Mass Action Law • Fermi level in an Extrinsic Semiconductor and effect of temperature on Fermi Level • P-N Junction Diode • Characteristic of P-N junction diode • Rectification • Ripple factor and efficiency • Filters: Series Inductor, Shunt capacitor, L and π section • Zener diode and Voltage Regulation • Conclusion of the Unit
3.	**Bipolar Junction Transistor (BJT)**
	• Introduction of the Unit • PNP and NPN transistors • Transistor - CB, CE and CC configurations: Input and Output characteristics • Current gains and their relationship. • Relationship between α and β • Transistor as an amplifier • Transistor load line • Transistor as a diode • Transistor Biasing • Selection of Operating Point • Bias Stabilization

	• Conclusion of the Unit
4.	**Field Effect Transistors (JFET and MOSFETs)**
	• Introduction of the Unit • Junction Field Effect Transistors (JFET) • Characteristics of JFETs • FET Configurations • DC load line and bias point • FET biasing • FET small signal models • MOSFET: Construction and working, I-V characteristics • Enhancement and depletion modes • Comparison of JFETs and MOSFETs • Conclusion of the Unit
5.	**Power Amplifiers**
	• Introduction of the Unit • Need of power amplifiers • Classification of power amplifiers, Class A, Class B and Class C power amplifiers • Efficiencies • Harmonic distortion in power amplifier • Variation of output power in Transformer coupled power amplifier • Introduction of Push-Pull Amplifier • Introduction of Tuned amplifiers • Conclusion of the Unit

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Principles of Electronics	**V.K. Mehta and R. Mehta**	Rev. Ed., 2010	S. Chand and Company
2.	Electronic Devices and Circuits: An Introduction	**Allen Mottershead**	2005	Prentice-Hall of India
3.	A Textbook of Applied Electronics	**R. S. Sedha**	1990	S.Chand and Company Ltd.

Code: BSA03103	INORGANIC CHEMISTRY	3.0 Credits [LTP: 3-0-0]

OBJECTIVE– The objective of the course is to enable the student to know the severity of corrosion and methods of preventing it and use of lubricants under different operating conditions. To understand the concepts of fuels and energy resources, generation of energy from various types of fuels, to learn the manufacturing processes of cement, glass and refractories.

COURSE OUTCOMES

Students will be able to:

CO103.1: Apply scientific principles to prevent/ control corrosion using the mechanism of corrosion.
CO103.2: Justify the use of lubricant on the basis of its properties like Viscosity & Viscosity Index, Flash and Fire Point, Cloud and Pour Point, Carbon Residue, Oiliness, Aniline Point, Steam Emulsification Number, Precipitation Number and Neutralization Number.
CO103.3: Demonstrate the manufacturing of cement, refractories and glass and their applications.
CO103.4: Characterize fuels in terms of efficiency of combustion.
CO103.5: Evaluate chemistry behind the constitution, classification and synthesis of dyes.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	**2**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO5	**2**	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability

C. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	**Corrosion**	8
2.	**Lubricants**	7
3.	**Cement, Refractories and Glass**	7
4.	**Fuel**	8
5.	**Synthetic Dyes and Polymers**	6

D. DETAILED SYLLABUS

Unit	Unit Details
1.	**Corrosion**
	• Introduction oftheUnit • **Corrosion** Definition of corrosion and its Significance • Mechanisms of Corrosion: Chemical (Dry) corrosion and Electrochemical (Wet) corrosion • Types of corrosion: Galvanic corrosion, Concentration cell corrosion, Stress corrosion, Pitting corrosion • Factors affecting the rate of corrosion • Protection from corrosion : Material selection and design, Improvement of Environment , Coating of metallic surface, Cathodic protection, Anodic protection, Electroplating, Tinning, Galvanization and Modification in designs • Some practical examples of corrosion • Conclusion of the Unit
2.	**Lubricants**
	• Introduction of the Unit • **Lubricants** Introduction of lubricants, Classification, Properties and Uses of lubricants, • Mechanism of lubrication • Properties of lubricants: Viscosity & Viscosity Index, Flash and Fire Point, Cloud and Pour Point, Carbon Residue, Oiliness, Aniline Point, Steam Emulsification Number, Precipitation Number and Neutralization Number • Conclusion of the Unit
3.	**Cement, Refractories and Glass**
	• Introduction of the Unit • **Cement:** Composition and Significance of cement, • Manufacturing of Portland cement by Rotary Kiln Technology, • Chemistry of setting and hardening of cement and role of gypsum, • **Refractories,** Classification and its properties, • Requisites of good refractory and manufacturing of refractory, • Detailed study of Silica and Fire clay refractory and their uses • **Glass:** Definition of glass, its Properties, Manufacturing of glass, Importance of annealing in glass making, • Types of glasses and their commercial uses • Conclusion of the Unit
4.	**Fuel**

	• Introduction of the Unit • **Fuel :**Classification of Fuels, • Calorific value: Gross and Net calorific values (SI units). • Determination of calorific value of a solid, liquid and gaseous fuel, • Carbonization and Cracking- Fixed bed cracking, moving bed catalytic cracking. • Knocking, Octane number, Cetane number, prevention of knocking, anti-knocking agents, • Synthetic petrol, Bergius process and Fischer Tropsch process. • Conclusion of the Unit.
5.	**Synthetic Dyes and Polymers**
	• Introduction of Unit • **Synthetic dyes:** Color and constitution (electronic concept.), classification of dyes, Chemistry and synthesis of Methyl orange, Congo red, Malachite green, Crystal violet, Phenolphthalein, Fluorescein, Alizarin and Indigo • **Synthetic polymers**: Addition or chain growth polymerization, Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler Natta polymerization and vinyl polymers. Condensation or step growth polymerization. Polyesters, polyamides, phenol-formaldehyde resin, urea-formaldehyde resin, epoxy resins and polyurethanes. Natural and synthetic rubbers • Conclusion of the Unit

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Industrial Chemistry	B.K. Sharma	**latest**	Krishna Prakasam Media (P) Ltd., Meerut, 2001
2.	A text book of Engineering Chemistry	Dr. Sunita Rattan	**latest**	S.K. Kataria& Sons, New Delhi (2012)
3.	Engineering Chemistry	by J C Kuriacose and J. Rajaram	3rd Edition (1995)	Tata McGraw-Hill Co, New Delhi (2004)

Code: BSA03104	PHYSICAL CHEMISTRY	3.0 Credits [LTP: 3-0-0]

OBJECTIVE– The objective of the course is to understand the basic terminologies of chemical kinetics, to understand the theories of reaction rates and catalysis and develop skills to provide solutions in daily life situations.

COURSE OUTCOMES

Students will be able to:

CO104.1: Apply Raoult's law on colligative properties, abnormal molar mass, degree of dissociation/association
CO104.2: Derive integrated rate expressions for studying kinetics of zero order first order To derive integrated rate expressions for studying kinetics of zero order, first order, second order and third order reaction by differential and integration method and solve numerical problems.
CO104.3: Identify the order of reaction using conductometric, potentiometric, optical, plarimetry and spectrophotometermethod and explain Arhenius equation, Simple collision theory and Transition state theory.
CO104.4: Interpret the equilibrium constant using Le Chatelier's principle, Clapeyron equation and Clausius-Clapeyron equation
CO104.5: Apply the effect of common ion on solubility equilibria in practical assignments and calculate hydrolysis constant, degree of hydrolysis and pH for different salts.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	2	1	-	-	-	-	-	-	-	-
CO2	3	-	2	-	-	-	-	-	-	-	-	-
CO3	2	3	-	-	-	-	-	-	-	-	-	-
CO4	2	3	1	1	-	-	-	-	-	-	-	-
CO5	3	2	1	1	-	-	-	-	-	-	-	-

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	**Solutions**	7
2.	**Chemical Kinetics I**	7
3.	**Chemical Kinetics II**	7
4.	**Chemical Equilibrium**	7
5.	**Ionic Equilibrium**	8

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Solutions**
	• Introduction of the Unit • Ideal and non ideal solutions • Methods of expressing concentrations, activity and activity coefficients • Dilute solutions-colligative properties, Raoults law • Relative lowering of vapour pressure, Molecular weight determination • Osmosis, Law of osmotic pressure and its determination, determination of molecular weight from osmotic pressure • Elevation of boiling point and depression in freezing point • Abnormal molar mass, degree of dissociation and association of molecules • Conclusion of the Unit
2.	**Chemical Kinetics I**
	• Introduction of the Unit • **Chemical kinetics and its scope**, rate of a reaction, factors influencing the rate of a reaction-concentrations, temperature, pressure, solvent, light, catalyst, concentration dependence of rates • Mathematical characteristics of simple chemical reaction- zero order, first order, second order, pseudo order, half-life and mean life. • Determinations of the order of reaction- differential method, method of integration, method of half-life period and isolation method • Radioactive decay as a first order phenomenon • Conclusion of the Unit
3.	**Chemical Kinetics II**
	• Introduction of the Unit • **Experimental methods of chemical kinetics**: conductometric, potentiometric, optical methods, polarimetry and spectrophotometery. • Theories of chemical kinetics, Effect of temperature on rate of reaction, • Arrhenius Equation, concepts of activation energy • Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis) • Expression for the rate constant based on equilibrium constant and thermodynamic aspects • Conclusion of the Unit
4.	**Chemical Equilibrium**
	• Introduction of the Unit • **Chemical Equilibrium:**Equilibrium constant andFree energy change • Thermodynamic derivation of the law of mass action • Le Chatelier's principle • Reaction isotherm and reaction isochore

	• Clapeyron equation and Clausius-Clapeyron equation • Applications • Conclusion of the Unit
5.	**Ionic Equilibrium**
	• Introduction of the Unit • **Ionic Equilibrium:** Strong, moderate and weak electrolytes • degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water • Ionization of weak acids and bases, pH scale, common ion effect • Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts, Buffer solutions • Solubility and solubility product of sparingly soluble salts – applications of solubility product principle • Conclusion of the Unit

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Physical Chemistry	Castellan, G.W.	4th Ed.	Narosa (2004).
2.	Physical Chemistry	Barrow, G.M.	latest	Tata McGraw-Hill (2007).

Code: BSA03105	ANALYTICAL GEOMETRY	3.0 Credits [LTP: 3-0-0]

OBJECTIVE– This course helps students in exploring the accurately identify the equations, properties and graphs of the parabola, circle and ellipse. Convert between radian measure and degree measure and apply to arc length. Demonstrate the ability to use trigonometric functions to find the parts of a right triangle and to solve problems involving right triangles.

COURSE OUTCOMES

Students will be able to:

CO105.1: Analyze the characteristics and properties of planes.
CO105.2: Develop mathematical arguments about geometric relationships of straight lines.
CO105.3: Demonstrate working knowledge of three-dimensional structure of sphere.
CO105.4: Explain the 3-D geometry using cone and cylinder.
CO105.5: Visualize and represent geometric figures and classify central conicoid geometric solids

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	2	-	-	-	-	-	-	-	-
CO2	3	2	1	2	-	-	-	-	-	-	-	-
CO3	1	2	3	2	-	-	-	-	-	-	-	-
CO4	3	2	1	2	-	-	-	-	-	-	-	-
CO5	3	1	2	2	-	-	-	-	-	-	-	-

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	**Plane**	9
2	**Straight Line**	7
3	**Sphere**	7
4	**Cone and Cylinder**	7
5	**Central Conicoids**	6

B. DETAILED SYLLABUS

Unit	Unit Details
1	**Plane**
	• Introduction of the Unit • System of Coordinates, Direction Cosines, Direction Ratios and Projections, • Angle between two lines, Condition of Perpendicularity and parallelism, • Lagrange's Identity, Equation of plane in various forms, Angle between two planes, Distance of a point from a plane, plane through intersection of two planes - Plane coaxial with given planes, • Planes bisecting the angle between two planes, Equation of Pair of Planes • Conclusion of the Unit.
2	**Straight Line**
	• Introduction of the Unit • Equation of Straight line, Symmetrical Form, General Form, • Perpendicular distance of a point from a line, angle between plane and line, • General Equation of Plane containing Line, Co-planarity of two lines, Skew lines, Intersection of three planes. • Conclusion of the Unit
3	**Sphere**
	• Introduction of the Unit • Equation of the sphere in general and standard forms • Equation of a sphere with given ends of a diameter. • Plane section of a sphere. Sphere through a given circle. • Intersection of two spheres, Orthogonality of spheres Tangent Plane, Plane of Contact, • Radical plane of two spheres, Coaxial system of spheres • Conclusion of the Unit
4	**Cone and Cylinder**
	• Introduction of the Unit • Cone, Enveloping Cone, Tangent plane of a cone, Condition of Tangency, Reciprocal cone, condition of three mutually perpendiculars, Right Circular Cone, Cylinder, Enveloping cylinder, Right Circular Cylinder. • Conclusion of the Unit
5	**Central Conicoids**
	• Introduction of the Unit • Central Conicoids, Standard Equation, • Ellipsoid, Hyperboloid of one and two sheet, Intersection of line with Conicoid, • Section with Circle, Tangent lines and Tangent Planes, Condition of tangency, Director Sphere • Conclusion of the Unit

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	A Textbook of Analytical Geometry of Three Dimensions	P.K. Jain and Khalil Ahmad	1999	Wiley Eastern Ltd.
2.	The Elements of Coordinate Geometry	S.L. Loney:	1999	McMillan and Company, London.
3.	Analytical Solid Geometry	P. K. Mittal, Shanti Narayan,	1992	S. Chand &Co.delhi

Code: BSA03106	NUMBER THEORY	3.0 Credits [LTP: 3-0-0]

OBJECTIVE– This course helps students to Identify and apply various properties of and relating to the integers including the Well-Ordering Principle, primes, unique factorization, the division algorithm, and greatest common divisors. Identify certain number theoretic functions and their properties.

COURSE OUTCOMES

Students will be able to:

CO106.1: Explain the concept of divisibility and able to find greatest common divisor of large integers using Euclidean algorithm
CO106.2: Explain applications anddefinitions of congruence, residue classes and least residues.
CO106.3: Apply Euler-Fermat's theorem to prove relations involving prime numbers.
CO106.4: Identify certain number theoretic functions and their properties.
CO106.5: Determine the value of Euler Phi-function and Euler-Phi function for integers.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	2	-	-	-	-	-	-	-	-
CO2	3	2	1	2	-	-	-	-	-	-	-	-
CO3	2	3	1	2	-	-	-	-	-	-	-	-
CO4	3	2	1	2	-	-	-	-	-	-	-	-
CO5	3	1	2	2	-	-	-	-	-	-	-	-

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	**Euler Theorem**	7
2	**Divisibility**	7
3	**Fundamental theorem of Arithmetic**	7
4	**Functions**	8
5	**Division and Euclidean Algorithm**	7

B. DETAILED SYLLABUS

Unit	Unit Details
1	**Euler Theorem**
	• Introduction of the Unit • Euler's Phi – function, • Euler's theorem, • Some properties of the Phi – function • Conclusion of the Unit
2	**Divisibility**
	• Introduction of the Unit • Special Divisibility tests, • Linear Congruences, The Little Fermat's theorem, • Wilson's theorem • Conclusion of the Unit
3	**Fundamental theorem of Arithmetic**
	• Introduction of the Unit • The Fundamental theorem of arithmetic, • Sieve of Eratosthenes, The GoldbachConjecture , • Basic properties of congruence • Conclusion of the Unit
4	**Functions**
	• Introduction of the Unit • The random functions, • The Mobius inversion formula, • The greatest integer function • Conclusion of the Unit
5	**Division and Euclidean Algorithm**
	• Introduction of the Unit • The Division Algorithm, Lame's theorem, • The g.c.d. – The Euclidean Algorithm, • Linear Diophantine Equation • Conclusion of the Unit

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Basic Number Theory	S B Malik	2nd edition	Vikas Publishing House
2.	Elementary Number Theory	David M. Burton,	2001	Universal Book Stall, delhi
3.	Introduction to Analytic Number Theory	.T. M. Apostol,	1976	Springer Valley, India

Code: BSA03207	CHEMISTRY LAB	1.5 Credits [LTP: 0-0-3]

OBJECTIVE– To develop theoretical aquatic chemistry basis, use the principles for the evaluation of water quality, develop understanding of the basic principles and concepts of advanced **fuel** combustion and acquire skills based on chemical kinetics experiments

COURSE OUTCOMES

Students will be able to:

CO207.1: Learn and apply basic techniques used in chemistry laboratory for water analyses and purification.
CO207.2: Select lubricants for various purposes.
CO207.3: Assess the quality of different varieties of coal sample.
CO207.4: Elucidate kinetics and solubility product of sparingly soluble salts and their applications.
CO207.5: Acquire the ability to understand, explain and use instrumental techniques for chemical analysis.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	-	-	-	-	-	-	-	-	-
CO2	2	3	2	-	-	-	-	-	-	-	-	-
CO3	2	3	3	1	-	-	-	-	-	-	-	-
CO4	2	3	3	1	-	-	-	-	-	-	-	-
CO5	1	2	3	-	-	-	-	-	-	-	-	-

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability

LIST OF EXPERIMENTS

Industrial Inorganic Chemistry	
1	To determine the hardness of water by complexometric method
2	To determine the free chlorine in given water sample
3	To determine the properties (viscosity & flash and fire point) of given lubricant by Redwood viscometer &Pensky Marten apparatus respectively.
4	To determine dissolved O_2 in given water sample.
5	Proximate analysis of coal sample.
6	To determine the calorific value of solid fuel by Bomb Calorimeter.
Physical Chemistry	
7	To determine the rate constant of the hydrolysis of Ethyl acetate using an acid as a catalyst
8	To determine the melting/boiling points of given mixture.
9	To determine the strength of given acid conductometric ally.
10	To determine the solubility and solubility products of sparingly soluble substance.
11	To estimate the amount of acids present in a given mixture conductometric ally.
12	To determine the strength of strong acid using strong base by pH meter.

Code: BSA03208	PHYSICS LAB	1.5 Credits [LTP: 0-0-3]

OBJECTIVE– To experimentally realize electronics circuits and its characteristics expose the student to working of diode, transistor etc.

COURSE OUTCOMES

Students will be able to:

CO208.1: Develop a general understanding of different electrical and electronic devices and their characteristics.
CO208. 2: Develop an understanding and assessment of PN junction diode and transistor characteristics
CO208.3: Understand and apply the phenomenon of bridge rectifier and CRO
CO208.4: Apply the principle of Seeback effect and study the variation of Thermo-Emf of a Thermocouple
CO208.5: Understand and operate various electrical and thermal components and verification of physical laws

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	–	–	–	–	–	–	–	3	3
CO2	3	2	–	–	–	–	–	–	–	–	3	2
CO3	2	–	–	–	–	–	–	–	–	–	2	–
CO4	3	–	–	–	–	–	–	–	–	–	3	–
CO5	–	3	–	–	–	–	–	–	–	–	–	3

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development

LIST OF EXPERIMENTS:

1	Identification, testing and application of Resistors, Inductors, Capacitors, PN-Diode, Zener Diode, LED, LCD, BJT, Photo Diode, Photo Transistor, Analog/Digital Multi- Metres and Function/Signal Generator.
2	Study of characteristics of a P-N junction diode.
3	Study of characteristics of a zener diode.
4	Voltage regulation using zener diode
5	Measure the frequency, voltage, current with the help of CRO.

6	Study half wave rectifier and effects of filters on wave. Also calculate ripple factor.
7	Study bridge rectifier and measure the effect of filter network on D.C. voltage output & ripple factor.
8	To study the variation of Thermo-Emf of a Thermocouple with Difference of Temperature of its Two Junctions.
9	Study the BJT amplifier in common emitter configuration. Measure voltage gain plot gain frequency response and calculate its bandwidth.
10	Experimental verification of first law of thermodynamics by discharging of condenser.
11	Study of variation of total thermal radiation with temperature.
12	Plot drain current - drain voltage and drain current – gate bias characteristics of field effect transistor and measure of Idss&Vp

Code: BSA03209	ANANDAM COURSE	2 Credits [LTP: 0-0-1]

OVERVIEW AND OBJECTIVES: The Anandam program aims to instill the joy of giving in young people, turning them into responsible citizens. Who will build a better society through daily action; it will build the habit of service in students across colleges and universities in Rajasthan. The students will have to undertake the course each semester starting with the 2020-21 academic year.

Course Outcomes

- Each student will be able to work as team member.
- Student will learn social activities.
- Students will be familiar with society.

DETAILED SYLLABUS

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register/ Personal Diary
- Share this Register/ Personal Diary day in the 30-minute Anandam time slot dedicated by the college.
- Undertake one group service project for 64 Hours every term (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion session held once a month.

Code: BSA03210	COMMUNICATION SKILLS-II	2Credits [LTP: 0-0-3]

OBJECTIVE– The objective of the programme is to recognize different styles of communication and how to improve understanding and build rapport with others. Appreciated the role of body language and voice tone in effective communication. Communicate their message in an effective and engaging way for the recipient.

COURSE OUTCOME

The student would be able to:

CO210.1: Broaden their outlook through cross-fertilization and exposure to new and different experiences and ideas and enrich their understanding of the issues under discussion.
CO210.2: Prepare for any type of interview from classic one-on-one interview to panel interviews, Phone/Skype interviews, Behavioral/Situational, Interviews, interviews at job fairs and meals even the dreaded stress interview.
CO210.3: Examine the impact of positive attitude on personal and professional environments & apply positive psychology techniques to improve effectiveness in work.
CO210.4: Evaluate information and its sources critically & Incorporate selected information into one's knowledge base.
CO210.5: Develop a comprehensive set of practical skills and tools to rely on through leadership practice. Such skills and tools include time management, meeting management and agenda setting, group dynamics, and team building.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	–	–	–	–	–	–	–	-	–	3	–	3
CO2	–	–	–	–	–	–	–	-	–	3	–	2
CO3	–	–	–	–	–	–	–	3	–	2	–	-
CO4	–	–	–	–	–	–	–	-	–	2	–	1
CO5	–	–	–	–	–	–	–	-	–	2	–	1

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Skill Development/ Entrepreneur

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1	Group Discussion	**8**
2	Technical/HR Interview/ Resume Building	**8**
3	Positive Attitude & Motivation	**8**
4	Conversational Skills	**4**
5	Leadership Attitude & Confidence Building	**4**

B. DETAILED SYLLABUS

Unit	Unit Details	
1.	**Group Discussion**	**Method**
	• Introduction of the Course & the topic • Practice Sessions • Conclusion & Summary of the Unit	• Theory/Practical • Practical • Theory/Practical
2.	**Technical/HR Interview/ Resume Building**	
	• Introduction of the topic • Practice Sessions • Resume Updation • Conclusion & Summary of the Unit	• Theory/Practical • Practical • Theory/Practical • Theory/Practical
3.	**Positive Attitude & Motivation**	
	• Introduction of the topic • Developing Positive Attitude Sessions • Motivation Enrichment Sessions • Conclusion & Summary of the Unit	• Theory/Practical • Practical • Theory/Practical • Theory/Practical
4.	**Conversational Skills**	
	• Introduction of the topic • Techniques of Conversation • Activities on Situational Based Conversation • Important Phrases used for different Conversation. • Conclusion & Summary of the Unit	• Theory/Practical • Theory/Practical • Practical • Practical • Theory/Practical
5.	**Leadership Attitude & Confidence Building**	
	• Introduction of the topic • Qualities of a leader • Activities to improve Leadership qualities • Confidence Building Sessions • Conclusion & Summary of the Unit	• Theory/Practical • Theory/Practical • Practical • Practical • Theory/Practical

Code: BSA03211	PRESONALITY GROOMING-II	Credits 2[LTP: 0-0-3]

OBJECTIVE– The objective of the programme is to build self-confidence, enhance self-esteem and improve overall personality of the participants. The programme aims at grooming the participants through sensitizing them about proper behavior, socially and professionally, in formal and informal circumstances.

COURSE OUTCOMES
Students will be able to:

CO211.1: Enhance their behaviour and standards for appearance, actions and attitude in a business environment.
CO211.2: Explore time management strategies to add time for success activities &identify procrastination behaviours and strategies to avoid them.
CO211.3:Identify appropriate verbal and non-verbal communication skills/techniques for an interview (e.g. eye contact, use of filler words, hand gestures, and verbal pace).
CO211.4: Explore how presentation works, develop a unique individual style, understand what happens in front of an audience & Practice a whole range of techniques.
CO211.5: Enhance their self-esteem, confidence and assertive behaviour to handle difficult situations with grace, style, and professionalism.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	–	–	–	–	–	–	–	–	–	2	–	2
CO2	–	–	–	–	–	–	–	–	–	3	–	3
CO3	–	–	–	–	–	–	–	3	–	2	–	-
CO4	–	–	–	–	–	–	–	–	–	3	–	2
CO5	–	–	–	–	–	–	–	–	–	–	–	1

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related toSkill Development/ Entrepreneur.

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1	**Self-Management**	4
2	**Team Management Technique**	8
3	**Cracking Job Interviews & Resume Building**	8
4	**Professional Presentation Skills**	6
5	**Techniques in Group Discussion**	6

B. DETAILED SYLLABUS

Unit	Unit Details	
1	**Self-Management**	
	• Introduction of the topic • Situational Role Plays • Conclusion & Summary of the Unit	• Theory/Practical • Practical • Theory/Practical
2	**Team Management Technique**	
	• Introduction of the topic • Defining teams and teamwork. • Understanding the types of teams and when to use a team. Team-based problem solving. • Team composition, personality & behavior. • Team assessment methods. • Team leadership styles and techniques. • The role of team values, identity, affinity, and interdependence in team performance. • Self-selection in teams. Morale & attitude in teams. • Conclusion & Summary of the Unit	• Theory/Practical • Theory/Practical • Theory/Practical • Theory/Practical • Theory/Practical • Theory/Practical • Theory/Practical • Theory/Practical • Theory/Practical
3	**Cracking Job Interviews & Resume Building**	
	• Introduction of the topic • Patterns & Composition of Questions • Correcting the Common Interview Pitfalls • How to Sustain in Difficult Situations during Interview • Stress Interview • Behavioural Event interviews • Practice Session	• Theory/Practical • Practical • Practical • Practical • Practical • Theory/Practical

	• Conclusion & Summary of the Unit	
4	**Professional Presentation Skills**	
	• Introduction of the topic • Overview of the process of developing a presentation • Analysis of speakers and speaking styles • The parts of a presentation: introduction, body, and conclusion • Practice with common presentation types • Using visuals (e.g., PowerPoint) effectively • Conclusion & Summary of the Unit	• Theory/Practical • Theory/Practical • Theory/Practical • Practical • Practical • Practical • Theory/Practical
5	**Techniques in Group Discussion**	
	• Introduction of the topic • Skills of group discussion • Continuation of Skills of group discussion • Guidelines for group discussion • Team player of group discussion • Successful Group Discussion • Awareness in group discussion • Conclusion & Summary of the Unit	• Theory/Practical • Practical • Practical • Practical • Practical • Theory/Practical

Code: BSA03612	Discipline and Talent Enrichment Programme (TEP-III)	1 Credit

OVERVIEW AND OBJECTIVES The objective of Discipline and TEP is to provide students with the opportunities to enhance job-fetching skills and at the same time to cultivate the student's personal interests and hobbies while maintaining the good disciplinary environment in the University.

TEP is integrated into the curriculum for holistic development of students through active participation in various activities falling in Technical and non-technical categories.

Discipline and Talent Enrichment Programme (TEP) shall be evaluated irrespective of period/time allocation (as in the case of Extra Curricular activity) in the teaching scheme as a 1 credit course. The record related to discipline, related activities aremaintained for each student, and they shall be evaluated for the same. It shall be counted in calculation of SGPA but it is not a backlog subject. However, the attendance of these classes shall be recorded and accounted in the total attendance.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	2	-	-	-	-	-	-	-	2
CO2	-	-	-	2	-		-	-	-	-	-	3
CO3	-	-	-	3	-	-	-	-	-	-	-	3
CO4	-	-	-	3	-	-		-	-	-	-	3
CO5	-	-	-	1	-	-	-	-	-	3	-	3

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Entrepreneur

Code: BSA04101	QUANTUM MECHANICS	3.0 Credits [LTP: 3-0-0]

OBJECTIVE–This course is part one of a two semester course focused on a rigorous exposition to the principles of Quantum mechanics. The Dirac bra-ket formalism will be introduced and used throughout to present the principles of Quantum Mechanics in a general context.

COURSE OUTCOMES

Students will be able to:

CO101.1: Apply the basic concepts of Quantum Mechanics and Heisenberg uncertainty principle.

CO101.2: Point out the mechanism and importance of Schrodinger equation in Quantum Mechanics.

CO101.3: Role plays of Operators in Quantum Mechanics and their Applications

CO101.4: Compare the theory of potential barrier and apply this in the decay of alpha particle from the nucleus.

CO101.5: Solve the concept of simple harmonic oscillator at atomic level.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	–	–	–	–	–	–	–	–
CO2	2	2	3	2	–	–	–	–	–	–	–	–
CO3	3	3	2	2	–	–	–	–	–	–	–	–
CO4	3	2	2	3	–	–	–	–	–	–	–	–
CO5	3	3	2	–	–	–	–	–	–	–	–	–

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	**Development of Quantum Mechanics**	8
2.	**Schrodinger Equations**	7
3.	**Operators in Quantum Mechanics and their Applications**	7
4.	**Bound State Problems**	7
5.	**Simple Harmonic Oscillator (1-D Case)**	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Development of Quantum Mechanics**
	• Introduction of the Unit • Black body radiation spectrum • Classical theory and its failure • Planck quantum hypothesis • Matter Waves: De Broglie hypothesis • Wave packet, Phase velocity and group velocity • Davison Germer experiment. • Heisenberg Uncertainty Principaland its application such as (i) Non existence of electron in nucleus, (ii) Ground state energy of H–atom, (iii) Ground state energy of harmonic oscillator (iv) Natural width of spectral line • Compton effect • Conclusion of the Unit
2.	**Schrodinger Equations**
	• Introduction of the Unit • Wave function and its interpretation, • Schrödinger time dependent and time independent one-dimensional equation, • Three-dimensional Schrödinger wave equation, • Probability current density, • Physical meaning of ψ, • Conditions to be satisfied by ψ. • particle in one dimensional box • Eigen function and eigen values • Discrete energy levels • Extension of results for three dimensional case and degeneracy of level. • Conclusion of the Unit
3.	**Operators in Quantum Mechanics and their Applications**
	• Introduction of the Unit • Definition of operator in quantum mechanics • Eigen function • Eigen value and Eigen value equation • Hermition operator • Parity operator • Exchange operator • Expected value • Normalization of wave function • Orthogonally of wave function • Stationary states • Commutation relations

	• Ehrenfest's theorem • Bohr's principle of complementarity • principle of superposition • Conclusion of the Unit
4.	**Bound State Problems**
	• Introduction of the Unit • Potential step • Rectangular potential barrier • Calculation of reflection and transmission coefficient • Qualitative discussion of the application to alpha decay (tunnel effect) • square well potential problem, • calculation of transmission coefficient • Resonant scattering • Conclusion of the Unit
5.	**Simple Harmonic Oscillator (1-D Case)**
	• Introduction of the Unit • Schrödinger equation and its solutions, • Eigen function, • Energy eigen values. • Zero point energy, • Parity, • Symmetric and anti-symmetric wave functions with graphical representation. • **Rigid rotator**: Schrodinger equation and its solution. • Conclusion of the Unit

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Quantum Mechanics: A Textbook for Undergraduates students	**Mahesh C. Joshi**	2009	PHI
2.	Quantum Physics of Atoms, Molecules, Solid, Nuclei and Particles	**R. Eisberg and R. Resnick**	1985	John Wiley & Sons, Singapore
3.	Quantum Mechanics & Modern Physics	**Mahipal Singh**	2008	Ram Prasad & Sons, Agra

Code: BSA04102 ANALOG AND DIGITAL ELECTRONICS 3.0 Credits [LTP: 3-0-0]

OBJECTIVE– This course is intended for the students to facilitate the development into advance digital electronics investigation and introduce fundamental principles of analog and digital electronics commonly used in smart electronics research.

COURSE OUTCOMES

Students will be able to:

CO102.1: Role plays of the different types of number systems and De-Morgan Theorem
CO102.2: Point out the mechanism of the combinational circuits and flip-flop.
CO102.3: Judge the concepts and potential applications of feedback systems and their frequency responses.
CO102.4: Identify the configuration of different types of sinusoidal oscillators.
CO102.5: Discussions for the mechanism of operational amplifier and its different applications.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	–	–	–	–	–	–	–	–
CO2	3	2	3	2	–	–	–	–	–	–	–	–
CO3	3	3	2	2	–	–	–	–	–	–	–	–
CO4	3	3	2	3	–	–	–	–	–	–	–	–
CO5	2	2	3	2	–	–	–	–	–	–	–	–

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	**Number System & Boolean Algebra**	7
2.	**Sequential & Combinational logic circuits**	6
3.	**Feedback Amplifier**	8
4.	**Sinusoidal & Non sinusoidal Oscillators**	8
5.	**OPAMP and its Basic Applications**	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Number System & Boolean Algebra**
	• Introduction of the Unit • Decimal and Binary number system • **Octal** and Hexadecimal number system • Interconversion • Character codes • ASCII, BCD, Gray code • Logical operations • Boolean algebra • Simplification of boolean expression, • Gates: NOT, AND, OR, NAND, NOR and XOR gates • De-Morgans theorems • Universal gates • Logic circuits for boolean expressions • Conclusion of the Unit
2.	**Sequential & Combinational logic circuits**
	• Introduction of the Unit • Half adder • Full adder • Parallel adder • Half subtractor • Full subtractor • Parallel subtractor, • Flipflops; RS, D, JK • Clocked and edge triggered • PRESET and CLEAR • Counters: Synchronous and Asynchronous counter • Conclusion of the Unit
3.	**Feedback Amplifier**
	• Introduction of the Unit • Feedback concept • Positive and negative feedbacks and their properties • Sampling and mixing • Feedback topology: Voltage series, Voltage shunt, Current series, Current shunt • Effect of positive and negative feedback on gain of amplifier • Frequency response • Gain-stability • Noise, Distortions • Effect of negative feedback on input and output impedances of an amplifier

	• CE amplifier with current series feedback • Conclusion of the Unit
4.	**Sinusoidal & Non sinusoidal Oscillators**
	• Introduction of the Unit • Operation of oscillator • Classification of oscillators • Barkhausen criterion for sustained oscillations • L-C oscillator • R-C Phase shift oscillator • Hartley oscillator • Colpitt's oscillators. • Non Sinusoidal Oscillators: Transistor as a switch • Introduction of multivibrator • Conclusion of the Unit
5.	**OPAMP and its Basic Applications**
	• Introduction of the Unit • OPAMP and its Basic Applications • Differential Amplifier: Common mode and difference mode signals and their gains • CMRR, Emitter- Coupled differential amplifier • Basic Operational Amplifier (Op-Amp) • Ideal operational amplifier • Concept of virtual ground • Inverting and non-inverting OPAMP • Applications of Op-Amp • Inverting Op-Amp as constant multiplier • Sign-Changer • Adder or summing amplifier • Integrator • Differentiator • Conclusion of the Unit

C. RECOMMENDED STUDY MATERIAL:

Code: BSA04103	INORGANIC CHEMISTRY	3.0 Credits [LTP: 3-0-0]

OBJECTIVE– The objective of the course is to understand the basic concepts of acids and bases, classification of solvents and their reactions, to learn the general characteristics of d- and f block elements, to realize the chemistry of metal carbonyls and to gain knowledge of the functions of metal ions in biological systems.

COURSE OUTCOMES
Students will be able to:

CO103.1: Demonstrate different Acid Base theories and Solvent system concept.
CO103.2: Analyze metal ligand bonding in transition metal complexes with the help of Valence Bond Theory and Crystal field Theory.
CO103.3: Outline magnetic &spectral properties, thermodynamic and kinetic aspects of metal complexes.
CO103.4: Summarize synthesis, properties and applications of organometallic compounds.
CO103.5: Evaluate redox potential, redox cycle and disproportionation using Frost, Latemar and Roubaixdiagram.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	1	-	-	-	-	-	-	-	-
CO2	2	3	1	-	-	-	-	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-
CO4	3	3	1	-	-	-	-	-	-	-	-	-
CO5	2	3	1	-	-	-	-	-	-	-	-	-

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Acids & Bases and Non-aqueous Solvents	8
2.	Metal Ligand bonding in transition metal complexes	7
3.	Magnetic and Spectral properties of Transition Metal Complexes	7
4.	Organometallic Chemistry	8
5.	Oxidation & Reduction	6

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Acids & Bases and Non-aqueous Solvents**
	• Introduction of the Unit • **Acids and bases:** Theories ofArrhenius, Bronsted-Lowry, Lux-Flood • Solvent system concept and Lewis concept of acids and bases • Hard and Soft Acids and Bases (HSAB): Classification of acids and bases as hard and soft. • Pearson's HSAB concept, acid-base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness • **Non-aqueous solvents :**Physical properties of solvent, types of solvent and their general characteristics • reactions in non-aqueous solventswith reference to liq. NH_3 and liq. SO_2, HF • Conclusion of the Unit
2.	**Metal Ligand bonding in transition metal complexes**
	• Introduction of the Unit • **Transition Metals:** Characteristic properties transition elements – ionic radii, oxidation states, complexation tendency, magnetic behavior and electronic spectral properties. • Metal ligands bonding in transition metal complexes • Limatation of VBT, Elementary idea of CFT, Crystal field splitting in Octahederal ,Tetrahederal and Square planer complexes ,Factors affecting the crystal field parameter • Conclusion of the Unit
3.	**Magnetic and Spectral properties of Transition Metal Complexes**
	• Introduction of the Unit • **Magnetic Properties of Transition Metal Complexes:**Types of magnetic behavior, methods of determining magnetic susceptibility, L-S and J-J coupling, orbital contribution to magnetic moments. Correlation of magnetic moment data and stereochemistry of Co (II) and Ni (II) complexes; anomalous magnetic moments • **Spectral properties of transition metal complexes:** Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states and Spectoscopic terms (L-S Coupling) , spectrochemical series, orgelenergy level diagram for d^1 and d^9 states, the electronic spectrum of $[Ti(H_2O)_6]^{+3}$ complex ion. • Thermodynamic and Kinetic Aspects of Metal Complexes: A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes • Conclusion of the Unit
4.	**Organometallic Chemistry**
	• Introduction of the Unit • **Organometallic chemistry:** Definition, nomenclature and classification of organometallic compounds, • Preparation, properties, bonding and applications of alkyls and aryls of Li, Al, Hg, Sn and Ti, a brief account of metal – ethylenic complexes and homogenous hydrogenation, mononuclear carbonyls and the nature of bonding in metal carbonyls. • Conclusion of the Unit
5.	**Oxidation & Reduction**
	• Introduction of the Unit • Use of Redox potential data

	• Analysis of redox cycle • Redox stability in water • Disproportnation • Diagrammatical presentation of potential data-Frost, Latimar and pourbaix diagram • Principle involved in the extraction of elements • Conclusion of the Unit

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Selected Topics in Inorganic Chemistry	Malik Tuli,Madan	Latest	S. Chand & Sons
2.	Advanced Inorganic Chemistry	S. K Agarwal, Keemtil	Latest	PragatiPrakashan

Code: BSA04104	ORGANIC CHEMISTRY	3.0 Credits [LTP: 3-0-0]

OBJECTIVE– The objective of the course is to understand the chemistry of carboxylic acids and their derivatives, to understand the chemistry of amines and quaternary ammonium salts, to know the chemistry of phenols and organonitrogen compounds.

COURSE OUTCOMES

Students will be able to:

CO104.1: Describe the nomenclature, structure, bonding and characteristic reactions of Phenols and Ethers

CO104.2: Analyze chemical behavior of aldehyde and ketones and discuss name reactions of synthesis.

CO104.3: Explain physical and chemical properties of Carboxylic acids.
CO104.4: Compare physical and chemical properties of carboxylic acid derivatives.
CO104.5: Discuss chemical behavior and nucleophilic substitution reactions of amines and diazonium salts.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	-	-	-	-	-	-	-	-
CO2	3	2	1	1	-	-	-	-	-	-	-	-
CO3	3	3	1	1	-	-	-	-	-	-	-	-
CO4	2	3	1	2	-	-	-	-	-	-	-	-
CO5	2	3	2	2	-	-	-	-		-	-	-

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	**Phenols and Ethers**	8
2.	**Aldehydes and Ketones**	7
3.	**Carboxylic Acids**	7
4.	**Carboxylic Acid Derivatives**	7
5.	**Amines and Diazonium Salts**	7

B. DETAILED SYLLABUS

Unit	Unit Details
1	**Phenols and Ethers**
	• Introduction of the Unit. • **Phenols:** (Phenol case) Nomenclature, Structure and Bonding, Preparation*:* Cumenehydroperoxide method, from diazonium salts. • Physical Properties and acidic character**.** Comparative acidic Strengths of Alcohols and Phenols.resonance stabilization of phenoxide ion. • Reactions*:* Electrophilic substitution: Nitration, halogenation and sulphonation. Reimer- Tiemann Reaction, Gattermann-Koch Reaction, Houben–Hoesch Condensation, Schotten – Baumann Reaction, Fries Rearrangement,Claisen Rearrangement, Lederer- Manasse Reaction • **Ethers (aliphatic and aromatic):** Cleavage of ethers with HI. • Nomenclature of Ethers, Method of Formation, Chemical Reactions – Cleavage and autooxidation, Ziesel's Method. • Synthesis of epoxide, Acid and base-catalyzed ring opening of Epoxide , orientation of epoxide, reactions of Grignard and organolithium reagents with epoxides • Conclusion of the Unit
2	**Aldehydes and Ketones**
	• Introduction of the Unit. • Nomenclature and Structure of Carbonyl Group. • **Aldehydes and ketones (aliphatic and aromatic):** (Formaldehye, acetaldehyde, acetone and benzaldehyde) • Preparation: from acid chlorides and from nitriles. • Reactions – Reaction with HCN, ROH, $NaHSO_3$, NH2-G derivatives. Iodoform test. Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation. Clemensen reduction and Wolff Kishner reduction. Meerwein-PondorffVerley reduction, Perkin and KnoevenAgel Condensation, Mannich Reaction. • synthesis of aldehydes and ketones using 1,3-dithianes. syntheses of ketones from carboxylic acids, Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction, MPV (Meervein-Pondrof-Verley), Clemmensen, Wolff-Kishner, LiAlH4 and NaBH4 reductions, Use of acetals and 1,3-dithiane as protecting group. • Conclusion of the Unit
3	**Carboxylic acids**
	• Introduction of the Unit. • **Carboxylic acids** (aliphatic and aromatic), Nomenclature. • Carboxylic Acids Structure and bonding, physical properties. acidity of carboxylic acids, effects of substituents on acid strength., mechanism of decarboxylation. Methods of formation and chemical reactions of halo acids. Hydroxy acids - malic, tartaric and citric acids.

	• *Reactions:* Hell – Vohlard–Zelinsky, reaction, Synthesis of acid chlorides, esters, amides**,** • *Preparation:* Acidic and Alkaline hydrolysis of esters. • Methods of Formation of alpha, beta unsaturated monocarboxylic acid. • Dicarboxylic acid- Method Formation and effect of heat and dehydrating agents, succinic, glutaric acid and adipic acid. • Conclusion of the Unit
4	**Carboxylic acid derivatives**
	• Introduction of the Unit. • **Carboxylic acid derivatives (aliphatic):** (Upto 5 carbons) • *Preparation:* Acid chlorides, Anhydrides, Esters and Amides from acids and theirinterconversion. • *Reactions:* Comparative study of nucleophilicity of acyl derivatives. Reformatsky Reaction, Perkin condensation. • Carboxylic Acid Derivatives : nomenclature Relative stability of acyl derivatives.. Preparation of carboxylic acid derivatives. chemical reactions, mechanisms of esterification and hydrolysis (acidic and basic • Conclusion of the Unit
5	**Amines and Diazonium Salts**
	• Introduction of the Unit. • Preparation of nitroalkanes and nitroarencs. Chemical reactions of nitroalkanes. Mechanisms of nucleophilic substitution in nitroarcncs and their reductions in acidic, neutral and alkaline media. Picric acid.seperation of $1^{0,}$ 2^{0},3^{0}. • **Amines:** Amines (Aliphatic and Aromatic): (Upto 5 carbons) • *Preparation*: from alkyl halides, Gabriel's Phthalimide synthesis, HofmannBromamide reaction. • *Reactions:* Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, with HNO_2, Schotten – Baumann Reaction. Electrophilic substitution (case aniline): nitration, bromination, sulphonation • *Reactions:* conversion to benzene, phenol, dyes • Amines: Structure. nomenclature and preparation of alkyl, and aryl amines (reduction of nitro compounds. nitrites), reductive amination of aldehydic and ketonic compounds.. Structural features effecting basicity of amines. Amine salts as phase-transfer catalysts. Hoffmann brormamide reaction with mechanism. Diazotisation and mechanism. transformations of aryl diazonium salts, azo coupling and its applications • **Diazonium salts**: *Preparation:* from aromatic amines • Conclusion of the Unit

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1	Organic Chemistry	Morrison and Boyd	Latest	Prentice Hall
2.	Organic Reaction and Their Mechanisms	P. S. Kalsi	Latest	New Age Science
3.	Organic Chemistry	P. L. Soni	Latest	S. Chand & Sons

Code: BSA04105 STATISTICS AND PROBABILITY THEORY 3.0 Credits [LTP: 3-0-0]

OBJECTIVE– This course aims to provide an understanding of the basic concepts in probability theory and statistical analysis. Students will learn the fundamental theory of distribution of random variables, the basic theory and techniques of parameter estimation and tests of hypotheses.

COURSE OUTCOMES
Students will be able to:

CO105.1Explain and represent to the various form of data using statistics.

CO105.2: Evaluate the statistical data using measures of central tendency and dispersion.
CO105.3: Analyzethe correlation and regression.
CO105.4: Explain the basic concepts of probability and their properties.
CO105.5: Determine the probability distribution for discrete and continuous random variable.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	2	-	-	-	-	-	-	-	-
CO2	3	2	1	2	-	-	-	-	-	-	-	-
CO3	2	1	2	2	-	-	-	-	-	-	-	-
CO4	3	1	2	2	-	-	-	-	-	-	-	-
CO5	3	2	1	2	-	-	-	-	-	-	-	-

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability

A OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	**Statistics**	8
2	**Central Tendency & Dispersion**	7
3	**Correlation and Regression**	7
4	**Probability Theory**	6
5	**Probability Distribution**	8

B DETAILED SYLLABUS

Unit	Unit details
1	**Statistics**
	• Introduction of the Unit. • Introduction of Statistics, Scope of Statistics, • Types of data, Collection, classification and tabulation of data. • Presentation of data: Frequency polygon, frequency curve, Ogive, Bar diagram, Histogram and Pie chart. • Conclusion of the Unit
2	**Central Tendency &Dispersion**
	• Introduction of the Unit. • Measures of Central Tendency: Mean, median, mode, • Measures of Dispersion: Absolute and relative measures of range, • Quartile deviation, mean deviation, standard deviation (σ), • Coefficient of variation. • Conclusion of the Unit
3	**Correlation and Regression**
	• Introduction of the Unit. • Correlation, Types of correlation, • Karl Pearson Coefficient (r) of correlation, Properties, • Rank correlation coefficient, Regression, • Lines of Regression, Properties of regression coefficients • Conclusion of the Unit
4	**Probability Theory**
	• Introduction of the Unit. • Random Experiment: Trial, Events and their types • Definition of Probability, Sample Point and Sample space. • Axiomatic Approach of probability and its properties. • Addition and multiplication theorems of probability. Conditional probability. Bayes theorem and its applications (Simple problems only) • Conclusion of the Unit
5	**Probability Distribution**
	• Introduction of the Unit. • Random variable and its types • Distribution function, Probability mass function and Probability density function • Discrete probability distribution: Binomial and Poisson's distribution • Continuous probability distribution: Normal distribution • Conclusion of the Unit

C RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Elements of Statistics, Schaum's outline series,	Bernstein, S. & Bernstein, R	**2001**	McGraw-Hill.
2.	Introduction to Probability Models	Sheldon Ross	9th Ed	Academic Press, Indian Reprint
3.	Introduction to the Theory of Statistics	Alexander M. Mood, Franklin A. Graybill and Duane C. Boes	3rd Ed	Tata McGraw- Hill, Reprint 2007.

Code: BSA04106	ABSTRACT ALGEBRA	3.0 Credits [LTP: 3-0-0]

OBJECTIVE–This course aims to provide a first approach to the subject of algebra, which is one of the basic pillars of modern mathematics. The focus of the course will be the study of certain structures called groups, rings, fields and some related structures.

COURSE OUTCOMES
Students will be able to:

CO106.1: Demonstrate insight into algebraic structure with their axiomatic.
CO106.2: Identify subgroups of a given group and their properties.
CO106.3: Explain the fundamental concepts of normal subgroups, homomorphisms and isomorphism.
CO106.4: Demonstrate knowledge of rings and their properties.
CO106.5: Demonstrate knowledge of fields and their properties.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	-	-	-	-	-	-	-	-
CO2	2	2	3	2	-	-	-	-	-	-	-	-
CO3	3	1	2	2	-	-	-	-	-	-	-	-
CO4	3	1	2	2	-	-	-	-	-	-	-	-
CO5	3	2	1	2	-	-	-	-	-	-	-	-

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	Group	9
2	Subgroup	6
3	Group Morphism	6
4	Rings and Sub-rings	8
5	Fields	7

B DETAILED SYLLABUS

Unit	Unit details
1	**Group**
	• Introduction of the Unit. • Binary operation, Algebraic Structure, Groups, • Abelian Group, Cyclic Group, order of element, • Generator of Cyclic Group, Cyclic permutation • Conclusion of the Unit
2	**Subgroup**
	• Introduction of the Unit. • Subgroup, center of a group, • Group Zn of integers under addition modulo n and the • Group U(n) of units under multiplication modulo n, • Cosets, Lagrange's theorem • Conclusion of the Unit
3	**Group Morphism**
	• Introduction of the Unit. • Morphism of groups, Cayley's theorem • Normal subgroups and Quotient groups • Fundamental theorem of Isomorphism. • Conclusion of the Unit
4	**Rings and Sub-rings**
	• Introduction of the Unit. • Definition and simple properties of rings • Commutative and non-commutative rings • Sub-rings, Morphism of Rings • Embedding of a Ring • Conclusion of the Unit
5	**Fields**
	• Introduction of the Unit. • Integral domains and Fields • Characteristics of a Ring and Field • Prime fields • Definition of Vector Spaces • Conclusion of the Unit

C RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Elements of Abstract Algebra	B. K. C. Sarangi	**2016**	RBD, Jaipur
2.	Abstract Algebra	M. Artin	2nd Ed	Pearson, 2011
3.	A First Course in Abstract Algebra	John B. Fraleigh	7th Ed	Pearson,India 2002

Code: BSA04207	CHEMISTRY LAB	1.5 Credits [LTP: 0-0-3]

OBJECTIVE– The objective of the course is to introduce fundamental methods and procedures used in the synthesis of organic and inorganic compounds and learn different techniques for separation and purification of organic compounds.

COURSE OUTCOMES

Students will be able to:

CO207.1: Have an idea of estimation technique of various ions present in a mixture.
CO207.2: Recognize the basic practical skills for the synthesis and analysis of organic compounds.
CO207.3: Purify and separate compounds with special techniques.
CO207.4: Analyze and present experimental results and draw sound conclusions based on experimental evidence.
CO207.5: Exposed to the different processes used in industries and their applications

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	-	-	-	-	-	-	-	-	-
CO2	2	3	3	-	-	-	-	-	-	-	-	-
CO3	2	3	3	-	-	-	-	-	-	-	-	-
CO4	2	3	3	-	-	-	-	-	-	-	-	-
CO5	1	2	3	1	-	-	-	-	-	-	-	-

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development

LIST OF EXPERIMENTS

Inorganic Chemistry	
1	Estimation of sodium carbonate and sodium hydroxide present in a mixture.
2	Estimation of acetic acid in commercial vinegar using NaOH
3	Estimation of water of crystallization in Mohr's salt by titrating with $KMnO_4$.
4	Estimation of Ferrous and Ferric by dichromate method

5	Estimation of Cu as copper thiocyanate
6	Preparation of Ni- DMG complex
Organic Chemistry	
7	To separate and identify the organic mixture containing two solid components using water and prepare their suitable derivatives.
8	To separate and identify the organic mixture containing two solid components using NaOH and prepare their suitable derivatives
9	To prepare Iodoform from ethanol and acetone
10	To prepare acetanilide from aniline
11	Separation of o and p nitro phenol by steam distillation
12	Synthesis of methyl orange

Code: BSA04208	PHYSICS LAB	1.5 Credits [LTP: 0-0-3]

OBJECTIVE– To experimentally realize digital electronics circuits and expose the student to working of Op-Amp.

COURSE OUTCOMES
Students will be able to:

CO208.1: Understand the operation and perform the various integrated circuits
CO208.2: Verify and analyze the truth table of various logic gates and designing a counter using flip-flop.
CO208.3: Analyze and apply the concept of converter from A to D and D to A types of circuits.
CO 208.4: Understand the concept of various multivibrator
CO 208.5: Understand and analyze the frequency of various oscillators

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	–	–	–	–	–	–	–	–	2	2
CO2	3	2	–	–	–	–	–	–	–	–	3	2
CO3	–	–	–	–	–	–	–	–	–	–	–	–
CO4	3	–	–	–	–	–	–	–	–	–	3	–
CO5	2	3	–	–	–	–	–	–	–	–	2	3

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Skill Development/ Entrepreneur

LIST OF EXPERIMENTS:

1.	To study and perform the following experiments. (a) Operation of digital multiplexer and demultiplexer. (b) Binary to decimal encoder. (c) Characteristics of CMOS integrated circuits.
2.	To study and perform experiment- Compound logic functions and various combinational circuits based on AND/NAND and OR/NOR Logic blocks.
3.	To study and perform experiment - Digital to analog and analog to digital converters.
4.	To study and perform experiment- Various types of counters and shift registers.

5.	To study and perform experiment - Interfacing of CMOS to TTL and TTL to CMOS ICs.
6.	To study and perform experiment- BCD to binary conversion on digital IC trainer.
7.	To study and perform experiment - (a) Astable (b) Monostable (c) BistableMultivibrators and the frequency variation with different parameters, observe voltage waveforms at different points of transistor.
8.	To study and perform experiment -Voltage comparator circuit using IC-710.
9.	To study and perform experiment- Schmitt transistor binary circuit.
10.	Design 2 bit binary up/down binary counter on bread board.
11.	Study of operation of Colpitt's Oscillator and Hartley Oscillator
12.	Study transistor phase shift oscillator and observe the effect of variation in R & C on oscillator frequency and compare with theoretical value.

Code: BSA04209	ANANDAM COURSE	2 Credits [LTP: 0-0-1]

OVERVIEW AND OBJECTIVES: The Anandam program aims to instill the joy of giving in young people, turning them into responsible citizens. Who will build a better society through daily action; it will build the habit of service in students across colleges and universities in Rajasthan. The students will have to undertake the course each semester starting with the 2020-21 academic year.

Course Outcomes

- Each student will be able to work as team member.
- Student will learn social activities.
- Students will be familiar with society.

DETAILED SYLLABUS

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register/ Personal Diary
- Share this Register/ Personal Diary day in the 30-minute Anandam time slot dedicated by the college.
- Undertake one group service project for 64 Hours every term (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion session held once a month.

Code: BSA04210	PROFESSIONAL SKILLS-I	2 Credits [LTP: 0-0-3]

OBJECTIVE– The objective of the programme is to build self-confidence, enhance self-esteem and improve overall personality of the participants. The programme aims at grooming the participants through sensitizing them about proper behavior, socially and professionally, in formal and informal circumstances.

COURSE OUTCOMES

Students will be able to:

CO210.1: Understand how to leverage grammar and formatting in email preparation&understand and know how to follow the stages of the writing process (prewriting/writing/rewriting) and apply them to technical and workplace writing tasks & to enhance the speaking tone, pace & common phrases that's appropriate for phone conversations.
CO210.2: Improve group morale and promotes team bonding amid adversity.
CO210.3: Sharpen the ability to critically analyze a given piece of information and collectively work in a group to arrive at a solution or develop a perspective.
CO210.4: Find ways to overcome nervousness for presentation; recognize presentation weak spots and areas for improvement & learn, practice and acquire the skills necessary to deliver effective presentation with clarity and impact.
CO210.5: Use writing techniques effectively in the delivery of instruction, assessment, and professional development.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	–	–	–	–	–	–	–	-	–	3	–	3
CO2	–	–	–	–	–	–	–	-	–	3	–	3
CO3	–	–	–	–	–	–	–	2	–	1	–	-
CO4	–	–	–	–	–	–	–	-	–	2	–	2
CO5	–	–	–	–	–	–	–	-	–	2	–	2

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Skill Development/ Entrepreneur

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1	**Resume Building & Group Discussion**	8
2	**Time Management & Team Work**	8
3	**Stress & Behavioral Event Interview**	4
4	**Presentation Skills & Confidence Building**	6
5	**Effective Communication**	6

B. DETAILED SYLLABUS

Unit	Unit Details	
1.	**Resume Building & Group Discussion**	
	• Introduction of the topic • Important Elements of a Resume • Elements of Video Resume • **Preparation of Individual Resume** • **Group Discussion :** Introduction and Categories of Group Discussion • Topics in GD • Measurable Dimensions in GD • How to prepare for GD • Correcting common mistakes in GD • Mock GD and Feedback • Conclusion & Summary of the Unit	• Theory • Theory/Practical • Practical • Practical • Theory/Practical • Theory/Practical • Theory/Practical • Practical • Practical • Practical • Theory/Practical
2.	**Time Management & Team Work**	
	• Introduction to the topic • Relevance of Time Management • Activities based on Time Management • Strategies for effective Team Work • Activities based on Team work • Conclusion & Summary of the Unit	Theory/Practical Theory/Practical Practical Theory/Practical Practical Theory/Practical
3.	**Stress & Behavioral Event Interview**	
	• Introduction to the topic • Tips to handle different types of Interviews. • Practice Sessions • Conclusion & Summary of the Unit	• Theory/Practical • Theory/Practical • Practical • Theory/Practical
4.	**Presentation Skills & Confidence Building**	
	• Introduction to the topic	• Theory/Practical

	• Presentation of the Technical Projects • Presentation of Research paper • Practice Sessions • Conclusion & Summary of the Unit	• Practical • Practical • Practical • Theory/Practical
5.	**Effective Communication**	
	• Introduction of the topic • Communication process and handling them • KISS (Keep it short and sweet) in communication - Composing effective messages. • Practice Sessions • Conclusion & Summary of the Unit	• Theory/Practical • Practical • Practical • Practical • Theory/Practical

Code: BSA04211	NEGOTIATION SKILLS	2 Credits [LTP: 0-0-3]

OBJECTIVE–

Negotiation skills in business help to prevent losses and increase the gains for you and your organization. We provide an insight of how to build rapport and convince others during negotiation. We also aim at enhancing your confidence levels in persuading others by using various negotiation techniques.

COURSE OUTCOMES

The student would be able to:

CO211.1: Develop sales mindset and attitudes that drive commitment to sales target.
CO211.2: Understand the psychology of the selling/buying process and their role in facilitating it.
CO211.3: Understand negotiation and Identify steps for proper negotiation preparation & learn bargaining techniques and strategies of inventing options for mutual gain and move negotiations from bargaining to closing.
CO211.4: Identify the actions taken on different stages of negotiations; appreciate and explain the importance of pre-negotiation and post-negotiation phases.
CO211.5: Understand negotiation dynamics and how to prepare for uncertainty & learn to craft agile strategy and be quick on your feet in changing circumstances.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	–	–	–	–	–	–	–	-	–	2	–	2
CO2	–	–	–	–	–	–	–	-	–	2	–	2
CO3	–	–	–	–	–	–	–	2	–	1	–	-
CO4	–	–	–	–	–	–	–	-	–	3	–	3
CO5	–	–	–	–	–	–	–	-	–	2	–	2

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Skill Development/ Entrepreneur

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1	Introduction to Sales: Building a Sales Relationship	6
2	Efficiency & Measurement in Sales	6
3	Ethics & Secrets of Powerful Negotiation	4
4	Introduction to Negotiation	8
5	Trust, Human behaviour and Psychology for Negotiation	6

B. DETAILED SYLLABUS

Unit	Unit Details	
1.	**Introduction to Sales: Building a Sales Relationship**	
	• Introduction of the Course & the topic • Self -Impression & Body Language. • The types of People & the Delight Factor • Practice Sessions • What is Sales? • Types of Sales • Importance of Sales • Personal Selling & Process • Conclusion & Summary of the Unit	• Theory/Practical • Practical • Practical • Practical • Theory/Practical •
2.	**Efficiency & Measurement in Sales**	
	• Introduction of the Course & the topic • Principles of Sales Efficiency • The Science of Sales Measurement • Practice Sessions • Conclusion & Summary of the Unit	• Theory/Practical • Practical • Practical • Practical • Theory/Practical
3.	**Ethics & Secrets of Powerful Negotiation**	
	• Introduction of the Course & the topic • Practice Session on Reciprocity. • Practice Session on Publicity • Practice Session on Trust & Universality. • Conclusion & Summary of the Unit.	• Theory/Practical • Practical • Practical • Practical • Theory/Practical
4.	**Introduction to Negotiation**	**Method**
	• Introduction of the Course & the topic • Defining Negotiation • Identify the qualities of successful and unsuccessful negotiators.	• Theory/Practical • Theory/Practical • Practical • Practical

	• Identify different negotiation situations to practice during class • Conclusion & Summary of the Unit.	• Theory/Practical
5.	**Trust, Human behaviour and Psychology for Negotiation**	
	• Introduction of the Course & the topic • Choosing a negotiation strategy based on relationship and results. • Positional bargaining & Identifying the differences between "Soft" and "Hard" negotiating. • Practice Sessions • Conclusion & Summary of the Unit.	• Theory/Practical • Theory/Practical • Theory/Practical • Practical • Theory/Practical

Code: BSA04612 Discipline and Talent Enrichment Programme (TEP-IV) 1 Credit

OVERVIEW AND OBJECTIVES The objective of Discipline and TEP is to provide students with the opportunities to enhance job-fetching skills and at the same time to cultivate the student's personal interests and hobbies while maintaining the good disciplinary environment in the University.

TEP is integrated into the curriculum for holistic development of students through active participation in various activities falling in Technical and non-technical categories.

Discipline and Talent Enrichment Programme (TEP) shall be evaluated irrespective of period/time allocation (as in the case of Extra Curricular activity) in the teaching scheme as a 1 credit course. The record related to discipline, related activities aremaintained for each student, and they shall be evaluated for the same. It shall be counted in calculation of SGPA but it is not a backlog subject. However, the attendance of these classes shall be recorded and accounted in the total attendance.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	2	-	-	-	-	-	-	-	2
CO2	-	-	-	2	-		-	-	-	-	-	3
CO3	-	-	-	3	-	-	-	-	-	-	-	3
CO4	-	-	-	3	-	-		-	-	-	-	3
CO5	-	-	-	1	-	-	-	-	-	3	-	3

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Entrepreneur

Code: BSA05101 MATHEMATICAL PHYSICS 3.0 Credits [LTP: 3-0-0]

OBJECTIVE– The course aims to introduce the methods for solutions of basic partial differential equations of mathematical physics as the basis for further application in courses of theoretical physics.

COURSE OUTCOMES
The Students will be able:

CO101.1: Analyze the knowledge of the coordinate transformation.
CO101.2: Role plays the mechanism of Tensors & Dirac delta function.
CO101.3: Acquire knowledge of the Fourier series and apply it to different transformations.
CO101.4: Point out the concepts and potential applications of Differential equations of second order & Special Functions
CO101.5: Prepare the mechanism of partial differential equations & boundary value problems.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	–	–	–	–	–	–	–	–
CO2	2	2	3	3	–	–	–	–	–	–	–	–
CO3	3	3	2	2	–	–	–	–	–	–	–	–
CO4	3	2	3	2	–	–	–	–	–	–	–	–
CO5	2	2	–	1	–	–	–	–	–	–	–	–

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	**Coordinate Transformation**	8
2.	**Tensors & Dirac Delta Function**	7
3.	**Fourier Series**	7
4.	**Differential Equations of Second Order & Special Functions**	7
5.	**Partial Differential Equations & Boundary Value Problems**	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Coordinate Transformation**
	• Introduction to the Unit • Differential operator • Laplacian operator • Cylindrical co-ordinates • Spherical (Polar) coordinates • Transformation of cylindrical polar coordinates into i,j,k • Conversion of spherical polar coordinates (r, ɵ, ϕ) into i,j,k. • Relation between cylindrical and polar coordinates • Conclusion & real life application
2.	**Tensors & Dirac Delta Function**
	• Introduction to the Unit • Coordinate transformations • Transformation of covariant, contra variant and mixed tensors • Addition, subtraction, outer product , contraction and inner product of tensors • Quotient law • Symmetric and anti symmetric tensors • Metric tensor • Dirac delta function and its representation • Dirac delta function in three Dimensions • Derivative of Dirac delta function and its properties • Conclusion & real life application
3.	**Fourier Series**
	• Introduction to the Unit • Even and Odd Functions • Complex Form of Fourier Series, Analysis of Periodic Waveforms • Fourier series with respect to an orthogonal function • Orthogonality of cosine series • Fourier integral theorem • Fourier transforms and its properties • Cosine and sine transforms

	• Complex transform • Conclusion & real life application
4.	**Differential Equations of Second Order & Special Functions**
	• Introduction to the Unit • The second order linear differential equation with variable coefficient and singular points • Series solution method • Its application to the Hermite, Lagendre and Laguerre differential equations • Basic properties like orthogonality, recurrence relation, graphical representation and generating function of Hermite, Legendre , Leaguere functions (simple applications) • Conclusion & real life application
5.	**Partial Differential Equations & Boundary Value Problems**
	• Introduction to the Unit • Laplace equation and its solution • Solution of Laplace equation in Cartesian coordinate system, boundary value problem • Solution of Laplace equation in spherical coordinate system, boundary value problem • Diffusion equation for Fourier equation of heat flow, boundary value problem • Wave equation in spherical polar coordinates-the vibrations of a circular membrane • Solution of Helmholtz equation in cylindrical co-ordinates • Conclusion & real life application

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Mathematical Physics	**H.K. Dass& Dr. Rama Verma**	Latest	S. Chand & Company
2.	Introduction to Mathematical Physics	**S Chandra, M. K. Sharma**	2005	Narosa
3	Mathematical Physics	**B. S. Rajput**	1995	Pragati Edition

Code: BSA 05102 ATOMIC AND MOLECULAR SPECTROSCOPY 3.0 Credits [LTP: 3-0-0]

OBJECTIVE– Objective of this course is to learn atomic, molecular and spin resonance spectroscopy with outlook of its application for qualitative and quantitative analysis.

COURSE OUTCOMES
Student will be able to:

CO102. 1: Use the basic theory of an atomic and molecular spectrum.
CO102. 2Role plays the concept of vector model of atom and Stern Gerlach experiment.
CO102. 3: Analyze the effect of magnetic and electric field on spectral lines.
CO102. 4: Point out the theory of energy levels, molecular distance, Raman Effect and its characteristics.
CO102. 5: Judge the origin and characteristics of X-rays.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	–	–	–	–	–	–	–	–
CO2	2	3	2	3	–	–	–	–	–	–	–	–
CO3	3	–	2	2	–	–	–	–	–	–	–	–
CO4	3	3	2	2	–	–	–	–	–	–	–	–
CO5	2	2	3	3	–	–	–	–	–	–	–	–

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Bohr's Theory of Spectra	7
2.	Vector Model of Atom and Stern-Gerlach Experiment	7
3.	Effect of Magnetic and Electric Field on Spectral Lines	7
4.	Molecular Spectra	8
5.	X-rays	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Bohr's Theory of Spectra**
	• Introduction to the Unit • Bohr's theory of spectra of hydrogen like atoms • Origin of spectral series • Ritz combination rule • Effect of finite mass of the nucleus on the spectrum • Bohr's correspondence principle • Wilson-Sommerfield's quantum condition • Sommerfield's theory of elliptic orbit (qualitative idea) • Relativistic correction • Frank and Hertz principle • Limitations of Bohr's theory • Conclusion & real life application
2.	**Vector Model of Atom and Stern-Gerlach Experiment**
	• Introduction to the Unit • Angular momentum of electron • Stern–Gerlach experiment and its consequence • Space quantization • Spin orbit interaction energy • Total angular momentum • Coupling schemes • Fine structure of a spectral line • Selection rules, Spectral term and their notations • Conclusion & real life application
3.	**Effect of Magnetic and Electric Field on Spectral Lines**
	• Introduction to the Unit • Angular momentum and magnetic moment • Zeeman Effect: Normal Zeeman effect and its selection rules • Anomalous Zeeman effect and its selection rules • Paschen back effect and selection rules

	• Stark effect: Linear Stark effect • Conclusion & real life application
4.	**Molecular Spectra**
	• Introduction to the Unit • Rotational Energy levels • Selection Rules and Pure Rotational Spectra of a Molecule • Vibrational Energy Levels • Selection Rules and Vibration Spectra • Rotation- Vibration Energy Levels • Selection Rules and Rotation-Vibration Spectra • Determination of Internuclear Distance • Quantum Theory of Raman Effect • Characteristics of Raman Lines. Stoke's and Anti-Stoke's Lines • Complimentary Character of Raman and infrared Spectra • Conclusion & real life application
5.	**X-rays**
	• Introduction to the Unit • Origin of continuous and characteristic X-Rays • Absorption and emission spectrum • Energy levels and Moseley's law • Fine structure of X-ray levels • Auger effect • Comparison of optical and X-ray spectra • Classification of molecular spectra, • Rotational spectra and Rotational-Vibrational spectra and selection rules • Conclusion & real life application

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Atomic physics	J. B. Rajam	2007	S. Chand & Company
2.	Elements of Spectroscopy	S.L. Gupta, V. Kumar and R.C. Sharma	2005	Prentice-Hall of India
3.	Fundamentals of Molecular Spectroscopy	Colin N. Banwell and Elaine M. Mccash	1995	Tata McGraw-Hill, New Delhi,

Code: BSA05103 ORGANIC CHEMISTRY 3.0 Credits [LTP: 3-0-0]

OBJECTIVE– The objective of the course is to impart the knowledge of spectroscopy, to know the chemistry of five and six membered heterocyclic compounds and to understand organic chemical reactions that involve structural changes and learn about natural products.

COURSE OUTCOMES
The students will be able to:

CO103.1: Familiarize basic concepts of structure elucidation of organic compounds using UV, IR and NMR spectroscopy.
CO103.2: Demonstrate comprehensive knowledge about Nuclear Magnetic Resonance spectroscopy and PMR spectra of organic compounds.
CO103.3: Apply mechanism of action of heterocyclic compounds in pharmaceutics/drugs.
CO103.4: Categories carbohydrates and structure determination of carbohydrates with conversion.
CO103.5: Explain the chemical nature of Amino Acids, Peptides and Proteins.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	1	-	-	-	-	-	-	-	-
CO2	2	3	1	-	-	-	-	-	-	-	-	-
CO3	2	3	-	-	-	-	-	-	-	--	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	**Electromagnetic Spectrum**	8
2.	**Nuclear Magnetic Resonance (NMR) spectroscopy**	7
3.	**Heterocyclic Compounds**	7
4.	**Carbohydrates**	7
5.	**Amino Acids, Peptides and Proteins**	7

B. DETAILED SYLLABUS

Unit	Unit Details
1	**Electromagnetic Spectrum**
	• Introduction to the Unit • **Electromagnnetic Radiation** • Origin of organic spectra, Types of energy changes, Types of molecular spectra, General instrumentation ,absorbance and transmittance, line width. • **Ultraviolet Absorption Spectroscopy**- absorption laws (Beer-Lambert Law) molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, • Effect of solvents on transitions, effect of conjugation, concept of chromophore and auxochrome, bathochromic, hypsochromic and hyperchromic and hypochromic shifts, • UV spectra of conjugated enes and enones. • **Infrared Absorption Spectroscopy** – Theory-Absorption of infra radiation Molecular vibrations, Hookes law, selection rules, intensity and position of IR bands measurement of IR spectrum, finger print region, characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds. • Conclusion & real life application.
2	**Nuclear Magnetic Resonance (NMR) spectroscopy**
	• Introduction to the Unit. • **Nuclear Magnetic Resonance (NMR) spectroscopy**: Principles of NMR spectroscopy, Larmor precession, chemical shift and low resolution spectra different scales, spin-spin coupling and high resolution spectra, interpretation of PMR spectra of organic molecules • Proton magnetic resonance (^{1}H-NMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals. Interpretation of NMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, I,1,2-tribromoethane, ethyl acetate, toluene and acetophenone. • Conclusion & real life application
3	**Heterocyclic Compounds**

	• Introduction to the Unit. • **Heterocylic Compounds :** Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine • Methods of synthesis and chemical reactions, with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. • Comparison of basicity of pyridine, piperidine and pyrrole • Introduction to condensed five and six-membered heterocyclic compounds • Preparation and reactions of indole, quauinoline and isoquinoline • Mechanism of electrophilic substitution reactions of indole, quinoline and isoquionoline • Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fisher-indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis. • Conclusion & real life application.
4	**Carbohydrates**
	• Introduction to the Unit • **Carbohydrates**: Classification, and General Properties • Glucose and Fructose (open chain and cyclic structure) • Determination of configuration of monosaccharides, absolute configuration of Glucose and Fructose, Mutarotation, ascending and descending in monosaccharides • Structure of disacharrides (sucrose, cellobiose, maltose, lactose) and polysaccharides (starch and cellulose) excluding their structure elucidation • Mechanism of osazone formation. Epimers, anomers. Interconversion of glucose and fructose, chain lengthening and chain, shortening of aldoses. Erythro and threodiastereomers. Conversion of glucose into mannose.. Determination of ring size of monosaccharides. Formation of glycosides, ethers and esters. Cyclic structure of D (+)-glucose and fructose. Structures of ribose and deoxyribose. • Conclusion & real life application.
5	**Amino Acids, Peptides and Proteins**
	• Introduction to the Unit • **Amino Acids: Preparation** by Strecker synthesis using Gabriel's phthalimide synthesis. Zwitterion, Isoelectric point and Electrophoresis • Reactions of Amino acids: ester of –COOH group, acetylation of $–NH_2$ group, complexation with Cu^{2+} ions, ninhydrin test • Overview of Primary, Secondary, Tertiary and Quaternary Structure of proteins. • Determination of Primary structure of Peptides by degradation- Edmann degradation (N terminal and C terminal) thiohydantoin and with carboxy peptidase enzyme • Synthesis of simple peptides (upto dipeptides) by N-protection (t-butyloxycarbonyl and phthaloyl) &C activating groups and Merrifield solid-phase synthesis

	• Amino Acids, Peptides, Proteins and its classification, structure and stereochemistry of amino acids. acid-basebehaviour, isoelectric point and electrophoresis. Preparation and reactions of alpha-amino acids. • Nucleic acids — Introduction, constituents of nucleic acids - nucleosides and nucleotides • Conclusion & real life application.

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	A Text Book of Organic Chemistry	O. P. Agarwal	Vol. I & II	Goyal Publication
2.	A Text Book of Organic Chemistry	B. S. Bahl and ArunBahl	Latest	S. Chand & Company Ltd.
3.	Organic Chemistry	S. M. Mukherji, S. P. Singh and R. P. Kapoor	Vol. I, II & III	Wiley Eastern Ltd. (New Age International)
4	Organic Chemistry	I.L. Finar	Vol.-I & II	Pearson Education, Asia

Code: BSA05104 PHYSICAL CHEMISTRY 3.0 Credits [LTP: 3-0-0]

OBJECTIVE– The objective of the course is to understand the basics and concepts of photochemistry and to become familiar with the fundamentals of adsorption. This course also disseminates the concepts and methodology of quantum mechanics, its applications to spectroscopy and establishes relation between structure determination and spectra.

COURSE OUTCOMES

The students will be able to:

CO104.1: Evaluate photochemical and photophysical processes using Jablonski diagram and their quantum yield expressions.
CO104.2: Rationalize the selection rules in rotational and vibrational spectra.
CO104.3: Examine simple molecules by Vibration and Raman spectroscopy.
CO104.4: Outline the mechanisms of unimolecular and bimolecular reactions at surfaces using Gibbs, Freundlich and Langmuir isotherm.
CO104.5: Differentiate between classical and quantum mechanics and solve the Schroedinger equation to obtain wave functions for some basic, physically important types of potential in one dimension, and estimate the shape of the wave function.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-		-	-	-	-	-
CO2	3	2	-	2	-	-	-	-	-	-	-	-
CO3	3	2	3	1	-	-	-	-	-	-	-	-
CO4	2	2	2	-	-	-	-	-	-	-	-	-
CO5	2	2	3	-	-	-	-	-	-	-	-	-

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	**Photochemistry**	**7**
2.	**Spectroscopy I**	**8**
3.	**Spectroscopy II**	**7**
4.	**Adsorption**	**6**
5.	**Quantum Mechanics I**	**8**

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Photochemistry**
	• Introduction to the Unit. • **Photochemistry:** Interaction of radiation with matter, difference between thermal and photochemical processes. • Laws of photochemistry: Grothus-Drapper law, Stark-Einstien law • Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non radiative process (internal conversion, inter system crossing) quantum yield, photosensitized reaction-energy transfer process (simple examples) • Conclusion & real life application
2.	**Spectroscopy I**
	• Introduction to the Unit. • **Spectroscopy I:** Electromagnetic radiation of the spectrum, basic features of different spectrometers, statement of the Born Oppenheimer approximation, degree of freedom. • Rotational spectrum: Diatomic molecules, Energy levels of rigid rotator, (semiclassical principles) selection rules, spectral intensity, distribution using population distribution (Maxwell Boltzmann distribution), determination of bond length, qualitative description of non-rigid rotator, isotope effect. • Electronic spectrum: Concept of potential energy curves for bonding and anti-bonding molecular orbital's, qualitative description of selection rules and Frank – Condon principle. • Conclusion & real life application
3.	**Spectroscopy II**
	• Introduction to the Unit • **Spectroscopy II:** Vibrational spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant, qualitative relations of force constants and bond energy, effect of anharmonic motion and isotopes on the spectrum, idea of vibrational frequencies of different functional groups. • Raman spectrum**:** Concept of polarizability, pure rotational and pure vibrational

	Raman spectra of diatomic molecules, selection rules • Conclusion & real life application
4.	**Adsorption**
	• Introduction to the Unit. • **Adsorption:** Difference between adsorption, absorption and sorption, Chemisorption, adsorbent and adsorbate, reversible and irreversible adsorption, • Characteristics of adsorption ,adsorption of gases by solids, factors affecting adsorption, types of adsorption • Types of adsorption isotherms;Freundlich and Langmuir adsorption isotherms, Adsorption Techniques, Some important adsorbents used in industries, Application of adsorption. • Conclusion & real life application
5.	**Quantum Mechanics I**
	• Introduction to the Unit • **Quantum Mechanics I:** Black body radiation, Planck`s radiation law, photoelectric effect, heat capacity of solids, Bohr's model of hydrogen atom (no derivation) and its defects. • Compton Effect. De Broglie hypothesis, Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiltonian operator, Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box. • Schrodinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave functions. • Conclusion & real life application

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Fundamentals of Molecular Spectroscopy	C. M. Banwell and E. McCash	4th Edition	Tata McGraw Hill
2.	Spectrometric Identification of Organic Compounds	Robert M. Silverstein, Francis X. Webster, David Kiemle	7th Edition	Wiley
3.	Applications of spectroscopic techniques in Organic Chemistry	P.S. Kalsi	6th Edition	New Age International
4	Physical Chemistry	Bahl and Tuli	Latest	S. Chand

BSA05105	REAL ANALYSIS	3.0 Credits [LTP: 3-0-0]

OBJECTIVE–This course helps students in exploring and describes the fundamental properties of the real numbers that underpin the formal development of real analysis; demonstrate an understanding of the theory of sequences and series, continuity, differentiation and integration.

COURSE OUTCOMES:
The students will be able to:

CO105.1: Fundamental definitions of sets, Axioms, Real number, complete ordered field, Interval, Neighborhood of a point.
CO105.2: Explain the Boundedness, supremum, Infimum of sequence, various types of sequence, limits, Cauchy's theorem.
CO105.3: Evaluate the limits & Continuity of functions, Heine's definition of continuity, Types of Discontinuity, Boundedness theorem, Intermediate Value theorem.
CO105.4: Analyze the derivative, Darboux's Theorem, Rolles's Theorem, Lagranges mean value theorem, Cauchy mean value theorem, Taylor's Theorem, Maclaurin's theorem.
CO105.5: Evaluate the upper and Lower Darboux sums, Riemann Integral, Properties of R-Integrable function, Mean value theorem of Integral Calculus, Fundamental theorem of Integral Calculus.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	**3**	**1**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**3**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	**2**	**1**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO5	**2**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development

A OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	**Real Field**	9
2	**Real Sequences**	6
3	**Limit and Continuity of Function**	6
4	**Mean value theorem**	8
5	**Riemann Integration**	7

B DETAILED SYLLABUS

Unit	Unit details
1	**Real Field**
	• Introduction to the Unit • Introduction-ordered sets, The Field Axioms, Order axioms • Completeness axioms, Real number as a complete ordered field • Interval, neighbourhood of a point • Heine Borel Theorem • Conclusion & real life application
2	**Real Sequences**
	• Introduction to the Unit • Boundedness, supremum, Infimum of sequence, Limit of sequence, Convergent sequences • Divergent sequence, Theorems on convergent sequence and limits • Cauchy's first theorem on limits, Subsequences, Cauchy sequence, Cauchy's general principle • Infinite Series, Applications of theorem (Without proof) and numerical based negative test • Cauchy Convergence test, Ratio Comparison test, Hyperharmonic series test, Raabe's Test, Logarithmic ratio test, De Morgan's test • Conclusion & real life application
3	**Limit and Continuity of Function**
	• Introduction to the Unit • Limits of functions, Continuity • Heine's definition of continuity, Discontinuity • Types of Discontinuity, Boundedness theorem • Intermediate Value theorem, Uniform continuity • Conclusion & real life application
4	**Mean value theorem**
	• Introduction to the Unit • Derivative, necessary condition, Properties of derivatives • Darboux's Theorem, Rolles's Theorem • Lagranges mean value theorem, Cauchy mean value theorem • Taylor's Theorem, Maclaurin's theorem • Conclusion & real life application
5	**Riemann Integration**

	• Introduction to the Unit • Upper and Lower Darboux sums, Upper and Lower Riemann Integral • Necessary and sufficiency condition of R- Integrability, Properties of R-Integrable function • Mean value theorem of Integral Calculus, Fundamental theorem of Integral Calculus • Conclusion & real life application

C RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Principles of Mathematical Analysis	Walter Rudin	**3rded**	McGraw–Hill International Editions, Singapore
2.	Mathematical Analysis	Tom M. Apostol	2nd Ed	Pearson, India
3.	Real Analysis	K. C. Sarangi	2016	RBD Jaipur

Code: BSA05106 OPTIMIZATION TECHNIQUES 3.0 Credits [LTP: 3-0-0]

OBJECTIVE–This course provides to finding the optimal solution values of more than one-desired goals. Each vector of the objective function is a function of the solution vector. If there is no single best solution for all purposes, but rather several solutions.

Course Outcomes:
The students will be able to:

CO106.1: Develop mathematical arguments for Linear Programming.
CO106.2: Evaluate Linear Programming problem using simplex method.
CO106.3: Analyze the Linear Programming problem using two Phase method, Duality and Transportation Problem, Modified distribution method for finding the optimum solution.
CO106.4: Analyze the Assignment Problem, Crew assignment and travelling salesman problem.
CO106.5:Solve the problems of competitive situations between two competitors using Game theory.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**1**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	**3**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**2**	**3**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	**3**	**1**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO5	**3**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	**PSO2**	**PSO3**
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development

A OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	**Linear Programming**	9
2	**Simplex Method**	6
3	**Transportation Problem**	6
4	**Assignment Problem**	8
5	**Game Theory**	7

B DETAILED SYLLABUS

Unit	Unit details
1	**Linear Programming**
	• Introduction to Unit • Concept of optimization, • Linear Programming: Introduction, Formulation of a Linear Programming Problem (LPP), • Requirements for an LPP, Advantages and limitations of LP. • Graphical solution, Multiple, unbounded and infeasible solutions. • Conclusion & real life application
2	**Simplex Method**
	• Introduction to Unit • Principle of simplex method: standard form, basic solution, basic feasible solution. • Computational Aspect of Simplex Method: Cases of unique feasible solution, no feasible solution, • Multiple solution and unbounded solution and degeneracy • Two Phase method, Duality in LPP, primal-dual relationship • Conclusion & real life application
3	**Transportation Problem**
	• Introduction to Unit • Transportation Problem: Methods for finding basic feasible solution of a transportation problem • Modified distribution method for finding the optimum solution • Unbalanced and degenerate transportation problems • Conclusion & real life application
4	**Assignment Problem**
	• Introduction to Unit • Assignment Problem: Solution by Hungarian method, • Unbalanced assignment problem, maximization in an assignment problem, • Crew assignment and travelling salesman problem. • Conclusion & real life application
5	**Game Theory**

	• Introduction to Unit • Game Theory: Two Person zero sum game • Game with saddle points, the rule of dominance • Algebraic, graphical and linear programming methods for solving mixed strategy games • Conclusion & real life application

C RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Operations Research – An Introduction	H.A. Taha	**3rded**	Pearson, India
2.	Operations Research	KantiSwarup, P.K. Gupta and Manmohan.	2nd Ed	S. Chand publication Delhi
3.	Operations Research	P.K. Gupta and D.S. Hira	2016	S. Chand & Co. Delhi

Code: BSA05207	CHEMISTRY LAB	1.5 Credits [LTP: 0-0-3]

OBJECTIVE– The students would be trained to identify which separation method is most suited for a given mixture and what physical change occurs during the separation process and be able to use the evidence based comparative chemistry approach to explain the chemical synthesis and analysis.

COURSE OUTCOMES
Students will be able to:

CO207.1: Understand chemical and molecular processes that take place in organic chemical reactions in synthesis.
CO207.2: Explain the principles of the chromatographic techniques.
CO207.3:Acquire the ability to understand, explain and use instrumental techniques for chemical analysis
CO207.4: Prepare water quality assessment report
CO207.5: Apply subject knowledge and skill to solve complex problems with defined solutions

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	**2**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**2**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	**2**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO5	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability

LIST OF EXPERIMENTS:

1	Synthesis of p bromoacetanalide
2	Synthesis of p-nitroacetanalide
3	Benzolytation of Aniline
4	Paper chromatographic separation of amino acids and sugars (only binary mixtures)
5	To separate a mixture of sugar by paper chromatography
6	Synthesis of Aspirin
Physical Chemistry	
7	To determine the heat of neutralization for strong acid and strong base
8	Potentiometric measurements-Strong acid with strong base.
9	To study the saponification of ethyl acetate conductmetrically
10	Analysis of phosphorous in given water sample
11	To separate acetanilide from a mixture with salicylic acid by solvent extraction.
12	To obtain phase diagram of water- acetic acid and chloroform system.

Code: BSA05208	**PHYSICS LAB**	**1.5 Credits [LTP: 0-0-3]**

OBJECTIVE– To experimentally realize different types of constants and expose the student to verification of inverse square law by photocell.

COURSE OUTCOMES
Student will be able to:

CO208.1: Understand of concepts and theoretical principles of Boltzmann constant and Plank's Constant
CO208.2: Understand and able to find the Joule constant and wavelength of a He- Ne Laser
CO208.3: Understand the working of Ballistic galvanometer by and learn about Stefan's constant
CO208.4: Understand the concept of electron and mass ratio and learn about photocell.
CO208.5: Understand and perform computer programming using mathematical formula

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**3**	**3**
CO2	**2**	**1**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**2**	**1**
CO3	**1**	**2**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**1**	**2**
CO4	**2**	**1**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**2**	**1**
CO5	**3**	**3**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**3**	**3**

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	**PSO2**	**PSO3**
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

LIST OF EXPERIMENTS:

1	To determine the value of Boltzmann Constant by studying Forward Characteristics of a Diode.
2	To determine the value of Planck's Constant using LEDs of at least 4 Different

	Wavelengths.
3	To find J by Callender and Barne's method
4	To determine the Wavelength and the Angular Spread of a He-Ne Laser.
5	To determine the value of Stefan's Constant.
6	Determination of high resistance by leakage method.
7	Determination of coefficient of Mutual induction by using ballistic galvanometer.
8	Determination of dielectric constant by condenser method.
9	Determination of e/m by Thomson method.
10	To verify inverse square law by Photo cell
11	To find the product of two matrices.
12	To find maximum, minimum and range of a given set of numbers.

Code: BSA05209	ANANDAM COURSE	2 Credits [LTP: 0-0-1]

OVERVIEW AND OBJECTIVES: The Anandam program aims to instill the joy of giving in young people, turning them into responsible citizens. Who will build a better society through daily action; it will build the habit of service in students across colleges and universities in Rajasthan. The students will have to undertake the course each semester starting with the 2020-21 academic year.

Course Outcomes

- Each student will be able to work as team member.
- Student will learn social activities.
- Students will be familiar with society.

DETAILED SYLLABUS

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register/ Personal Diary
- Share this Register/ Personal Diary day in the 30-minute Anandam time slot dedicated by the college.
- Undertake one group service project for 64 Hours every term (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion session held once a month.

BULCHM5201 PROFESSIONAL SKILLS-II 1 Credit [LTP: 0-0-2]

COURSE OUTCOMES:

Students would be able to:

CO201.1: Learn how to update and manage the experience, education, and skills & expertise sections on social media & formulate appropriate updates as a means to promote business activities

CO201.2: Understand how to leverage grammar and formatting in formal documents & demonstrate how to follow the stages of the writing process (prewriting/writing/rewriting) and apply them to technical and workplace writing tasks.

CO201.3: Evaluate presentation's weak spots and areas for improvement & learn, practice and acquire the skills necessary to deliver effective presentation with clarity and impact.

CO201.4: Evaluate basic factors such as personal skills & abilities, career fields, willingness to learn and strengthen the chances to get desirable jobs.

CO201.5: Understand negotiation and team skills dynamics and how to prepare for uncertainty & learn to craft agile strategy and be quick on your feet in changing circumstances.

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1	**Personal Branding**	**2**
2	**Professional Writing-II**	**8**
3	**Presentation Skills: Professional Setting**	**2**
4	**Job Interview & Group Discussion : Preparation by Mock Practice**	**4**
5	**Negotiation Skills, Team Management & Professional Awareness**	**8+**

B. DETAILED SYLLABUS

LIST OF LABS	
1.	Personal Branding : Its best practices
2.	Professional Writing II: Abstract Writing, Statement of purpose and other formal documents
3.	Expanding Professional Vocabulary
4.	Resume Building-II: Revising & Updating
5.	E-Learning & E-Content Development-II
6.	Presentation Skills in Professional Setting
7.	Job Interviews II: Preparation and Presentation for Mock Interviews
8.	Advanced Group Discussion-II: Analysis of professional GD Videos and Practices on Topics/Video/Article based topics
9.	Negotiation Skills & and Conflict Resolution-II
10.	Change and Transition Management
11.	Team Building Strategies: Project Management
12.	Career Awareness & Productive Mindset

Code: BSA05411 INDUSTRIAL TRAINING & SEMINAR 1 Credit [LTP: 0-0-2]

OBJECTIVE– The objective of Industrial Training & Seminar is to expose the students to actual working environment and enhance their knowledge and skill from what they have learnt and instill the good qualities of integrity, responsibility and self-confidence.

COURSE OUTCOMES
Students will be able to:

CO411.1: Develop advanced and lifelong learning skills.
CO411.2: Extend the boundaries of knowledge through research and development.
CO411.3: Write formatted report for explaining the work during industrial training and describing the experience.
CO411.4: Understand basis of professional practice, administrative functions and company culture.
CO411.5: Develop greater clarity about academic & career goals and explore options in career plans.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	**3**	-	-	-	-	-	-	-	-	**3**
CO2	-	-	**3**	-	-	-	-	-	-	-	-	**3**
CO3	-	**3**	**2**	-	-	-	-	-	-	-	-	**2**
CO4	--	-	**2**	-	-	-	-	-	**3**	-	-	**2**
CO5	-	-	**3**	-	-	-	-	-	**3**	-	-	**3**

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Skill Development/Entrepreneur.

A. **OUTLINE OF THE COURSE**

1	At the end of the Fourth Semester each student would undergo Industrial Training in an Industry/ Professional Organization / Research Laboratory with the prior approval of the Head of Department and Training & Placement Officer for two months.
2	Students shall be required to submit log book and certificate from the organization and power point presentation based on the training.
3	Students shall be required to submit a written typed report and power point presentation based on the training.
4	Students shall be required to give the presentations in the allotted period about the training attended after 4th Semester.
5	The evaluation shallbedone as per continuous evaluation process during V^{th} semester by the respective department and the marks/result shall be notified accordingly. A department specific panel comprising of **HOD/Sr. Faculty/ Project Coordinators** shall judge each individual student for the above-mentionedwork. The departmental panel shall display the proper schedule for the class/ one to one interaction/presentation for all the students.

Code: BSA05612 Discipline and Talent Enrichment Programme (TEP-V) 1 Credit

OVERVIEW AND OBJECTIVES The objective of Discipline and TEP is to provide students with the opportunities to enhance job-fetching skills and at the same time to cultivate the student's personal interests and hobbies while maintaining the good disciplinary environment in the University.

TEP is integrated into the curriculum for holistic development of students through active participation in various activities falling in Technical and non-technical categories.

Discipline and Talent Enrichment Programme (TEP) shall be evaluated irrespective of period/time allocation (as in the case of Extra Curricular activity) in the teaching scheme as a 1 credit course. The record related to discipline, related activities aremaintained for each student, and they shall be evaluated for the same. It shall be counted in calculation of SGPA but it is not a backlog subject. However, the attendance of these classes shall be recorded and accounted in the total attendance.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	2	-	-	-	-	-	-	-	2
CO2	-	-	-	2	-		-	-	-	-	-	3
CO3	-	-	-	3	-	-	-	-	-	-	-	3
CO4	-	-	-	3	-	-		-	-	-	-	3
CO5	-	-	-	1	-	-	-	-	-	3	-	3

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Entrepreneur

Code: BSA06101 SOLID STATE PHYSICS 3.0 Credits [LTP: 3-0-0]

OBJECTIVE– The course gives an introduction to solid state physics, and will enable the student to employ classical and quantum mechanical theories needed to understand the physical properties of solids. Emphasis is put on building models able to explain several different phenomena in the solid state.

COURSE OUTCOMES

The Students will be able to:

CO101.1: Differentiate the crystal structure of different elements by X ray diffraction.
CO101.2: Apply the Thermal Properties of solids and its applications.
CO101.3: Produce the different magnetic materials, B-H Curve, Hysteresis loop and Energy Loss
CO101.4: Use the electrical properties of materials, energy band theory and Hall Effect and its applications.
CO101.5: Develop the types of superconductor and different theories for explaining it.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**2**	**2**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**
CO2	**3**	**3**	**3**	**2**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**
CO3	**2**	**2**	**2**	**3**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**
CO4	**3**	**3**	**2**	**2**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**
CO5	**3**	**3**	**3**	**3**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	**Crystal Structure**	8
2.	**Thermal Properties of Solids**	7
3.	**Magnetic Properties**	7
4.	**Electrical Properties of Materials**	7
5.	**Superconductivity**	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Crystal Structure**
	• Introduction of the Unit • Solids: Amorphous and Crystalline Materials • Lattice Translation Vectors • Lattice with a Basis – Central and Non-Central Elements • Unit Cell. Reciprocal Lattice • Types of Lattices • Miller indices • Crystal structures of simple cubic, FCC, BCC, HCP, diamond. • Diffraction of x-rays by Crystals • Bragg's Law • Rotating crystal method • Laue Method and Powder method • Conclusion & real life application
2.	**Thermal Properties of Solids**
	• Introduction of the Unit • Concepts of thermal energy and Phonons • Internal Energy and Specific Heat • Einstein theory of specific heat • Debye model of lattice specific heat Electronic Contribution of the internal Energy hence to the Specific Heat of Metals • Thermal Conductivity of the lattice • Electrical Conductivity: Drude-Lorentz Theory of Electrical Conductivity • Boltzmann Transport Equation • Sommerfield Theory of Electrical Conductivity • Mathiessen's Rule • Thermal Conductivity and Wildemann-Franz's Law • Conclusion & real life application
3.	**Magnetic Properties**
	• Introduction of the Unit

	• Dia-, Para-, Ferri- and Ferromagnetic Materials • Classical Langevin Theory of dia – and Paramagnetic Domains • Quantum Mechanical Treatment of Paramagnetism • Curie's law • Weiss's Theory of Ferromagnetism and Ferromagnetic Domains • Discussion of B-H Curve • Hysteresis loop and Energy Loss • Outline of antiferromagnetism and ferrimagnetisms, ferrites • Conclusion & real life application
4.	**Electrical Properties of Materials**
	• Introduction of the Unit • Elementary Band Theory of Solids • Bloch Theorm • Kronig-Penney Model • Effective Mass of Electron • Concept of Holes,Band Gaps • Energy Band Diagram and Classification of Solids • Law of Mass Action • Band Theory of Solids • Direct and Indirect Band Gap • Conductivity in Semiconductors. • Hall Effect in Semiconductors (Qualitative Discussion Only) • Conclusion & real life application
5.	**Superconductivity**
	• Introduction of the Unit • Experimental Results • Critical temperature • Critical magnetic field • Meissner effect • Type I and type II Superconductors • London's Equation and Penetration Depth • Isotope effect • Idea of BCS theory (No derivation): Cooper Pair and Coherence length • Variation of Superconducting Energy Gap with Temperature • Experimental Evidence of Phonons • Josephson Effect • Conclusion & real life application

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Introduction to Solid State Physics	**Charles Kittel**	7th Edition	John Wiley and Sons, Inc.
2.	Solid State Physics	**A. J. Dekkar**	2000	Macmillan India Limited
3.	Solid State Physics	**S.L. Gupta and V. Kumar**	2013	Kadar Nath& Co. Meerut

Code: BSA06102 NUCLEAR PHYSICS 3.0 Credits [LTP: 3-0-0]

OBJECTIVE: The objective of the course is to understand the concepts and methods in nuclear and particle physics and to understand radioactivity, transmutation, nuclear reactions and the applications of isotopes.

COURSE OUTCOMES

The Students will be able to:

CO102.1: Discuss fundamentals of nucleus, Rutherford scattering and Rutherford's scattering formula
CO102.2: Apply the basic mechanism of nuclear fusion and fission.
CO102.3: Analyze the classification of elementary particles.
CO102.4: Categorize the need for accelerators and different types of accelerators.
CO102.5: Compare the different types of nuclear radiation detectors.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	—	—	—	—	—	—	—	—
CO2	3	3	2	2	—	—	—	—	—	—	—	—
CO3	2	2	3	3	—	—	—	—	—	—	—	—
CO4	3	3	2	2	—	—	—	—	—	—	—	—
CO5	3	2	2	3	—	—	—	—	—	—	—	—

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	**Structure of Nuclei**	7
2.	**Nuclear Fission and Fusion**	8
3.	**Particle Physics**	7
4.	**Accelerators**	7
5.	**Radiation Detectors**	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Structure of Nuclei**
	• Introduction of the Unit • Basic Properties of Nuclei: (1) Mass, (2) Radii, (3) Charge, (4) Angular Momentum, (5) Spin, (5) Magnetic Moment (μ), (6) Stability • Rutherford scattering and Rutherford's scattering formula • Constituents of nucleus • Magnetic dipole moment of nuclei • Basic idea about quadruple moment of nucleus • Nuclear spin and parity • Orbital angular momentum • Nuclear mass, Mass Defect and Binding energy • Theory of Nuclear forces. • Packing fraction and binding energy of nucleus • Liquid drop model of nucleus • Semi-empirical mass formula (Volume, Surface, Coulomb, Asymmetry and Pairing energy terms) • Conclusion & real life application
2.	**Nuclear Fission and Fusion**
	• Introduction of the Unit • The Discovery of Nuclear Fission • The Energy Release in Fission • Fission cross Section and threshold, Neutron emission in fission • The prompt neutron and delayed neutrons • Mechanism for the emission of delayed neutrons • Energy of fission Neutrons • Barrier Penetration-Theory of Spontaneous fission • Nuclear Energy Sources • Nuclear Fission as a source of Energy • The Nuclear Chain Reaction

	• Condition of controlled chain Reaction, Nuclear Reactors • Energy release in fusion • Fusion reactions in stars: carbon and pp cycle. • Conclusion & real life application
3.	**Particle Physics**
	• Introduction of the Unit • Classification of elementary particles • Properties of particles. • Fundamental interactions, • **Conservation laws** : Energy ,momentum, angular momentum, charge, lepton number, Baryon number, isospin, strangeness, Invariance under charge, parity, C.P., time and C.P.T.,(Qualitative discussion). • **Cosmic rays:** Properties of cosmic rays ,properties of secondary radiation, electronic showers ,geomagnetic effects, cosmic ray stars, the origin of cosmic rays • Conclusion & real life application
4.	**Accelerators**
	• Introduction of the Unit • Need for accelerators • Ion sources, Van De graff generator • Drift tube, Linear accelerator • Wave guide accelerator • Cyclotron ,synchrocyclotron • Electron synchrotron, Proton synchrotron • Conclusion & real life application
5.	**Radiation Detectors**
	• Introduction of various methods used in detection of nuclear radiation • Principle and working of (i) Ionization chamber (ii) Proportional counter (iii) Geiger- Muller counter; Dead time, Recovery time and paralysis time • Scintillation counter • Cloud chamber • Bubble chamber • Spark chamber • Solid state detectors • Basic components of mass spectroscope • Conclusion & real life application

C. RECOMMENDED STUDY MATERIA

Sr.No	Reference Book	Author	Edition	Publication
1.	Nuclear Physics	**S.N. Ghoshal**	2012	S. Chand Publication, Delhi
2.	Nuclear Physics	**D.C. Tayal**	1982	Himalaya Publishing House
3.	The Atomic Nucleus	**R.D. Evans**	1955	Mc-Graw Hill

Code: BSA06103 INORGANIC CHEMISTRY 3.0 Credits [LTP: 3-0-0]

OBJECTIVE– The objective of this course is to introduce the students to d and f block elements, highlights the concept of horizontal similarity in a period, and stresses on their unique properties. It familiarizes them with coordination compounds, which find manifold applications in diverse fields. Also they would be familiarizing with the fundamental principles of separation processes used in analytical chemistry.

COURSE OUTCOMES

The students will be able to:

CO103.1: Describethe electronic configuration, atomic radii , ionic radii, oxidation state of lanthanides and their separation.
CO103.2: Differentiate between Lanthanides and Actinides and learn the separation techniques of trans-uranium elements.
CO103.3: Demonstrate the preparation, structure and industrial applications of inorganic polymers.
CO103.4: Interpret the chemistry of coordination compounds on the basis of Werner's Theory and its industrial applications.
CO103.5: Examine the basic principle of crystallization, distillation, solvent extraction, TLC and column chromatography.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**2**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	**2**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO5	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	**Lanthanides**	8
2.	**Actinides**	7
3.	**Inorganic Polymer**	7
4.	**Coordination Compounds**	8
5.	**Separation Techniques and Chromatography**	6

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Lanthanides**
	• Introduction to the Unit • **Lanthanides:** Comparative study of lanthanide elements with respect to electronic configuration, atomic and ionic radii, oxidation state and complex formation. • Lanthanide contraction. Occurrence and principles of separation of lanthanides. • General features and chemistry of Lanthanides • Conclusion & real life application
2.	**Actinides**
	• Introduction to the Unit • **Actinides:** Comparative study of actinide elements with respect to electronic configuration, atomic and ionic radii, oxidation states and complex formation; • Occurrence and principles of separation. • General features and chemistry of actinides, principles of separation of Np, Pu and Am from U. Trans-Uranium elements • Comparison of Lanthanides and Actinides • Conclusion & real life application
3.	**Inorganic Polymer**
	• Introduction to the Unit • **Inorganic Polymer:** Classification, Preparation and Structure of silicones, silicon resin, silicon rubber, silicon fluid, industrial application of silicones • Preparation, properties, substitution reaction and structure of phosphazenes • Conclusion & real life application.
4.	**Coordination Compounds**
	• Introduction to the Unit • **Coordination Compounds:** Werner's theory, nomenclature, chelates, stereo-chemistry of coordination numbers 4, 5 and 6. • Nomenclature and isomerism in coordination complexes. • Important applications of coordination compounds. • Theories of metal-ligand bonding in transition metal complexes- Sidgwick effective

	atomic number concept, • valence bond theory of coordination compounds • Conclusion & real life application
5.	**Separation Techniques and Chromatography**
	• Introduction to the Unit • **Separation Techniques:** Principles and process of solvent extraction • the distribution law and partition coefficient, batch extraction, continuous extraction and counter current distribution • Gravimetric methods, theory of precipitation, co-precipitation, post precipitation, theory of purifying the precipitates • **Chromatography:** Classification of chromatographic methods, general principle and application of adsorption, Partition chromatography, Ion-exchange, thin layer and paper chromatography • Conclusion & real life application

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	A New Concise Inorganic Chemistry	J. D. Lee	5th Edition	Chapman & Hall, London
2.	Modern Inorganic Chemistry	R. C. Aggarwal	1st Edition	KitabMahal, Allahabad
3.	Basic Inorganic Chemistry	F. A. Cotton, G. Wilkinson, and Paul L. Gaus	3rd Edition	John Wiley & Sons, New York

Code: BSA06104	PHYSICAL CHEMISTRY	3.0 Credits [LTP: 3-0-0]

OBJECTIVE– The objective of the course is to understand basic terminologies of electrochemistry, to know the theories of strong electrolytes, to be familiar with the fundamentals of different types of electrochemical cells.

COURSE OUTCOMES
The students will be able to:

CO104.1: Describe the fundamental concepts of electrochemistry and relate the conductivity of an electrolyte with its concentration.
CO104.2: Assess the different types of electrochemical cells and cell potential from standard cell potential using the Nernst Equation.
CO104.3: Explain fundamental principle of thermodynamic and thermo chemistry
CO104.4: Apply various laws of thermodynamics in real life situations.
CO104.5:Outline the basic quantum mechanical approach to deriving molecular orbital's from atomic orbitals..

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	2	-	-	-	-	-	-	-	-
CO2	3	2	3	-	-	-	-	-	-	-	-	-
CO3	2	2	3	1	-	-	-	-	-	-	-	-
CO4	3	2	1	1	-	-	-	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Electrochemistry I	8
2.	Electrochemistry II	7

3.	**Thermodynamics-I**	**7**
4.	**Thermodynamics-II**	**8**
5.	**Quantum Mechanics II**	**6**

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Electrochemistry I**
	• Introduction to the Unit • **Electrochemistry I**: Electrical transport- conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution. • Migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes. Ostwald dilution law its uses and limitations. • Debye Huckel– Onsager`s equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf method and moving boundary method. • Application of conductivity measurements; determination of degree of dissociation, determination of Ka of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations. • Conclusion & real life application
2.	**Electrochemistry II**
	• Introduction to the Unit • **Electrochemistry II-:** Types of reversible electrodes, gas metal ion, metal-metal ion, metal insoluble salt-anion and redox electrodes. • Electrode reactions, Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode, reference electrodes, standard electrode potential, sign convention, electrochemical series and its significance. • Electrolytic and Galvanic cells-reversible and irreversible cells, conventional representation of electrochemical cells • EMF of a cell and its measurements. Computation of cells EMF. Calculation of thermodynamic quantities of cell reactions (ΔG, ΔH and K), polarization, over potential and hydrogen overvoltage. Concentration cell with and without transport, liquid junction potential, application of concentration cells. Valency of ions, solubility product and activity coefficient, potentiometric titrations. Definition of pH and pK_a, determination of pH using hydrogen quinhydrone and glass electrodes, potentiometric methods • Conclusion & real life application
3.	**Thermodynamics-I**

	• Introduction to the Unit • **Thermodynamics terms**: systems, surroundings etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamics process. Concept of heat and work • First law of thermodynamics**:** statement, definition of internal energy and enthalpy. Heat capacity. Heat capacities at constant volume and pressure and their relationship. • Joule law-Joule Thomson co-efficient and inversion temperature. Calculation of w,q,dU&dHfor the expansion of ideal gases under isothermal and adiabatic condition for reversible process. • Thermochemistry: Standard state, standard enthalpy of formation, Hess's law of heat summation and its applications. Heat of reaction at constant pressure and at constant volume. Enthalpy of neutralization. Bond dissociation energy and its calculation from thermochemical data, temperature dependence of enthalpy. Kirchhoff s equation • Conclusion & real life application
4.	**Thermodynamics-II**
	• Introduction to the Unit • **Second law of thermodynamics**: Carnot cycle and its efficiency. Carnot theorem. Thermodynamic scale of temperature. • Concept of entropy: Entropy as a state function, entropy as a function of Volume and temperature, entropy as a function of pressure and temperature, entropy change in physical change, Clausius inequality, entropy as a criteria of spontaneity and equilibrium, Entropy change in ideal gases and mixing of gases • **Third law of thermodynamics**: Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions: Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, A &G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G and A with P, V and T. • Conclusion & real life application
5.	**Quantum Mechanics II**
	• Introduction to the Unit • **Molecular orbital theory**: Basic ideas criteria for forming M.O. from A.O. construction of M.O.`s by LCAO-H^{2+} ion, calculation of energy levels from wave functions, physical picture of bonding and antibonding wave functions, concept of σ, σ * and π, π* orbitals and their characteristics. Hybrid orbitals sp, sp^2, sp^3, calculation of coefficients of atomic orbitals used in these hybrid orbitals • Conclusion & real life application

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Essentials of physical Chemistry	Puri, Sharma,Pathania	Latest	Vishal Publishing co.
2.	Advanced Physical chemistry	Gurdeep Raj	Latest	Goel Publication

Code: BSA06105	COMPLEX ANALYSIS	3.0 Credits [LTP: 3-0-0]

OBJECTIVE–This course helps students in exploring andIdentify curves and regions in the complex plane defined by simple expressions. Describe basic properties of complex integration and having the ability to compute such integrals. Decide when and where a given function is analytic and be able to find it series development.

COURSE OUTCOMES:
The students will be able to:

CO105.1: Investigate complex functions, concept of limit, continuity and differentiability of complex functions.
CO105.2: Evaluate the analytic functions using Cauchy-Riemann equations (Cartesian and polar form), sufficient conditions for differentiability, Harmonic Function.
CO105.3: Evaluate the Complex integration by using Cauchy integral formula, Cauchy theorem andLiouville's theorem
CO105.4: Analyze the Taylor's Theorem, Laurent's theorem, Power series, Taylor series, Laurent series, Absolute convergence, Abel's theorem, Circle and radius of Convergence.
CO105.5: Explain the conformal mapping. Bilinear transformation and its properties.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**1**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	**3**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**3**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	**3**	**1**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO5	**2**	**3**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	**Continuity and Differentiability**	9
2	**Analytic Functions**	6
3	**Complex Integration**	6
4	**Taylor's and Laurent's Theorem**	8
5	**Conformal Mapping**	7

B. DETAILED SYLLABUS

Unit	Unit details
1	**Continuity and Differentiability**
	• Introduction to the Unit • Complex plane, Connected and Compact sets, Curves and regions in complex plane, • Jordan Curve theorem (Statement only), Complex valued function, • Limits, Limits involving the point at infinity, continuity and differentiability • Conclusion & real life application
2	**Analytic Functions**
	• Introduction to the Unit • Analytic functions, Cauchy-Riemann equations (Cartesian And polar form), • Sufficient conditions for differentiability, • Harmonic Function, • Construction of an analytic function. • Conclusion & real life application
3	**Complex Integration**
	• Introduction to the Unit • Complex integration, Complex line integral, • Cauchy integral theorem, indefinite integral, • fundamental theorem of integral calculus for complex functions, • Cauchy integral formula, Liouville's theorem • Conclusion & real life application
4	**Taylor's and Laurent's Theorem**
	• Introduction to the Unit • Taylor's Theorem, Laurent's theorem, • Power series, Taylor series, Laurent series, • Absolute convergence, Abel's theorem, Circle and radius of Convergence, • Analyticity of the sum function of power series. • Conclusion & real life application
5	**Conformal Mapping**
	• Introduction to the Unit • Conformal mapping. Bilinear transformation and its properties.

	• Elementary mappings $w(z)=\frac{1}{2}\left(z+\frac{1}{z}\right)$, z^2, e^z, sinz, cosz and logz. • Evaluation of real definite integral by contour integration (Simple problems only) • Conclusion & real life application

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Complex Variables and Applications	James Ward Brown and Ruel V. Churchill,	8th Ed.	McGraw – Hill International Edition, 2009.
2.	Complex analysis,	Joseph Bak and Donald J. Newman	2nd Ed	Springer-Verlag New York,
3.	Complex Analysis	Purohit and Goyal	2016	Jaipur Publishing House

Code: BSA06106 DISCRETE MATHEMATICS 3.0 Credits [LTP: 3-0-0]

OBJECTIVE– This course is based on Concepts and notations from discrete mathematics are useful in studying and describing objects and problems in branches of computer science, such as computer algorithms, programming languages, cryptography, automated theorem proving, and software development.

COURSE OUTCOMES:
The students will be able to:

CO106.1: Explain the concept of Sets, Cardinality, Principle of inclusion and exclusion, Mathematical Induction, relations, equivalence relations and partition, Denumerable sets, partial order relations, Pigeon Hole Principle.
CO106.2Demonstrate Propositions, logical operations, logical equivalence, Conditional propositions, Tautologies and contradictions also Quantifier, Predicates and Validity.
CO106.3: Analysis the Boolean algebra, Lattices and Algebraic Structure, Duality, Lattices, Chains and antichains, Distributive and complemented lattices, Boolean lattices, Boolean functions.
CO106.4: Evaluate Basic terminology of Graphs and their properties.
CO106.5: Evaluate Basic terminology of Trees and their properties.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	**3**	**1**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**2**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	**3**	**1**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO5	**3**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development

A. **OUTLINE OF THE COURSE**

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	**Set Theory**	**9**
2	**Propositions and logic**	**6**
3	**Boolean Algebra**	**6**
4	**Graph Theory**	**8**
5	**Trees**	**7**

B. **DETAILED SYLLABUS**

Unit	Unit details
1	**Set Theory**
	• Introduction to the Unit • Sets, Cardinality, Principle of inclusion and exclusion, • Mathematical Induction, relations, equivalence relations and partition, • Denumerable sets, partial order relations, • Pigeon Hole Principle and its applications. • Conclusion & real life application
2	**Propositions and Logic**
	• Introduction to the Unit • Propositions, logical operations, logical equivalence, • Conditional propositions, • Tautologies and contradictions. • Quantifier, Predicates and Validity. • Conclusion & real life application
3	**Boolean Algebra**
	• Introduction to the Unit • Boolean Algebra, Lattices and Algebraic Structure, • Duality, Lattices, Chains and antichains, • Distributive and complemented lattices, • Boolean lattices, Boolean functions and expressions. • Conclusion & real life application
4	**Graph Theory**
	• Introduction to the Unit • Graphs- Basic terminology, • Multigraphs, weighted graph, • Paths and circuits, • Shortest paths, Introduction to Eulerianand Hamiltonian Graphs. • Conclusion & real life application
5	**Trees**

	• Introduction to the Unit • Trees- Properties, Spannig Tree, Binary and Rooted Tree, • Diagraphs- Simple diagraph, • Asymmetric diagraphs and complete diagraphs. Diagraphs and binary relation, • Matrix representation of graphs and diagraphs. • Conclusion & real life application

C. **RECOMMENDED STUDY MATERIAL:**

Sr.No	Reference Book	Author	Edition	Publication
1.	Finite Mathematics	Seymour Lipschutz	1983	McGraw- Hill Book Company, New York.
2.	Elements of Discrete Mathematics	C.L. Liu	2nd Ed	McGraw-Hilll Book Co.
3.	Graph theory with applications to computer science,	N. Deo	2016	Prentice Hall of India

Code: BSA06207 CHEMISTRY LAB 1.5 Credit [LTP: 0-0-3]

OBJECTIVE– Students will be able to demonstrate the experimental techniques and methods of their area of specialization in Chemistry and be able to understand the basic principle of equipments, instruments used in the chemistry laboratory.

COURSE OUTCOMES
Students will be able to:

CO207.1: Understand chemical and molecular processes that take place in inorganic chemical reactions in synthesis.
CO207.2: Analyze and present experimental results and draw sound conclusions based on experimental evidence.
CO207.3: Acquire the ability to understand, explain and use instrumental techniques for chemical analysis
CO207.4 Applying subject knowledge and skill to solve complex problems with defined solutions
CO207.5: Understand the different factors that contribute to the adsorption.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO5	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability/Skill Development

LIST OF EXPERIMENTS

Inorganic Chemistry	
1	Preparation of sodium trioxalatoferrate(III).
2	Estimation of Nickel complex
3	Preparation of copper tetraammine complex.
4	Separation and estimation of Mg(II) and Zn(II)
5	Preparation of Potassium dioxalatodiaquachromate(III).
6	Colorimetric determination of metal ions. Fe^{3+},
Physical Chemistry	
7	To determine the relative strength of two acids(HCl& H_2SO_4)
8	To verify Beer Lamberts law $KMnO_4$/$K_2Cr_2O_7$ and determine the concentration of the given solution.
9	To determine the strength of Na and K in a given sample by flame photometer.
10	To titrate potentiometrically the given ferrous ammonium sulphate solution using $K_2Cr_2O_7$ and calculate the redox potential of Fe^{+2}/Fe^{+3} system
11	To determine the dissociation constant of a weak acid Conductometrically and verify ostwalds dilution law.
12	Adsorption of acetic acid on charcoal

Code: BSA06208	PHYSICS LAB	1.5 Credit [LTP: 0-0-3]

OBJECTIVE– To experimentally realize different types of study like GM counter, calculation of sound wave, R-C transmission line with frequency change and fixed constants etc. and expose the student to determination of e/m value by helical method.

COURSE OUTCOMES

Students will be able to:

CO208.1: Learn the concept of RC and LC transmission lines at various frequencies.
CO208.2: Learn the concept of inverse square law and characteristics of GM counter
CO208.3: Learn the concept of Plank's and Stefan's constant using solar and photo cell
CO208.4: Learn the concept of LCR meter and determine the velocity of sound by standing wave method
CO208.5: Learn the concept of the magnetic susceptibility of solids and Hall coefficients of a semiconductor

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	—	—	—	—	—	—	—	—	3	3
CO2	2	1	—	—	—	—	—	—	—	—	2	1
CO3	1	2	—	—	—	—	—	—	—	—	1	2
CO4	2	1	—	—	—	—	—	—	—	—	2	1
CO5	3	3	—	—	—	—	—	—	—	—	3	3

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

LIST OF EXPERIMENTS:

1.	Study of a R-C transmission line at 50 Hz.
2.	Study of a L-C transmission line (i) at fixed frequency (ii) at variable frequency.
3.	Study the characteristics of a GM counter and verification of inverse square law for the same strength of a radioactive source.

4.	Study of β- absorption in Al foil using GM counter.
5.	Determination of Planck constant using solar cell.
6.	Determination of Stefan's constant using photocell.
7.	Determination of e/m by helical method.
8.	Determination of velocity of sound in air by standing wave method using speaker, microphone and CRO.
9.	Study of electromagnetic damping in LCR circuit using metal plate.
10.	Study the Iodine spectrum with the help of grating, spectrometer and ordinary bulb.
11.	To measure the Magnetic susceptibility of Solids.
12.	To determine the Hall coefficient of a semiconductor sample.

Code: BSA06209	ANANDAM COURSE	2 Credits [LTP: 0-0-1]

OVERVIEW AND OBJECTIVES: The Anandam program aims to instill the joy of giving in young people, turning them into responsible citizens. Who will build a better society through daily action; it will build the habit of service in students across colleges and universities in Rajasthan. The students will have to undertake the course each semester starting with the 2020-21 academic year.

Course Outcomes

- Each student will be able to work as team member.
- Student will learn social activities.
- Students will be familiar with society.

DETAILED SYLLABUS

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register/ Personal Diary
- Share this Register/ Personal Diary day in the 30-minute Anandam time slot dedicated by the college.
- Undertake one group service project for 64 Hours every term (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion session held once a month.

BULCHM6201 LEADERSHIP & MANAGEMENT SKILLS 1 Credit [LTP: 0-0-2]

COURSE OUTCOMES

Students will be able to:

CO6201.1: Integrate their understanding into their leadership skills development process.

CO6201.2: Demonstrate knowledge of the working environment impacting business organizations and exhibit an understanding of ethical implications of decisions.

CO6201.3: Assess leadership styles and sharpen the managerial skills to communicate effectively and facilitate decision making in relation with self-management, stress management and conflict management.

CO6201.4: Generate a creative thinking, something beyond the obvious answers and solution to a specific problem.

CO6201.5: Understand the significance of trust and team skills, creating new innovative ideas with the help of brainstorming and learn work etiquettes.

A. **OUTLINE OF THE COURSE**

UNIT NO.	UNIT NAME	HOURS
1	**Leadership Skills**	**6**
2	**Entrepreneurial Skills**	**2**
3	**Managerial Skills: Self –Management, Stress Management & Conflict Management**	**6**
4	**Creative Thinking & Design Thinking**	**6**
5	**Team Building & Confidence Building**	**4**

B. **DETAILED SYLLABUS**

LIST OF LABS	
1.	Leadership Skills: Stages of development
2.	Leadership Skills I: Attributes of great leaders, decision making, activities to enhance such qualities
3.	Leadership Through Biographies
4.	Entrepreneurial Skills: Traits & Competencies of an Entrepreneur
5.	Managerial Skills: Conflict Management
6.	Self-Management: Challenges & Solutions
7.	Stress Management : Causes of stress and regulation
8.	Creating Business Plans: Problem Identification and Idea Generation

9.	Design Thinking: Transforming Challenges into Opportunities
. 10	Creative Thinking & Analytical Thinking: Presentation
. 11	Team building: Developing teams and team work
. 12	Confidence Building : Improving engagement, communicating effectively & activities to facilitate decision making

Code: BSA06411	**DISSERTATION**	**1 Credits [LTP: 0-0-2]**

OBJECTIVE– The objective is to enable student to identify a problem in various field and to carry out literature survey, design an experiment, perform experiment, analyse data and write a report. To inculcate proficiency to identify appropriate research topic and presentation

COURSE OUTCOMES
Students will be able to:

CO411.1: Identify literature for review and research methods.
CO411.2: Apply knowledge and understanding in relation to the agreed area of study.
CO411.3: Communicate in written form by integrating, analysing and applying key texts and practices.
CO411.4: Develop responses on the basis of the evaluation and analysis undertake.
CO411.5:Demonstrate advanced critical research skills in relation to career development or work-related learning studies.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	-	-	**3**	-	-	-	-	-	-	-	**2**	**3**
CO2	-	-	**2**	-	-	-	-	-	-	-	-	**2**
CO3	-	-	**3**	-	-	-	-	-	-	-	-	**1**
CO4	-	-	**3**	**2**	-	-	-	-	-	-	-	**3**
CO5	-	-	**3**	**2**	-	-	-	-	-	-	-	**3**

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	**PSO2**	**PSO3**
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Skill Development/ Entrepreneur

A. OUTLINE OF THE COURSE

1	Dissertation consist of finalization of thesis based on literature review carried out during semester break of third year.
2	Objective finalization & presentation
3	Design & experimentation/survey details
4	Thesis preparation and submission
5	Final presentation

Code: BSA06612 Discipline and Talent Enrichment Programme (TEP-VI) 1 Credit

OVERVIEW AND OBJECTIVES The objective of Discipline and TEP is to provide students with the opportunities to enhance job-fetching skills and at the same time to cultivate the student's personal interests and hobbies while maintaining the good disciplinary environment in the University.

TEP is integrated into the curriculum for holistic development of students through active participation in various activities falling in Technical and non-technical categories.

Discipline and Talent Enrichment Programme (TEP) shall be evaluated irrespective of period/time allocation (as in the case of Extra Curricular activity) in the teaching scheme as a 1 credit course. The record related to discipline, related activities aremaintained for each student, and they shall be evaluated for the same. It shall be counted in calculation of SGPA but it is not a backlog subject. However, the attendance of these classes shall be recorded and accounted in the total attendance.

MAPPING OF COURSE OUTOCMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	2	-	-	-	-	-	-	-	2
CO2	-	-	-	2	-		-	-	-	-	-	3
CO3	-	-	-	3	-	-	-	-	-	-	-	3
CO4	-	-	-	3	-	-		-	-	-	-	3
CO5	-	-	-	1	-	-	-	-	-	3	-	3

MAPPING OF COURSE OUTOCMES WITH PROGRAMME SPECIFIC OUTCOMES

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Entrepreneur