POORNIMA UNIVERSITY

SCHOOL OF SCIENCE & HUMANITIES

DEPARTMENT OF SCIENCE & HUMANITIES

TEACHING SCHEME & SYLLABUS

BACHELOR OF SCIENCE

(ECC)

(BATCH-2021-24)

INDEX

POORNIMA UNIVERSITY

Your Dreams Our Goal

VISION

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

Mission

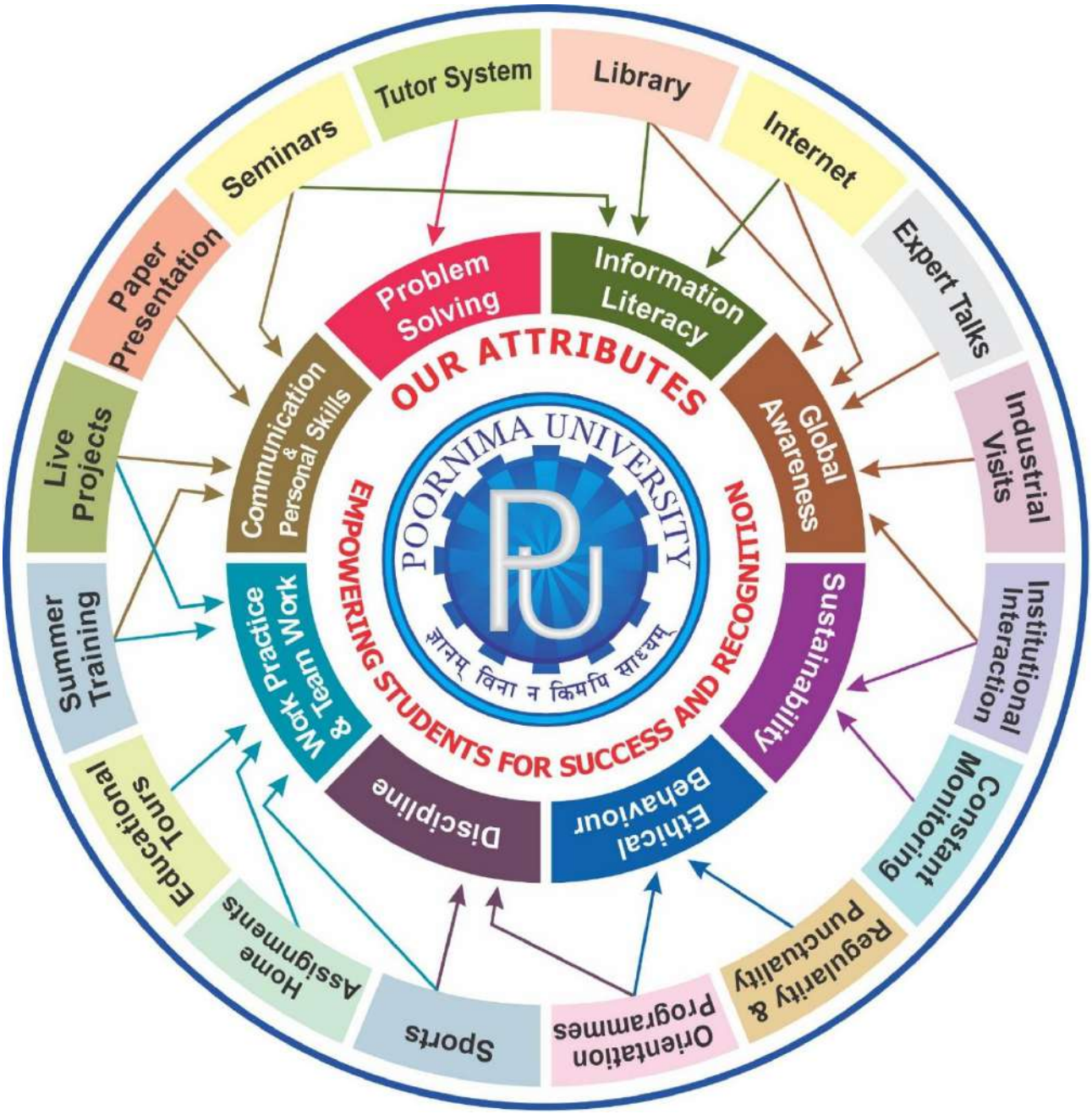
To evolve and develop skill based systems for effective delivery of knowledge so as to equip young professionals with dedication and commitment to excellence in all spheres of life.

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.)

Title of the Programme

1. Bachelor of Science (B.Sc.)

Nature of the Program

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

Preamble

3. 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. Keeping 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.

5. Specifically, the triggers for the comprehensive revamp of the curriculum are

(a) 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.

(b) 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.

(c) 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.

(d) 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.

(e) 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.

(f) 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.

6. 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

7. 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.

8. 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.

8.1 Programme Specific Outcomes

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

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.

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.

8.2 Program Objectives

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

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

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

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

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.

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.

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

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.

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.

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.

Project Management and Finance: Ability to work independently, identify appropriate resources required for a project, and manage a project.

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.

Highlights of the Curriculum

9. The New 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.

Pattern

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

Choice Based Credit System

11. 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.

12. 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.

Key Features of CBCS

13. (a) **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.

(b) **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.

(c) **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.

(d) **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.

(e) **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.

(f) **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.

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

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

Program Structure in Choice Based Credit System

14.

PROGRAM

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

Time Schedule

15. 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.

16. 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.

17. 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.

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.

Core Courses

18. 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.

(a) **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.

(b) **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.

19. Following specializations shall be offered

S.No	Course	Year of Starting
1	BA (Pass course)	2021
2	BA (Honors- Economics)	2021
3	BA (Honors- English)	2021
4	MA (English)	2021
5	MSc (Mathematics).	2021
6	B.Sc. (ECC)	2021

7	**B.Sc. (PCM)**	**2017**
8	**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.

<u>Pre-requisites for successful implementation of CBCS</u>

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

(a) 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.

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

(c) 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.

(d) 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.

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

(f) 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.

Credits

21. 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 course. 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.

22. 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.

23. 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.

24. 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.

25. 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,

26. 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.

27. (a) 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.)

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

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

Rationale for adoption of the Credit and Grading System

29. (a) **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.

(b) **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.

30. In view of the above lacunae, it is desirable that the marking systems used for the declaration of results 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 achieve by evaluating the true ability of the learners with the help of continuous evaluation.

Salient Features of the Grading System

31. (a) 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'.

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

(c) 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.

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

(e) 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.

Basics of Credit and Grading System

32. 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.

33. With 'Approach towards Grading' as the reference point, Grading may be classified as:

(a) 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'.

(b) 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.'

34. With 'Standard of Judgment', as the reference point Grading may be classified as:-

(a) 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.

(b) 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.

35. Absolute grading has several advantages such as

(a) The procedure is simple and straightforward to use

(b) Each grade is distinctly understandable

(c) 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.

36. The few limitations in Absolute Grading method are that:-

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

(b) Besides, the cut-offs of different categories are also arbitrarily decided.

37. 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.

Session Duration

38. Each teaching-learning, evaluation session shall be of 60 minutes. Batch size for tutorials shall be 50% of the normal class size, subject to a minimum of 30 students.

Registration

39. 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.

Examination

40. (a) Pattern of Examination: The evaluation scheme comprises of

(i) University Evaluation

(ii) Continuous Evaluation

41. 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

42. For each half credit course:-

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

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

University Evaluation

43. 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.

44. **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

45. 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.

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

Continuous Evaluation

47. 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.

48. 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.

49. 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.

50. 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

51. 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

52. 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.

53. 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.

Summer Internship Project

55. 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.)

56. 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.

57. 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.

58. 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.

59. 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

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

Dissertation

61. In III Year 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.

62. 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.

63. 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.

Assessment & Grade Point Average

64. 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.

65. **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.

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.

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

Guidelines for Open Elective

66. **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.

66.1 **Guide Lines for Department**:

66.1.1 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.

66.1.2. 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

66.1.3. 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.

66.1.4 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**

66.1.5. 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.

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

Guidelines for MOOC COURSES:

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

68.1 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.

68.2 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.

68.3 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.

68.4 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.

68.5 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.	1- Year	15- Credits
2.	2- Year	
3.	3-Year	

68.6 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

68.7 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.

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

68.9 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.

DETAILS OF COURSES

69. School of Science & Humanities offering the following courses.

S.No.	Course	Year of Starting
1	BA(Pass course)	2021
2	BA (Honors- Economics)	2021
3	BA (Honors- English)	2021
4	MA (English)	2021
5	MSc (Mathematics).	2021
6	B.Sc. (ECC)	2021

7	B.Sc. (PCM)	2017
8	Ph.D (in relevant Streams)	2012

ELIGIBILITY CRITERIA

70. 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	• 50% in Post Graduation + Virtual Entrance Examination & Interview.

COMPONENT WISE MARKS DISTRIBUTION

71. 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**

71.1. 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

71.2. Minimum Passing Percentage Components

Minimum Passing Percentage				
S. No	Program	IE	ESE	Total
1	B.Sc	35%	45%	50%
2	BA	35%	45%	50%
3	M.Sc.	35%	45%	50%
4	MA	35%	45%	50%
5	Ph. D.	-----	------	50%

71.2.1 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 shall give within the semester itself. Moreover, the minimum passing percentage in IE component is optional.

71.2.2 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.

71.2.3 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.

71.2.4 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.

Class Attendance & Debar Policy

71.3 Class Attendance and Debar Policy:

71.3.1 Class attendance and Marks for all courses of study will be taken from Department.

71.3.2 Apart from monthly communication for attendance, the tentative short attendance lists and final short attendance lists will be published by Chief Proctor.

71.3.3 The students have to maintain a minimum of 75% attendance, combining all courses / activities in his/her program of study.

71.3.4 If a student is unable to maintain so he/she will not be allowed to sit in the end semester examinations and has to repeat the semester.

71.3.5 For any medical issues / other participation consult department head/ department dean / proctor.

Eligibility ESE

71.5 Eligibility for ESE (End Semester Examination)

71.5.1 He/She has filled the relevant examination form in stipulated time period.

71.5.2 If student satisfies the minimum attendance criterion

71.5.3 If student is not guilty of any act of indiscipline

71.6 End Semester Examination & Back:

71.6.1 End Semester Examination (ESE) will hold at the end of each semester. They can further categorize as Main ESE and Back ESE.

71.6.2 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).

71.6.3 The ESE Theory will be held in two sessions (9-12 and 12:30-3:30).

71.6.4 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.

71.6.5 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.

71.6.6 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.

71.6.7 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

Name of Program: B.Sc. (ECC), Batch: 2021-24

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.	University Core Courses							
A.1	Theory							
BULCSA2101	Environmental Studies	2	-	-	40	60	100	2
BULCHM1101	Human Values & Professional Ethics	2	-	-	40	60	100	2
A.2	Practical							
A.2	Nil	-	-	-	-	-	-	-
	Nil							
B.	Department Core Courses							
B.1	Theory							
BESCES6101	Environmental Microbiology-II	3	-	-	40	60	100	3
BESCES6102	Natural Resource Conservation	3	-	-	40	60	100	3
BESCES6103	Organic Chemistry	3	-	-	40	60	100	3
BESCES6104	Physical Chemistry	3	-	-	40	60	100	3
BESCES6105	Computer Organization and Architecture	3	-	-	40	60	100	3
BESCES6106	AI & Machine Learning	3	-	-	40	60	100	3
B.2	Practical							
BESCES6201	Environmental Science Lab	-	-	2	60	40	100	1
BESCES6202	Computer Fundamentals & C Programming Lab	-	-	2	60	40	100	1
BESCES6203	Python Programming Lab	-	-	2	60	40	100	1
C.	Department Elective: Atleast One							
D.	Open Elective: Anyone	-	-	-	-	-	-	-
D.	Open Elective: Anyone							
	NIL	-	-	-	-	-	-	-
E.	Humanities and Social Sciences including Management courses OR Ability Enhancement Compulsory Course (AECC)							
BLUCHU6201	Professional Skills-II	-	-	2	60	40	100	1
F.	Skill Enhancement Courses (SEC) OR Project work, Seminar and Internship in Industry or Elsewhere							
BESCES6401	Dissertation	-	-	4	60	40	100	2
G.	Social Outreach, Discipline, TEP, VAC & Extra Curricular Activities							
BSACSA4601	Talent Enrichment Programme (TEP-IV)	-	-	-	50	-	50	1
BESCES6601	Social Outreach, Discipline, TEP, VAC & Extra Curricular Activities	20	-	10	50	-	50	1
	Total	20	-	10	50	-	50	1
	NIL	-	-	-	-	-	-	-
BESCES2601	Talent Enrichment Programme (TEP-II)	18	-	12	-	-	-	1
	Total	-	-	-	50	-	50	1
G.	Social Outreach, Discipline, TEP, VAC & Extra Curricular Activities	20	-	8				26
BESCES1601	Talent Enrichment Programme (TEP-I)	22	-	1	50	-	50	1
	Total	22	-	9				27.5
	Total Teaching Hours		31					
	Total	22		10				27.5
	Total Teaching Hours		32					

CORE Theory Subject

Code: BULCHM1101 HUMAN VALUES & PROFESSIONAL ETHICS 2 Credits [LTP:2-0-0]

COURSE OUTCOMES

Students will be able to:

CO101.1: Distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
CO101.2: Identify dialog within themselves to know what they 'really want to be' in their life and profession.
CO101.3: Understand the meaning of happiness and prosperity for a human being.
CO101.4: Facilitate the students to understand harmony at all the levels of human living, and live accordingly.
CO101.5: Facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life.

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: BESCES1101 FUNDAMENTALS OF ENVIRONMENTAL SCIENCE 3.0 Credits [LTP: 3-0-0]

COURSE OUTCOMES

Students will be able:

CO101.1: Explain the concept of the interaction of human society with the earth's system. Explain how science and the scientific method work to address environmental problems.
CO101.2: Explain sphere's interaction to earth's system and processes. Identify and analyze how matter and energy change and cycle through the system as the spheres interact.
CO101.3: Analysis the physical and biological structures and examines how ecosystem characteristics interact with each other.
CO101.4: Evaluate general application of conserving biodiversity and general understanding about ecosystems and ecosystem application.
CO101.5: Explain how the planet conserves matter and uses energy. The cycles move elements through ecosystems. Evaluate the storage of elements and recycle them.

A.OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	**Introduction to Environmental Science**	8
2.	**Physical and Chemical Environment**	8
3.	**Ecological Concepts**	8
4.	**Ecological Principles**	7
5.	**Biogeochemical cycles**	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction to Environmental Science**
	• Introduction of the Unit • Scope and Importance of Environmental Science • Multidisciplinary nature of Environmental Science • Origin and Evolution of Biosphere: Atmosphere of the Primitive Earth. Early Life forms, Origin of Life- Chemical basis, Evolution of Life forms through ages (Geological time scale) • Conclusion & Real life applications
2.	**Physical and Chemical Environment**
	• Introduction of the Unit • Earth's spheres and its components: Atmosphere, Hydrosphere, Lithosphere and Biosphere • Interaction of all the components(Atmosphere, Hydrosphere, Lithosphere and Biosphere) • Conclusion & Real life applications
3.	**Ecological Concepts**
	• Introduction of the Unit • Concept of Ecosystems • Types of Ecosystems • Ecosystem structure and functioning

	• Energy flow • Food chains and food webs • Ecological pyramids • Conclusion & Real life applications
4.	**Ecological Principles**
	• Introduction of the Unit • Liebig's Law of Minimum • Shelford's Law of Tolerance • Combined Concept of Limiting Factors • Conclusion & Real life applications
5.	**Biogeochemical cycles**
	• Introduction of the Unit • Definition and importance • Hydrological • Carbon • Oxygen • Nitrogen • Phosphorus • Sulphur • Conclusion & Real life applications

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	*Fundamentals of Environmental Biology*	Agrawal,K. C.	2001	Bikaner (India): Nidhi Publishers.
3.	*Environmental Encyclopedia*	Cunningham, W.P. Cooper, T.H. Gorhani, E. and Hepworth, M.T.	2001	Mumbai: Jaico Publ. House
6.	*Environmental Science*.	Santra, S. C.	2001	New Central Book Agency (P) Ltd.
7.	*Ecology and Environment*.	Sharma, P. D.	Latest	Meerut: Rastogi Publications.

Code: BESCES1102 ENVIRONMENTAL ECOLOGY & ECOSYSTEM DYNAMICS 3.0 Credits [LTP: 3-0-0]

COURSE OUTCOMES

Students will be able to:

CO102.1: Point out the various aspects of living organism and climatic factors - solar radiations, temperature, water and precipitation.

CO102.2: Point out about population dynamics like population growth, size, density, age, migration and impact of population growth on ecosystem.

CO102.3: Discuss the food chains, food webs, Ecological pyramids, ecosystem function.

CO102.4: Discuss the Concepts, Types, Trends of Succession and Climax and stability of ecosystem

CO102.5: Compare the Characteristics of Biomes like Terrestrial, Forests, Grasslands, Fresh water, Marine, Lake, river.

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	**Basic Principles of Ecology and Environment**	7
2.	**Population**	8
3.	**Ecosystem**	8
4.	**Succession**	8
5.	**Characteristics of Biomes**	8

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Basic Principles of Ecology and Environment**
	• Introduction of the Unit • Definition and Scope • Biological levels of organization, population, community, ecosystem and biosphere • Climatic factors - Solar radiations, temperature, water and precipitation • Conclusion & Real life applications
2.	**Population**
	• Introduction of the Unit • Basic concepts, population characteristics – density, natality, mortality, Age-structure, population growth. • Ecological niche and habitat • Positive and negative interactions of populations – competition, predation, parasitism, mutualism. • Conclusion & Real life applications
3.	**Ecosystem**
	• Introduction of the Unit • Basic concepts, components of ecosystem • Trophic levels, food chains and food webs • Ecological pyramids, ecosystem function. • Energy flow in ecological systems, energy efficiencies

	• Conclusion & Real life applications
4.	**Succession**
	• Introduction of the Unit • Concepts of succession • Types of Succession • Trends in succession • Climax and stability • Co-evolution and group selection • Conclusion & Real life applications
5.	**Characteristics of Biomes**
	• Introduction of the Unit • Terrestrial • Forests • Grasslands • Fresh water • Marine • Lake • River • Conclusion & Real life applications

C. RECOMMENDED STUDY MATERIAL:

S. No	Reference Book	Author	Edition	Publication
1	*Ecology and Environment.*	Sharma, P. D.	**2008**	Rastogi Publications
2	*Environmental Science*	Cunningham, W. P., & Saigo, B. W.	**1999**	Mc-Graw Hill Book Company
3	*Ecology: Principles and Applications*	Chapman, J. L., & Reiss, M. J.	**1995**	Cambridge University Press
4	*Essentials of Ecology*	Townsend, C., Harper, J., & Begon, M.	**2006**	Blackwell Science

Code: BESCES1103	INORGANIC CHEMISTRY	3.0 Credits [LTP: 3-0-0]

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.

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	Kitab Mahal, Allahabad
3	Basic Inorganic Chemistry	F. A. Cotton, G. Wilkinson, and Paul L. Gaus	Latest	John Wiley & Sons, New York

Code: BESCES1104	ORGANIC CHEMISTRY	3.0 Credits [LTP: 3-0-0]

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.

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

C. RECOMMENDED STUDY MATERIAL:

3.	**Alkenes**
	• Introduction of the Unit • Preparation: elimination reactions: dehydration of alcohols and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (partial catalytic hydrogenation) and trans-alkenes (birch reduction), Stereochemical aspects of these reactions • Chemical reactions of alkenes –electrophilic and free radical additions. Epoxidation, mechanisms involved in hydrogenation, oxidation with $KMnO_4$, 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

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: BESCES1105 OPERATING SYSTEMS 3.0 Credits [LTP: 3-0-0]

COURSE OUTCOMES

Students will be able to:

CO105.1: Explain the role of operating system with its function and services. (Understanding)
CO105.2: Compare Various Algorithm used for CPU Scheduling, Memory management and Disk Scheduling Algorithm. (Evaluate)
CO105.3: Apply various concepts related with Deadlock to solve Problems. (Apply)
CO105.4: Analyse Protection and Security Mechanism in Operating System. (Analyse)

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	**Introduction**	6
2	**Scheduling**	8
3	**Process and Threads**	8
4	**Memory Management**	8
5	**File System Interface**	6

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction**
	Operating System: Operating Systems Overview- Overview and Functions of operating systems, protection and security, operating Systems structures, services, system calls and their working, Batch, multiprogramming. Multitasking, time sharing, parallel, distributed & real -time O.S.
2.	**Scheduling**
	Basic concepts of CPU scheduling, Scheduling criteria, Scheduling algorithms, algorithm evaluation, multiple processor scheduling, real time scheduling I/0 devices organization, I/0 devices organization, I/0 devices organization, I/0 buffering.
3.	**Process and Threads**
	Process concept, process scheduling, operations on processes, threads, inter-process communication, precedence graphs, critical section problem, semaphores, classical problems of synchronization. Deadlock problem, deadlock characterization, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock, Methods for deadlock handling.
4.	**Memory Management**
	Concepts of memory management, logical and physical address space, swapping, contiguous and non-contiguous allocation, paging, segmentation, and paging combined with segmentation.
5.	**File System Interface**
	File system Interface- the concept of a file, Access Methods. Directory Structure. File system mounting, file protection and sharing mechanism. File System implementation- File system structure, file/directory implementation, efficiency and performance; file allocation methods, Free-space management.

C. RECOMMENDED STUDY MATERIAL:

S.No	Reference Book	Author	Edition	Publication
1.	Operating System Concepts	Abraham Silberchatz, Peter B. Galvin, Greg Gagne	8th edition.	CBH, Jaipur
2.	Operating Systems - Internals and Design Principles	Stallings	6th Edition	Pearson education.
3.	Operating systems- A Concept based Approach	D. M. Dhamdhere	3rd Edition	TMH, Delhi
4	Modern Operating Systems	Andrew S Tanenbaum	3rd edition	PHI
5	Principles of Operating Systems	B.L.Stuart		Cengage learning, India Edition
6	Operating Systems.	A.S. Godboie	2nd Edition	TMH

Code: BESCES1106 Computer Fundamentals & C Programming 3.0 Credits [LTP: 3-0-0]

COURSE OUTCOMES

Students will be able to:

CO106.1: Having the basic knowledge of programming paradigm, fundamentals of computer and peripherals and thus being prepared with the programming spectrum in depth as desired.

CO106.2: Student will be able to effectively solve any real life problem and lead the exploration of new application techniques for their use.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction of Computer Systems	8
2.	Introduction of C	5
3.	Operators and Expressions	6
4.	Control Structures	8
5.	Arrays, Strings and Functions	9

A. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction of Computer Systems**
	Definition of a Computer, History of Computers, Generations of Computers, types of computer – based on size and working principle, Block diagram of a Computer with functional units (explanation), Parts of a computer system, Information processing Cycle. Definition of software and hardware, types of programming languages, assembler, compiler, interpreter, linker, loader (Definitions only),number system – decimal, binary, octal and hexadecimal number, inter conversion of decimal to binary and vice versa. ASCII codes. Algorithm-definition, Characteristics, notations. Flowchart-definition, Symbols used in writing the flow-chart Writing an algorithm and flow-chart of simple problems.
2.	Introduction of C
	Introduction to C, features of C , basic C program structure, character set, tokens, keywords and identifiers. Constants, variables, data types, variable declaration, symbolic constant definition.
3.	Operators and Expressions
	C operators- arithmetic, relational, logical, bitwise, assignment, increment and decrement, conditional (?:) and special operators, Arithmetic expressions, precedence of operators and associatively. Type conversions, mathematical functions Definition of macro and pre-processor directives, Managing I/O operation – reading and writing a character, formatted and unformatted/O functions.
4.	Control Structures
	Conditional control statements- if, if-else, nestedif, switch, go to statement, while, do-while and for statements. Unconditional control statements- break, continue and return statements(definition and explanation with syntax, flowchart and examples)
5.	Arrays, Strings and Functions
	Definitions of an array, types-one and two dimensional array Strings–definition, declaration and initialization of string variable, string handling functions Functions – definition, need, syntax for function declaration, function prototype, category of functions, nesting of functions, function with arrays, scope of variables , parameter passing mechanism- call by value and call by reference. Recursion and Recursive function

C. RECOMMENDED STUDY MATERIAL:

S.No	Reference Book	Author	Edition	Publication
1.	Let us C,	Yashwant Kanetkar	6th Edition	PBP Publication
2.	The C programming Language	Richie and Kenninghan	2004	Pearson education.
3.	Programming in ANSI C	Balaguruswamy	3rd Edition, 2005	TMH, Delhi
Web Material: http://www.programmingsimplified.com/c-program-examples http://en.wikipedia.org/wiki/C_%28programming_language%29				

Code: BESCES1201	ENVIRONMENTAL SCIENCE LAB	1.5 Credits [LTP: 0-0-3]

COURSE OUTCOMES

Students will be able to:

CO201.1: Design and carry out scientific experiments as well as accurately record and analyze the quality of water samples from different.

CO201.2: Impart the students a thorough knowledge of systematic qualitative analysis of wastewater samples and drinking water samples through physiochemical parameters.

CO201.3: Develop skills for qualitative analysis with the different instruments

CO201.4: Develop skills required for the qualitative analysis of water using chemical process.

CO201.5: Learn and apply basic techniques of sampling and preservation methods and significance of characterization of water and wastewater.

LIST OF EXPERIMENTS

1	Estimation of pH in the water sample
2	Estimation of Acidity in the water sample
3	Estimation of Alkalinity in the water sample
4	Estimation of Chloride in the water sample
5	Estimation of Free CO_2 in the water sample
6	Estimation of Residual chlorine in the water sample
7	Estimation of Total Hardness in the water sample.
8	Estimation of conductivity of the water sample.
9	Estimation of Total Dissolved Solids in the water sample
10	Estimation of Dissolved oxygen in the water sample
11	Qualitative estimation of Nitrate
12	Qualitative estimation of Phosphate

Code: BESCES1202	CHEMISTRY LAB	1.5 Credits [LTP: 0-0-3]

COURSE OUTCOMES

Students will be able to:

CO202.1: Design and carry out scientific experiments as well as accurately record and analyze the results of such experiments.

CO202.2: Impart the students a thorough knowledge of Systematic qualitative analysis of mixtures containing two acid and two basic radicals

CO202.3: Develop skills for quantitative estimation using the different branches of volumetric Analysis.

CO202.4: Develop skills required for the qualitative analysis of organic compounds

CO202.5: Learn and apply basic techniques used in the organic laboratory for preparation, purification and identification of organic compounds.

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: BESCES1203 C PROGRAMMING LAB 1.5 Credits [LTP: 0-0-3]

COURSE OUTCOMES:

Student will be able to:

CO203.1: To design an algorithmic solution to a problem using problem.
CO203.2: To define and drive the steps involved in problem solving.
CO203.3: To solve abstract and complex problems using modular design methodology.
CO203.4: To learn creation of C Language programming of give problem.
CO203.5: To development of C programs based on static and dynamic memory allocation.

A. List of Programs

Part A	
	1. Find biggest number among 4 given numbers 2. Arithmetic operations using switch statement. 3. Find the Fibonacci series between M and N. 4. Prime numbers between M and N 5. Binary to Decimal conversion 6. Sorting an unsorted array 7. Searching an element in an array. 8. Addition of two matrices 9. Find the factorial of a number using function. 10. Accept N words and make it as a sentence by inserting blank spaces and a full stop at the end. 11. Printing the reverse of a string.
Part B	
	12. Searching an element in an array using pointers. 13. Checking whether the given matrix is an identity matrix or not 14. Addition and subtraction of two matrices. 15. Multiplication of two matrices. 16. Reverse of an integer. 17. Odd and even series of N numbers. 18. Get a string and convert the lowercase to uppercase and vice--versa using getchar() and putchar().

Code: BESCHM1107	ENGLISH	2 Credits [LTP: 2-0-0]

COURSE OUTCOME

The student will be able to:

CO107.1: Understand the mechanism of language and linguistic creativity to communicate with each other.

CO107.2 Apply writing skills effectively for a variety of professional and social communication

CO107.3: Understand the importance of intonation, word and sentence stress for improving communicative competence and foster social and emotional Learning.

CO107.4: Apply writing skills effectively for a variety of professional and social communication.

CO107.5: Understand the structured conversation to make their point of views clear to the listeners by reading short stories written in English.

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

A. 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

B. 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, Usage and Composition	Shiv K. Kumar & Hemalatha Nagarajan	Latest	Pearson, New Delhi, 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: BESCES1601	Talent Enrichment Programme (TEP-I)	1 Credit

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 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.

Code: BULCSA2101	ENVIRONMENTAL STUDIES	2.0 Credits [LTP: 2-0-0]

COURSEOUTCOMES

Students will be able to:

CO101.1: Understand the scope of environmental studies and explain the concept of ecology, ecosystem and biodiversity.
CO101.2: Implement innovative ideas of controlling different categories of Environmental Pollution.
CO101.3: Explain different environmental issues together with various Environmental Acts, regulations and International Agreements.
CO101.4: 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.
CO101.5: Determine the local environmental assets with simple ecosystems and identify local flora and fauna.

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**	Erach Barucha	Latest	UGC
2	Environmental Studies	Benny Joseph	Latest	Tata Mcgraw Hill
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: BESCES2101 ENVIRONMENTAL MICROBIOLOGY 3.0 Credits [LTP: 3-0-0]

COURSE OUTCOMES

Students will be able to:-

CO101.1: Point out the Classification, types of microorganism and Microbial growth curve such as lag phase, acceleration phase, exponential phase, deceleration phase, stationary phase, death phase

CO101.2: Demonstration the Positive and negative interactions of microorganism like Mutualism, Parasitism, Amensalism, Competition, Predation, Protocooperation.

CO101.3: Produce Microbial habitat in the aquatic environment and Microbial characteristics of fresh and marine water.

CO101.4: Point out the sources, habitat, communities and survival conditions of microbial in air.

CO101.5: Point out the habitat and different Microbial biogeochemical cycling like Carbon cycle, Nitrogen cycle, Sulphur cycle, Phosphorus

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	**Growth and Distribution of Microorganisms in the Environment**	**7**
2.	**Basics of Microbial Interactions in the Environment**	**9**
3.	**Microbiology of Water**	**6**
4.	**Microbiology of Air**	**7**
5.	**Microbiology of Soil**	**7**

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Growth and Distribution of Microorganisms in the Environment**
	• Introduction of the Unit • Basic Classification of microorganisms • Types of microorganism on the basis of nutrition • Factors affecting microbial growth(Temperature, pH, Oxygen concentration, Pressure and radiation) • Microbial growth curve (Lag phase, acceleration phase , exponential phase, deceleration phase, stationary phase, death phase) • Conclusion & Real Life Application
2.	**Basics of Microbial Interactions in the Environment**
	• Introduction of the Unit • Interaction among the microbial populations (Positive and negative interactions) • Mutualism • Parasitism • Amensalism • Competition • Predation • Protocooperation

	• Commensalism • Mycorrhizae-Ectomycorrhizae and Endomycorrhizae • Conclusion & Real Life Application
3.	**Microbiology of Water**

	• Introduction of the Unit
	• Microbial habitat in the aquatic environment
	  o Planktonic environment
	  o Benthic habitat
	  o Microbial mats
	  o Biofilms
	• Microbial characteristics of fresh and marine water
	• Conclusion & Real Life Application

4.	**Microbiology of Air**
	• Introduction of the Unit • Sources of microorganisms in air • Physical/Microbial habitats in air • Microbial communities in air • Factors affecting microbial survival in air • Conclusion & Real Life Application
5.	**Microbiology of Soil**
	• Introduction of the Unit • Soil habitat (Lithosphere) • Microbial biogeochemical cycling • Carbon cycle • Nitrogen cycle • Sulphur cycle • Phosphorus • Rhizosphere • Conclusion & Real Life Application

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	*Introduction to Biodeterioration*	Dennis Allsopp, K. J.	2004	*(2nd ed.).* Cape Town, South Africa: Cambridge University Press.
2.	*Environmental microbiology: principles and applications.*	Jjemba, P. K.	2004	Science Publishers
3.	*Microbial Ecology*	Barton, L., D. E.	2011	New Jersey: JOHN WILEY & SONS, INC., PUBLICATION
4.	*Textbook of Environmental Environmental Microbiology.*	Mohapatra, P. K.	2008	New Delhi: I. K. International Publishing House.
5.	*Microbiology*	Prescott, L. M.	2002	The McGraw−Hill Companies
6.	*Microbial Ecology: Fundamental and Applications*	Atlas, R.M., R. B.	2005	*(4th ed.).* New Delhi: Pearson Education Pvt. Ltd.
7.	*Environmental Microbiology*	Srivastava, M.	2008	Shree Publishers & Distributors.

Code: BESCES2102 NATURAL RESOURCE CONSERVATION 3.0 Credits [LTP: 3-0-0]

COURSE OUTCOMES

Students will be able to:

CO102.1: Point out the ecological processes, including human impacts that influence ecosystems change, natural succession and the future sustainability of natural resources.
CO102.2: Point out the profile, types, degradation, conservation of soil and forest resources in India.
CO102.3: Introduce to water sources, and water conservation methods like watershed management, rainwater harvesting.
CO102.4: Point out the Types, recourses, Environmental impact of Minerals
CO102.5: Point out the non-renewable energy resources and renewable energy resources.

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	**Introduction to Natural Resources**	7
2.	**Land Resources**	7
3.	**Water Resources**	6
4.	**Mineral Resources**	9
5.	**Energy Resources**	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction to Natural Resources**
	• Introduction of the Unit • Classification-Based on Chemical nature, Availability/Abundance, Occurrence, Origin, Utility • Sustainable Development- Concept and Basic aspects • Agenda 21: Salient features • Conclusion & Real Life Application
2.	**Land Resources**
	• Introduction of the Unit • Soil and its characteristics • Soil Profile • Types of soil in India • Soil degradation (Physical and chemical) • Soil conservation • Forest resources of India- Forest types and distribution • Importance and Conservation of forest • Conclusion & Real Life Application
3.	**Water Resources**

	• Introduction of the Unit • Sources and use of water(Surface and Ground water) • Water conservation- • Watershed management • Rainwater harvesting (Paar system. Talab / Bandhis, SazaKuva, Johad, Pat,Naada / Bandha,Chandela Tank, Bundela Tank, Kunds / Kundis, Kuis / Beris, Jhalaras, Nadis, Tobas) • Conclusion & Real Life Application
4.	**Mineral Resources**
	• Introduction of the Unit • Types of Minerals (metallic and non metallic) • Uses of mineral resources • Environmental Impacts of mining • Conclusion & Real Life Application
5.	**Energy Resources**
	• Introduction of the Unit • Classification of energy resource: Conventional and Non-conventional • Non-renewable energy resources: fossil fuels(coal, oil and natural gas) • Renewable energy resources: Hydroelectric power, Tidal power, wind power, biomass and solar energy • Conclusion & Real Life Application

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	*Global Environmental Negotiations I: Green Politics*	Agarwal, A., Narain, S., & Sharma, A.	1999	New Delhi: Centre for Science and Envionment
2.	*Beyond Rio*	Ahmaob, I., & Deloman, J.	1995	Macmillan.
3.	*Encyclopedia of Environment: Environmental Problems and Policies*	Field, B.	2005	*Vol, I and II.* New Delhi: Anmol Publications.
4.	*Environmental Problems and the United Nations*	Khanna, G. N.	1990	New Delhi: Ashish Publishing House
5.	*Our Common Future, Report of the OECD.*	-	1987	Oxford University Press.
6.	*Natural Resource Conservation-An Ecological Approach.*	Owen, S.	2008	-

Code: BESCES2103	ORGANIC CHEMISTRY	3.0 Credits [LTP: 3-0-0]

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.

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: BESCES2104	PHYSICAL CHEMISTRY	3.0 Credits [LTP: 3-0-0]

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.

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: BESCES2105 DATA STRUCTURE & ALGORITHM 3.0 Credits [LTP: 3-0-0]

COURSE OUTCOMES

Students will be able to:

CO105.1Implement the concept of Dynamic memory management, data types, algorithms, Big O notation.

CO105.2: Discuss basic data structures such as arrays, linked lists, stacks and queues.

CO105.3: Describe the hash function and concepts of collision and its resolution methods

CO105.4: Solve problem involving graphs and trees.

CO105.6: Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	**Stack**	**8**
2.	**Queue and Linked List**	**8**
3.	**Searching Techniques**	**8**
4.	**Tree**	**8**
5.	**Graphs and Hashing**	**6**

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Stack**
	• Introduction of unit • Definition of Data Structure and types with examples • Time complexity and Notations, Basic Stack Operations • Representation of a Stack using Static Array and Dynamic Array • Stack Applications: Reversing list, Factorial Calculation, Infix to postfix Transformation, Evaluating Arithmetic Expressions and Towers of Hanoi. • Conclusion & Real life applications
2.	Queue and Linked List
	• Introduction of unit • Definition and example, operations on queues, types of queue • Sequential representation,disadvantages of ordinary queue, circular queue and priority queue (concepts only) • Linked list–Definitions and types of lists, operations on Singly linked list, stack and queueimplementation using linked list • Circular and doubly linked list (concepts only) • Conclusion & Real life applications
3.	**Searching Techniques**
	• Introduction of unit • Sequential and binary search. Sorting Techniques: Basic concepts, • Sorting by: bubble sort, Insertionsort, selection sort, quick sort • Heap sort, merge sort, radix sort and counting sorting algorithms • Conclusion & Real life applications
4.	**Tree**

	• Introduction of unit • Tree definition, representation, types of tree • Tree terminologies with an example, Binary tree, linkedlist representation of binary tree • Tree traversals, binary search tree and its applications • Conclusion & Real life applications
5.	**Graphs and Hashing**
	• Introduction of unit • Graphs: Basic concepts, Different representations of Graphs, Graph Traversals (BFS & DFS),Minimum Spanning Tree (Prims &Kruskal), Dijkstra's shortest path algorithms • Hashing: Hash function, Address calculation techniques, Common hashing functions • Collisionresolution: Linear and Quadratic probing, Double hashing • Conclusion & Real life applications

C. RECOMMENDED STUDY MATERIAL:

S.No	Reference Book	Author	Edition	Publication
1	Data Structures and Algorithm Analysis in C	Weiss	II Edition,	Pearson Education, 2001
2	Schaum's outline series Data structures	Lipschutz		Tata McGraw-Hill
3	Data Structures and program designing using 'C'	Robert Kruse		Pearson Education,
4	Programming in ANSI C.	E. Balaguruswamy		Tata McGraw- Hill
5	Data Structures Using C	Bandyopadhyay	1999	Pearson Education,
6	Data Structures Using C	Tenenbaum	200	Pearson Education,

Code: BESCES2106	COMPUTER NETWORKS	3.0 Credits [LTP: 3-0-0]

COURSE OUTCOMES

Students will be able to:

CO106.1: analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies
CO106.2: specify and identify deficiencies in existing protocols, and then go onto formulate new and better protocols
CO106.3: analyze, specify and design the topological and routing strategies for an IP based networking infrastructure
CO106.4: Have a working knowledge of datagram and internet socket programming

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction	8
2.	Application layer	8
3.	Transport Layer	8
4.	Network Layer	8
5.	Data Link Layer	6

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction of Computer Network**
	• Introduction of unit • Definition and goals of computer network. • Types of Networks- Broadcast, point- to -point , LAN, WAN, MAN, network topologies • Wireless network example, Internet and its applications OSI model and TCP/IT model • Conclusion & Real life applications
2.	**Application layer**
	• Introduction of unit • Application Layer: Principles of computer applications • Web and HTTP, E-mail • DNS, Socket programmingwith TCP and UDP • Conclusion & Real life applications
3.	**Transport Layer**
	• Introduction of unit • Transport Layer: Introduction and transport layer services, Multiplexing and Demultiplexing • Connection lesstransport (UDP), Principles of reliable data transfer, Connection oriented transport (TCP), Congestion control • Conclusion & Real life applications
4.	**Network Layer**
	• Introduction of unit • Network Layer: Introduction, • Virtual and Datagram networks, study of router, IP protocol and addressing inthe Internet • Routing algorithms, Broadcast and Multicast routing. • Conclusion & Real life applications

5.	Data Link Layer
	• Introduction of unit • The Link layer: Introduction and link layer services • Error-detection and correction techniques • Multipleaccess protocols, addressing, Ethernet, switches. • Conclusion & Real life applications

C. RECOMMENDED STUDY MATERIAL:

S.No	Reference Book	Author	Edition	Publication
1	Computer Networking- A Top-Down approach	Kurose and Ross	, 5th edition	Pearson Education, 2001
2	Computer Networks- A Top-Down approach	Behrouz Forouzan		Tata McGraw-Hill
3	Computer Networks	Andrew Tanenbaum	(4th edition),	Prentice Hall
4	Computer Networking and the Internet	Fred Halsall	(5th edition	Addison Wesley
5	Data Communications and Networking	Behrouz Forouzan,	(4th edition)	McGraw Hil

Code: BESCES2201 ENVIRONMENTAL SCIENCE LAB 1.5 Credits [LTP: 0-0-3]

COURSE OUTCOMES

Students will be able to:

CO201.1: Design a vegetation of local area/University campus and Herbarium preparation.
CO201.2: Impart the students a thorough knowledge of systematic analysis of component in plant leaves.
CO201.3: Develop skills for qualitative and quantitative analysis with the different instruments
CO201.4: Develop skills required for the qualitative and quantitative analysis in fieldwork.
CO201.5: Learn and apply basic techniques for vegetation study in field.

LIST OF EXPERIMENTS

S.No.	**Experiments**
1.	Study of vegetation of local area/University campus and Herbarium preparation
2.	To find out minimum size and number of the quadrat for vegetation study
3.	Study of vegetation density, frequency and abundance by quadrat method
4.	Study of dominance of plant species by quadrat method
5.	To calculate the leaf area index
6.	To calculate percent leaf injury
7.	Estimation of chlorophyll content in leaves
8.	Determination of moisture percentage in soil
9.	Determination of organic carbon in soil
10.	Determination of pH of in soil

Code: BESCES2202	CHEMISTRY LAB	1.5 Credits [LTP: 0-0-3]

COURSE OUTCOMES

Students will be able to:

CO202.1: Identify the physical and chemical properties of common organic functional groups.

CO202.2: Learn the concept of separating the mixture

CO202.3: Become familiar with instrumental analysis techniques in chemistry.

CO202.4: Understand the concept of surface tension and viscosity

CO202.5: Understand the states of matter

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: BESCES2203	DATA STRUCTURE LAB	1.5 Credits [LTP: 0-0-3]

COURSE OUTCOME:
Student will be able to:

CO203.1: Select appropriate data structures as applied to specified problem definition.
CO203.2: Implement operations like searching, insertion, and deletion, traversing mechanism etc. on various data structure.
CO203.3: Implement appropriate sorting/searching technique for given problem.
CO203.4: Solve problem involving graphs, trees and heaps
CO203.5: Determine and analyze the complexity of given Algorithms.

LIST OF EXPERIMENTS:

Part A	
	1. Write a simple C program on a 32 bit compiler to understand the concept of array storage, size of a word. Find the address of an element and verify it with the theoretical value. 2. Simulate a stack, queue, circular queue and dequeue using a one dimensional array as storage element. 3. Represent a 2-variable polynomial using array. 4. Represent a sparse matrix using array.
Part B	
	1. Implement singly, doubly and circularly connected linked lists 2. Repeat exercises 2, 3 & 4 with linked structure. 3. Implementation of binary tree with operations like addition, deletion, traversal. 4. Depth first and breadth first traversal of graphs represented using adjacency matrix and list. 5. Implementation of binary search in arrays and on linked Binary Search Tree. Implementation of different sorting algorithm like insertion, quick, heap, bubble

Code: BESCES2601	Talent Enrichment Programme (TEP-II)	1 Credit

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 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.

Code: BESCES3101 ENVIRONMENTAL POLLUTION AND CONTROL-I 3.0 Credits[LTP: 3-0-0]

COURSE OUTCOMES

Students will be able to:

CO101.1: Explore the nature and types of air pollutants and their effects on environment and human health.
CO101.2: Point out the different methods of air pollution control and equipment to control air pollution.
CO101.3: Explore the nature and types of water pollutants and their effects on environment and human health.
CO101.4: Point out the different treatment and control methods for water pollution.
CO101.5: Explore the nature and types of noise pollutants and their effects on environment and human health.

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Air Pollution and its Effects	7
2.	Air Pollution Control Methods	7
3.	Water Pollution and its Effects	8
4.	Drinking Water & its Treatment Methods	6
5.	Noise Pollution and its Control	8

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Air Pollution and its Effects**
	• Introduction of the Unit • Nature of pollutants: Biological, Chemical and Physical • Types of air pollutants; their characteristics and sources • Effects of major air pollutants(SOx, NOx, CO_2, O_3 PAN, PM_{10} & PM $_{2.5}$) • Conclusion & Real life applications
2.	**Air Pollution Control Methods**
	• Introduction of the Unit • Basic methods of air pollution control (Reduction at source, change of process) • Equipment used to control air pollution & their working principals • Cyclones, • ESP • fabric filters • Wet scrubbers • Conclusion & Real life applications

3.	**Water Pollution and its Effects**
	• Introduction of the Unit • Sources and types of water pollutants (Inorganic, organic, O_2 demanding, thermal, plant nutrients, sediments, radioactive and infectious agents) • Effects of water pollutants on human health and environment • Conclusion & Real life applications
4.	**Drinking Water & its Treatment Methods**
	• Introduction of the Unit • Potable drinking water • Treatment methods • Coagulation • Flocculation, • Filtration and • Disinfection • Conclusion & Real life applications
5.	**Noise Pollution and its Control**
•	• Introduction of the Unit • Major sources of Noise pollution • Effects of noise pollution on human health • Control of noise pollution • Conclusion & Real life applications

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	*Living In The Environment*	Miller, T.G., S. E.	2012	*(17th Ed.).* Usa: Brooks/Cole Cenage Learning.
2.	*Environmental And Pollution Science*	Pepper, I., C. P.	2006	*(2nd Ed.).*Academic Press
3.	*Environmental Pollution And Control*	Pierce, J., R. E.	1998	Usa: Butterworth-Heinemann (Elsevier)
4.	*Environmental Chemistry*	Kaur, H.	2014	*(8th Ed.).* Meerut: Pragati Prakashan.
5.	*Air Pollution.*	Rao, M.N., H. R.	1989	New Delhi: Tata Mcgraw Hill Publishing Company Limited
6.	*Environmental Science: A Global Concern*	Cunningham, W. P., & Cunningham, M. A.	2012	*(12th ed.).* The McGraw-Hill Companies, Inc.

Code: BESCES3102 BIODIVERSITY AND WILDLIFE 3.0 Credits [LTP: 3-0-0]

COURSE OUTCOMES

Students will be able to:

CO102.1: Point out the definition, types and importance of biodiversity and introduce to heritage, hotspots, and hope spots of biodiversity in India, like Ramsar sites.
CO102.2: Point out the extinction of species, methods of conservation of biodiversity and national parks, sanctuaries and biosphere reserves.
CO102.3: Introduce to wildlife in historical perspective and wildlife habitats.
CO102.4: Point out conservation projects, red data book and practice exercise of wild life in Rajasthan
CO102.5: Introduce to different laws enacted for wildlife and biodiversity

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	**Introduction to Biodiversity**	5
2.	**Biodiversity Conservation**	8
3.	**Introduction to Wildlife**	8
4.	**Wildlife Management and Conservation**	8
5.	**Laws Enacted for Wildlife and Biodiversity**	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction to Biodiversity**
	• Introduction of the Unit • Definition and Types – Genetic, Species and Ecosystem Diversity(α, β and γ) • Importance - ecological, consumptive, productive, social, ethical and aesthetic • Key Biodiversity areas; Biodiversity heritage sites • Hotspots and hope spots in India • Introduction to Ramsar convention, Ramsar sites in India • Conclusion & Real life applications
2.	**Biodiversity Conservation**
	• Introduction of the Unit • Causes of loss of Biodiversity • Extinction of species –causes; examples of extinct species in India • Methods of Conservation (*in situ* and *ex situ*) • Protected areas-National parks ,sanctuaries and biosphere reserves, community and conservation reserves • Role of biotechnology in biodiversity conservation • Conclusion & Real life applications
3.	**Introduction to Wildlife**

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	*Global Environmental Issues*	Agarwal, A., Narain, S. and Sharma, A.	1999	New Delhi: Centre for Science and Environment
2.	*The Biodiversity of India.*	Bharucha, E.		Ahmedabad: Mapin Publishing Pvt. Ltd.
3.	*A Guide to the Convention on Biological Diversity*	Glowka, L. Guilmin, F. B. and Synge, H.	1994	IUCN Gland Switzerland and Cambridge, UK
4.	*Global Biodiversity.Status of the earth's Living Resources*	Groombridge, B.	1992	London, UK: WCMC.
5.	*Encyclopedia of Indian Natural History*	Hawkins, R. E.	1987	Bombay Natural History Society:OUP India
6.	*Global Biodiversity Assessment*	Heywood, V. H. and Waston, R.T.	1995	Cambridge: Univ. Press.
7.	*Understanding Biodiversity*	Kothari, A.	1997	New Delhi: Orient Longman.
8.	*Wildlife Conservation and Management*	Mathur, R.	2014	Meerut: Rastogi Publications

4. Wildlife Management and Conservation

- Introduction of the Unit
- Conservation projects- Project Tiger, Lion, Elephant, Rhino, Hoolock gibbon
- Red Data Book and categories to evaluate-Extinct, Extinct in the wild, Critically endangerd, Endangered, Vulnerable, Near Threatened, least concerned, Data deficient and not Evaluated
- Wild life in Rajasthan- Names and location of National Parks, tiger reserves and major sanctuaries
- Conclusion & Real life applications

5. Laws Enacted for Wildlife and Biodiversity

- Introduction of the Unit
- Wildlife (Protection) Act,1972
- Convention on Biological Diversity (CBD)
- Man And Biosphere (MAB) program me
- Conclusion & Real life applications

Code: BESCES3103	INORGANIC CHEMISTRY	3.0 Credits [LTP: 3-0-0]

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.

A. 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

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Corrosion**
	• Introduction of the Unit • **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 & Real life applications
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 & Real life applications
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 & Real life applications
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 & Real life applications
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 & Real life applications

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: BESCES3104	PHYSICAL CHEMISTRY	3.0 Credits [LTP: 3-0-0]

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.

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 & Real life applications
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 & Real life applications
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 & Real life applications
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 & Real life applications
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 & Real life applications

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: BESCES3105 COMPUTER ORGANIZATION AND ARCHITECTURE 3.0 Credits [LTP: 3-0-0]

COURSE OUTCOME:
Student will be able to:

CO105.1: understand and the use of basic concepts of Computer components.
CO105.2: understand the concept of memory hierarchy and the use of various input-output devices.
CO105.3: understand the various computer languages, operating system functions and the application of number systems.
CO105.4: understand the basic Computer Networking principles and the applications of WWW, multimedia and the usage of electronic mail.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	**Register Transfer and Micro-operation**	8
2.	**Basic Computer Organization**	8
3.	**Micro Programmed Control Unit**	8
4.	**Computer Arithmetic**	6
5.	**Modes of Data Transfer and Memory Organization**	6

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Register Transfer and Micro-operation**
	• Introduction of the Unit • Register Transfer Language, Register Transfer, Bus and Memory Transfer: Three state bus buffers, Memory Transfer. • Arithmetic Micro-operations: Binary Adder, Binary Adder-Subtrator, Binary Incrementor, • Logic Micro-operations: List of Logic micro operations, Shift Micro-operations (excluding H/W implementation), Arithmetic Logic Shift Unit. • Conclusion & Real life applications
2.	**Basic Computer Organization**
	• Introduction of the Unit • Instruction Codes, Computer Registers: Common bus system, Computer Instructions: • Instruction formats, Instruction Cycle: Fetch and Decode, Flowchart for Instruction cycle, Register reference instructions. • Conclusion & Real life applications
3.	**Micro Programmed Control Unit**
	• Introduction of the Unit • Control Memory, Address Sequencing, Conditional branching, Mapping of instruction, Subroutines. • Design of Control Unit, Central Processing Unit: Introduction, General Register Organization, • Stack Organization: Register stack, Memory stack; Instruction Formats, Addressing Modes. • Conclusion & Real life applications
4.	**Computer Arithmetic**

	• Introduction of the Unit • Introduction, Addition and Subtraction, • Multiplication Algorithms (Booth algorithm), Division Algorithms, • Input – Output Organization: Peripheral devices, Input – Output interface, Introduction of Multiprocessors: Characteristics of multi-processors. • Conclusion & Real life applications
5.	**Modes of Data Transfer and Memory Organization**
	• Introduction of the Unit • Modes of Data Transfer: Priority Interrupt, Direct Memory Access, • Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, • Associative Memory, Cache Memory, Virtual Memory • Conclusion & Real life applications

C. RECOMMENDED STUDY MATERIAL:

Sr. No	Reference Book	Author	Publication
1.	Computer System Architecture	Morris Mano	PHI
2.	Computer Organization and Architecture	William Stallings	PHI
3.	Digital Computer Electronics:	An Introduction to Microcomputers by Malvino	TMH

Code: BESCES3106 WEB DEVELOPMENT 3.0 Credits [LTP: 3-0-0]

COURSE OUTCOME:

CO106.1: Explain the history of the internet and related internet concepts that are vital inunderstanding web development.

CO106.2: Discuss the insights of internet programming and implement complete application overthe web.

CO106.3: Demonstrate the important HTML tags for designing static pages and separate design from content using Cascading Style sheet.

CO106.4: Utilize the concepts of JavaScript and Java.

CO106.5: Use web application development software tools i.e., Ajax, PHP and XML etc. and identifythe environments currently available on the market to design web sites.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	**Introduction to the Internet and the World Wide Web**	8
2.	**HTML & CSS**	8
3.	**XML and HTML5, CSS3**	8
4.	**PHP Server side scripting**	6
5.	**Practical website development**	6

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction to the Internet and the World Wide Web**
	• Introduction of the Unit • History of internet, Internet Design Principles, Internet Protocols - FTP, TCP/IP,SMTP, Telnet, etc., Client Server Communication, Web System architecture • Evolution of the Web, Web architectures, Web clients and servers, Static and Dynamic Web Applications, Front end and back end web development. • HTML, CSS, JS, XML; HTTP, secure HTTP, etc; URL, Web Services – SOAP, REST • Conclusion of the Unit
2.	**HTML & CSS**
	• Introduction of the Unit • Introduction to Html, Html Document structure, Html Editors, Html element/tag & attributes, Designing simple page - Html tag, Head tag, Body tag; • More Html tags - Anchor tag, Image tag, Table tag, List tag, Frame tag, Div tag ; Html forms - Input type, Text area, Select , Button, Images. • Introduction to CSS, Syntax, Selectors ,Embedding CSS to Html, Formatting fonts, Text & background colour, Inline styles, External and Internal Style Sheets, Borders & boxing • Conclusion of the Unit
3.	**XML and HTML5, CSS3**
	• Introduction of the Unit • Introduction to XML, Difference b/w Html & XML, XML editors, XML Elements & Attributes XML DTD, XML Schema, XML Parser, Document Object Model (DOM), XML DOM. • Introduction to HTML5, CSS3, New features, Local storage, Web Sockets, Server events, Canvas,

	Audio & Video, Geolocation, Microdata, Drag and Drop. Browser life cycle and browser rendering stages. Service workers
4.	**PHP Server Side Scripting**
	• Introduction of the Unit • Introduction to PHP, Basic Syntax, Variables, constants and operators, Loops, Arrays Strings, • Environment & environment variables, responding to HTTP requests, Files, Cookies, Sessions, Examples. • Conclusion of the Unit
5	**Practical Website Development**
	• Introduction of the Unit • Commonly used Web Servers and browsers, Setting up a server and domain name, website types and structures, • Web authoring tools, Web hosting, website maintenance, generating traffic to your website. • Conclusion of the Unit

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Book	Author	Publication
1.	Practical Web Design for Absolute Beginners	Adrian W. West	Apress 2016
2.	Introducing Web Development	Jorg Krause	Apress 2017
3.	HTML & CSS: The Complete Reference	Thomas Powell	McGraw Hill, Fifth Edition, 2010
4.	Creating a Website: The Missing Manual	Mathew Macdonald. O'Reilly	3rd Edition

Code: BESCES3201	ENVIRONMENTAL SCIENCE LAB	1 Credits [LTP: 0-0-2]

COURSE OUTCOMES

Students will be able to:

CO201.1: Learn and apply basic techniques used for air, water and soil pollution analysis.
CO201.2: Select spectroscopic methods for measurement of pollution in air and water.
CO201.3: Assess the Particulate Matter in air through laboratory experiment.
CO201.4: Elucidate Non-respirable and respirable dust in air
CO201.5: Acquire the ability to understand, explain and use instrumental techniques for pollution analysis.

1.	Measurement of Noise using Sound Level Meter (Field Practical).
2.	Determination of Particulate Matter (PM10) in ambient air (Gravimetric Method)
3.	Determination of PM2.5 in ambient air (Gravimetric Method)
4.	Analysis of sulphur dioxide in ambient air (Imporved Westand Gaeke Method)
5.	Analysis of Nitrogen dioxide in ambient air (Modified Jacob and Hochheiser Method)
6.	Analysis protocol for ozone in ambient air (Chemical Method)
7.	Analysis protocol for ammonia in ambient air (Indophenol Method)
8.	Analysis of Lead in ambient air (Atomic Absorption Spectrophotometer Method)
9.	Determination of Iron and Manganese in Water
10.	Determination of B.O.D. of Wastewater Sample
11.	Determination of COD in Water
12.	Determination of Fluoride in Water

Code: BESCES3202	CHEMISTRY LAB	1 Credits [LTP: 0-0-2]

COURSE OUTCOMES

Students will be able to:

CO202.1: Learn and apply basic techniques used in chemistry laboratory for water analyses and purification.
CO202.2: Select lubricants for various purposes.
CO202.3: Assess the quality of different varieties of coal sample.
CO202.4: Elucidate kinetics and solubility product of sparingly soluble salts and their applications.
CO202.5: Acquire the ability to understand, explain and use instrumental techniques for chemical analysis.

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: BESCES3203 WEB DEVELOPMENT LAB 1 Credits [LTP: 0-0-2]

COURSE OUTCOME:

Student will be able to:

CO203.1: Explain the history of the internet and related internet concepts that are vital in understanding web development.

CO203.2: Discuss the insights of internet programming and implement complete application over the web.

CO203.3: Demonstrate the important HTML tags for designing static pages and separate design from content using Cascading Style sheet.

CO203.4: Utilize the concepts of JavaScript and Java

CO203.5: Use web application development software tools i.e. Ajax, PHP and XML etc. and identify the environments currently available on the market to design web sites.

LIST OF EXPERIMENTS:

Part A	
	1. Hello World Web Page a) Create a web page using basic HTML features like tags, attributes, elements and page title. b) How to install, and configure a web server 2. Create a My Profile Page a) A more functional web page by making use of headings, paragraphs, lists, images and links. b) Design a web page using CSS include the following: i. Use different font styles. ii. Set background image for both the page and single elements on the page. 3. Create a My Profile Page a) Using textboxes, check boxes, radio buttons and submit buttons. b) Design a web page using CSS include the following: i. Control the repetition of image with background-repeat property. ii. Define style for links as a: link, b: active, c: hover, d: visited. iii. Add customized cursors for links. 4. Create XMLHttpRequest and retrieve data from a text file and an XML file. 5. Create the following webpage: a) Show the class timetable in a tabular format. b) Create a webpage using HTML to show your geolocation. 6. Create a webpage using HTML for audio and video player.
Part B	
	7. Create a login registration form using PHP.

	8. Develop a PHP webpage to manipulating files such as creating, writing, reading and uploading. 9. Create a dynamic webpage by using PHP conditional operators, loops and strings to create an dynamic timetable page. 10. Develop a PHP web application track the user as how many times visited and last visited time 11. Develop a static website – I. 12. Develop a dynamic website –II

Code: BLUCHU3201	COMMUNICATION SKILLS-I	1 Credit [LTP: 0-0-2]

COURSE OUTCOMES

Students will be able to:

CO201.1: Demonstrate depth of understanding, observing complexity, improve insight and develop independent thought and persuasiveness.
CO201.2: Determine the main ideas of the text by using key details and compare & contrast the most important points with the help of their perspective.
CO201.3: Practice the qualities of writing style by applying the concepts of sentence conciseness, accuracy, readability, coherence and by avoiding wordiness or ambiguity.
CO201.4: Distinguish words and phrases as per their intonation patterns and interpret the audios based on different situations
CO201.5: Demonstrate the understanding of impactful conversational skills, presentation skills & telephonic conversation by considering the need of the audience.

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1	**Intrapersonal/Interpersonal Skills**	8
2	**Reading Skills**	2
3	**Writing Skills**	4
4	**Listening Skills**	2
5.	**Speaking Skills**	8

B. DETAILED SYLLABUS

LIST OF LABS	
1.	Self – Awareness & Self-Introduction
2.	Goal Setting: Ambition induced, interest induced or environment conditioned
3.	Cultivating Conversational Skills
4.	Role Plays : Selection of varied plots, characters & settings
5.	Reading skills I: Newspaper Reading & General Article Reading
6.	Writing Skills I: Story Making by jumbled words
7.	Understanding and Applying Vocabulary
8.	Listening Skills I: Types and practice by analyzing situational listening
9.	Speaking Skills I: JAM
10.	PowerPoint Presentation Skills-I
11.	Telephonic Etiquettes and Communication
12.	Recognizing, understanding and applying communication style (Verbal/Non-Verbal)

Code: BESCES3601	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 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.

Code: BESCES4101 Environmental Pollution And Control-II 3.0Credits[LTP: 3-0-0]

COURSE OUTCOME

The student would be able to:

CO101.1: Point out types, sources, effects and control of soil pollution.

CO101.2: Explore the nature and types of radiation pollution and their effects on environment and human health.

CO101.3: Explore the nature and types of thermal pollution and their effects on environment and human health.

CO101.4: Evaluate information about the Sewage composition and different types of anaerobic treatment System.

CO101.5: Point out the different types of aerobic sewage treatment systems

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	**Soil/Land Pollution and its Control**	8
2.	**Radiation Pollution and its Control**	7
3.	**Thermal Pollution and its Control**	7
4.	**Sewage & its Treatment-I**	7
5.	**Sewage & its Treatment-II**	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Soil/Land Pollution and its Control**
	• Introduction of the Unit • Major sources of soil pollution • Types and effects of soil pollutants (domestic and municipal waste, industrial and mining waste, agricultural waste, radioactive and chemical waste) • Control of soil pollution • Conclusion & Real life applications
2.	**Radiation Pollution and its Control**
	• Introduction of the Unit • Major sources of radiation pollution • Effects of radiation pollution • Conclusion & Real life applications
3.	**Thermal Pollution and its Control**
	• Introduction of the Unit • Sources and effects of thermal pollution • Control of radiation and thermal pollution • Conclusion & Real life applications
4.	**Sewage & its Treatment-I**

•	• Introduction of the Unit • Sewage composition and characteristics • Primary treatment, secondary treatment & tertiary treatment • Anaerobic Treatment System: Upflow anaerobic sludge blanket reactor (UASB), Anaerobic fluidized bed reactor (AFB) • Conclusion & Real life applications
5.	**Sewage & its Treatment-II**
	• Introduction of the Unit • Aerobic Treatment Systems: • Activated sludge process • Trickling filters • Rotating biological contactors • Moving Bed Biofilm Reactor MBBR • Sequencing batch reactor(SBR) • Conclusion & Real life applications

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	*Living In The Environment*	Miller, T.G., S. E.	2012	Usa: Brooks/Cole Cenage Learning
2.	*Environmental And Pollution Science*	Pepper, I., C. P.	2006	Academic Press
3.	*Environmental Pollution And Control*	Pierce, J., R. E.	1998	Usa: Butterworth-Heinemann (Elsevier)
4.	*Environmental Chemistry*	Kaur, H.	2014	Meerut: Pragati Prakashan
5.	*Air Pollution*	Rao, M.N., H. R.	1989	New Delhi: Tata Mcgraw Hill Publishing Company Limited
6.	*Environmental Science: A Global Concern*	Cunningham, W. P., & Cunningham, M. A.	2012	The McGraw-Hill Companies, Inc.

Code: BESCES4102 ENVIRONMENTAL LEGISLATION & CONTEMPORARY ENVIRONMENTAL ISSUES 3.0 Credits [LTP: 3-0-0]

COURSE OUTCOMES

Students will be able to:

CO102.1: Point out the global environmental problems like ozone layer depletion, greenhouse effect.
CO102.2: Discussion of the environmental protection act and need for environmental legislations.
CO102.3: Point out the water quality parameters of drinking water and Salient features of water(prevention and control of pollution) Act.
CO102.4: Point out the water quality parameters of drinking water and Salient features of air (prevention and control of pollution) Act.
CO102.5: Discussions for the protection of forests and national forest policy.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	**Global Environmental Problems**	7
2.	**Legal Provisions for Environmental Protection in India**	6
3.	**Legal Aspects of Water Pollution**	8
4.	**Legal Aspects of Air Pollution**	8
5.	**Protection of Forests**	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Global Environmental Problems**
	• Introduction of the Unit • Ozone layer depletion • Green House Effect • Acid rain • Smog • Deforestation • Desertification • Climate change • Conclusion & Real life applications
2.	**Legal Provisions for Environmental Protection in India**
	• Introduction of the Unit • Need for Environmental Legislations • Environment and constitution of India(Article 48 A and 51A) • Environmental Protection Act, 1986-Salient features and major objectives • Conclusion & Real life applications
3.	**Legal Aspects of Water Pollution**

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication

1.	*Living In The Environment*	Miller, T.G., S. E.	2012	Usa: Brooks/Cole Cenage Learning
2.	*Environmental And Pollution Science*	Pepper, I. L., C. P.	2006	Academic Press
3.	*Environmental Pollution And Control*	Pierce, J., R. E.	1998	Usa: Butterworth-Heinemann (Elsevier)
4.	*Environmental Chemistry*	Kaur, H.	2014	Meerut: Pragati Prakashan
5.	*Air Pollution*	Rao, M.N., H. R.	1989	New Delhi: Tata Mcgraw Hill Publishing Company Limited
6.	*Environmental Science: A Global Concern*	Cunningham, W. P. & Cunningham, M. A.	2012	The McGraw-Hill Companies, Inc.

4.	**Legal Aspects of Air Pollution**
	• Introduction of the Unit • Standard quality parameters of ambient Air • The Air (Prevention and Control of Pollution) Act, 1981-Salient features & major objectives • Conclusion & Real life applications
5.	**Protection of Forests**
	• Introduction of the Unit • Present status of forests in India • The National Forest Policy-Major objectives • The Forest(Conservation) Act,1980-Major objectives • Conclusion & Real life applications

Code: BESCES4103	INORGANIC CHEMISTRY	3.0 Credits [LTP: 3-0-0]

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.

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 & Real life applications
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 & Real life applications
3.	**Magnetic and Spectral properties of Transition Metal Complexes**

C. RECOMMENDED STUDY MATERIAL:

PU/SSH/B.Sc.(ECC/2021-24/Ist-6th Semester Syllabus, Oct. 2021

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	Pragati Prakashan

- **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 & Real life applications

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 & Real life applications

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 & Real life applications

Code: BESCES4104	ORGANIC CHEMISTRY	3.0 Credits [LTP: 3-0-0]

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.

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 & Real life applications
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, LiAIH4 and NaBH4 reductions, Use of acetals and 1,3-dithiane as protecting group. • Conclusion & Real life applications
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 & Real life applications
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 & Real life applications
5	**Amines and Diazonium Salts**
	• Introduction 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

- Mechanisms of nucleophilic substitution in nitroarcnes 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 & Real life applications

Code: BESCES4105 DATABASE MANAGEMENT SYSTEMS 3.0 Credits [LTP: 3-0-0]

COURSE OUTCOMES

Students will be able to:

CO105.1: Evaluate business information problem and find the requirements of a problem in terms of data.
CO105.2: Understand the uses the database schema and need for normalization.
CO105.3: Design the database schema with the use of appropriate data types for storage of data in database.
CO105.4: Use different types of physical implementation of database

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	**Introduction of Database Management System**	8
2.	**E-R Model**	5
3.	**Relational Model**	6
4.	**Database Design**	8
5.	**SQL**	9

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction of Database Management System**
	• Introduction of the unit • Introductory concepts of DBMS : Introduction and applications of DBMS • Purpose of data base, Data,Independence, Database System architecture- levels • Mappings, Database, users and DBA • Conclusion and real life application
2.	**E-R Model**
	• Introduction of the unit • Entity-Relationship model : Basic concepts, Design process, constraints, Keys • Design issues, E-R diagrams, weak entity sets, extended E-R features – generalization • Specialization, aggregation, reduction to E-R database schema Conclusion and real life application • Conclusion and real life application
3.	**Relational Model**
	• Introduction of the unit • Relational Model : Structure of relational databases, Domains, Relations • Relational algebra – fundamental operators and syntax, relational algebra queries, tuple relational calculus SQL Concepts : Basics of SQL, DDL,DML,DCL, structure – creation, alteration • Defining constraints – Primary key, foreign key, unique, not null, check, IN operator, Functions - aggregate functions, Built-in functions – numeric, date • String functions, set operations, Use of group by, having, order by, join and its types, Exist, Any, All , view and its types. transaction control commands – Commit, Rollback, Savepoint, Conclusion and real life application • Conclusion and real life application
4.	Database Design

	• Introduction of the unit • Relational Database design : Functional Dependency – definition, trivial and non-trivial FD • Closure of FD set,closure of attributes, irreducible set of FD, Normalization – 1Nf, 2NF, 3NF, Decomposition using FD- dependency preservation, BCNF • Multivalued dependency, 4NF, Join dependency and 5NF, Conclusion and real life application • Conclusion and real life application
5.	**SQL**
	• Introduction of the unit • SQL queries programming and Triggers: The Forms of a Basic SQL Query • Union, and Intersection and Except, Nested Queries, Correlated Nested Queries • Set-Comparison Operations, Null Values and Embedded SQL, Dynamic SQL, ODBC and JDBC, Triggers and Active Databases • Conclusion and real life application

C. RECOMMENDED STUDY MATERIAL:

S.No	Reference Book	Author	Edition	Publication
1.	Database System Concepts	Abraham Silberschatz, Henry F. Korth, S. Sudharshan	5th	McGraw-Hill Higher Education
2.	An Introduction to Database Systems	BipinCDesai	Latest	Galgotia Publications
3.	Fundamentals of database Systems	Elmasri,Navathe	3rd	Addison Wesley
4.	A First Course in Database Systems	JefreyD.Ulman,Jenifer Widom	Latest	Pearson Education Asia
5.	Modern Database Management	Fred R McFadden,JefferyA Hoffer,MaryB.Prescott	5th	Addison Wesley

Code: BESCES4106	SOFTWARE ENGINEERING	3.0 Credits [LTP: 3-0-0]

COURSE OUTCOME:

Students will be able to:

CO106.1: Plan a software engineering process life cycle, including the specification, design, implementation, and testing of software systems that meet specification, performance, maintenance and quality requirements

CO106.2: elicit, analyze and specify software requirements through a productive working relationship with various stakeholders of the project

CO106.3: Analyze and translate a specification into a design

CO106.4: Know how to develop the code from the design and effectively apply relevant standards and perform testing, and quality management and practice

1. CO106.5: use modern engineering tools necessary for software project management, time management and software reuse.

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: BESCES4201	**ENVIRONMENTAL SCIENCE LAB**	**1 Credits [LTP: 0-0-2]**

COURSE OUTCOMES

Students will be able to:

CO201.1: Have an idea of purification technique of water quality parameters.
CO201.2: Recognize the basic practical skills for the estimation of CO_2, O^2 in the drinking water.
CO201.3: Purify and separate impurities with special techniques.
CO201.4: Analyze and present experimental results and draw sound conclusions based on experimental evidence.
CO201.5: Exposed to the different processes used in water purification.

LIST OF EXPERIMENTS

1	Determination of Free CO_2 in the water sample
2	Determination of Dissolved oxygen in the water sample
3	Determination of C.O.D. of water Sample
4	Determination of B.O.D. of water Sample
5	Determine the Ammonical Nitrogen in water sample
6	Determination of the optimum dosage of coagulant requirement of waste water sample
7	Determination of Available Chlorine in Bleaching Powder
8	Estimation of Sulphate in water sample
9	Qualitative estimation of Nitrate in water sample
10	Qualitative estimation of Phosphate in water sample
11	Determination of Iron and Manganese in Water
12	Determination of total solids, settable solids and suspended solids.

Code: BESCES4202	CHEMISTRY LAB	1 Credits [LTP: 0-0-2]

COURSE OUTCOMES

Students will be able to:

CO202.1: Have an idea of estimation technique of various ions present in a mixture.
CO202.2: Recognize the basic practical skills for the synthesis and analysis of organic compounds.
CO202.3: Purify and separate compounds with special techniques.
CO202.4: Analyze and present experimental results and draw sound conclusions based on experimental evidence.
CO202.5: Exposed to the different processes used in industries and their applications

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: BESCES4203	DBMS LAB	1 Credits [LTP: 0-0-2]

COURSE OUTCOME:

Student will be able to:

CO203.1: Use a desktop database package to create, populate, maintain, and query a database.
CO203.2: use an SQL interface of a multi-user relational DBMS package to create, secure, populate, maintain, and query a database.
CO203.3: Formulate query, using SQL, solutions to a broad range of query and data update problems.
CO203.4: Analyze an information storage problem and derive an information model expressed in the form
CO203.5: Execute various advance SQL queries related to Transaction Processing & Locking using concept of Concurrency control.

LIST OF EXPERIMENTS:

1. Design a Database and create required tables. For e.g. Bank, College Database
2. Apply the constraints like Primary Key, Foreign key, NOT NULL to the tables.
3. Write a SQL statement for implementing ALTER,UPDATE and DELETE.
4. Write the queries to implement the joins.
5. Write the query for implementing the following functions: MAX (), MIN (), AVG () and COUNT ().
6. Write the query to implement the concept of Integrity constrains.
7. Write the query to create the views.
8. Perform the queries for triggers.
9. Perform the following operation for demonstrating the insertion, updation and deletion
10. Write the query for creating the users and their role Query multiple tables using JOIN operation.
11. Grouping the result of query - GROUP BY clause and HAVING clause
12. Query multiple tables using NATURAL and OUTER JOIN operation.

Code: BULCHU4201	COMMUNICATION SKILLS-II	1 Credit [LTP: 0-0-2]

COURSE OUTCOMES: Students will be able to:

CO201.1: Develop the ability to identify difficult sounds, words and phrases to strengthen listening and applying these improved skills in spoken communication.
CO201.2: Cultivating knack for reading and writing by understanding the nuances of sentence structure and presentation style.
CO201.3: 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.
CO201.4: Develop a heightened awareness of the potential of digital communication and apply their knowledge in creating documents considering the needs of the netizens.
CO201.5: Propose their outlook through exposure to new and different experiences and ideas and enrich their understanding of the issues under discussion.

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1	**Advanced Listening & Speaking Skills**	12
2	**Advanced Reading & Writing Skills**	6
3	**Art of Negotiation Skills**	2
4	**Email Etiquettes**	2
5	**Group Discussion**	2

B. DETAILED SYLLABUS

LIST OF LABS	
1	Listening Skills II: Analysis of videos/audios by famous personalities
2	Speaking Skills II: Extempore, Debate etc.
3	Public Speaking: Key Concepts, Overcoming Stage Fear
4	Story-Telling Skills: Techniques of Story Telling, Prompts for story creation
5	Situational Conversational Skills
6	PowerPoint Presentation Skills-II
7	Reading Skills II: Technical Writings, Research Papers& Articles
8	Writing Skills II: Blog Writing &Review Writing
9	Picture Perception & Discussion
10	Art of Negotiation: Identify the qualities of successful and unsuccessful negotiators. Identify different negotiation situations to practice during class.
11	Email Etiquettes
12	Group Discussion: Dos &Don'ts, Informal GD

Code: BSACSA4601	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 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.

Code: BESCES5101 ENVIRONMENTAL IMPACT ASSESSMENT 3.0 Credits [LTP: 3-0-0]

COURSE OUTCOMES

The Students will be able:

CO101.1: Analyze the knowledge of the Environmental Impact Assessment.
CO101.2: Process includes in Environmental Impact.
CO101.3: Different types of methods used in Environmental Impact Assessment.
CO101.4: Point out the Basic principles of writing an EIS.
CO101.5: Introduce to Environmental Auditing the mechanism.

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	**Introduction to EIA**	8
2.	**Process of EIA**	7
3.	**Methods Used in EIA**	7
4.	**Preparation of Environmental Impact Statement**	7
5.	**Environmental Auditing**	7

B. DETAILED SYLLABUS

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	*Human Development Centre, Human Development in South Asia*	Mahbub ul Haq	2002	Oxford University Press
2.	*Environmental Hazards- Assessing risk and reducing disaster*	Smith, Keith	1996	London & New York
3.	*Environmental Impact Assessment*	Canter, L.	1995	McGraw Hill
4.	*Sustainable Development: Economics and Policy*	Rao, P.	2000	Wiley Blackwell
5.	*Introduction to Environmental Impact Assessment (Natural and Built Environment Series).*	Glasson, J., Therivel, R., & Chadwick, A.	2012	Routledge

1.	**Introduction to EIA**
	• Introduction of the Unit • Definition of EIA • EIA and sustainable development • Need for EIA • EIA Notification 2006 • Conclusion & Real life applications
2.	**Process of EIA**
	• Introduction of the Unit • Major Steps of EIA • Screening • Scoping • Collection of baseline information • Identification • Prediction • Evaluation • Conclusion & Real life applications
3.	**Methods Used in EIA**
	• Introduction of the Unit • Adhoc approach • Overlay method • Questionnaire method • Checklist method • Network method

	• Matrix method • Conclusion & Real life applications
4.	**Preparation of Environmental Impact Statement**
	• Introduction of the Unit • Basic principles of writing an EIS • Phases of writing EIS: Initial planning phase, Detailed planning phase and writing phase • Conclusion & Real life applications
5.	**Environmental Auditing**
	• Introduction of the Unit • Objectives of Environmental auditing • Importance of Environmental auditing • Steps of EA (outline) • Conclusion & Real life applications

Code: BESCES5102	REMOTE SENSING	3.0 Credits [LTP: 3-0-0]

COURSE OUTCOMES

Student will be able to:

CO102. 1: Comparison of advantages of aerial photo-interpretation and remote sensing.
CO102. 2 Use the basic concept of an remote sensing.
CO102. 3: Analyze the Remote Sensing Platforms and Sensors
CO102. 4: Point out the interpretation of satellite imagery
CO102. 5: Role of Remote Sensing in environmental study.

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Introduction to Remote Sensing and Aerial Photo-interpretation	7
2.	Basic Principles of Remote Sensing	7
3.	Remote Sensing Platforms and Sensors	7
4.	Interpretation of Data Products	8
5.	Application of Remote Sensing	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction to Remote Sensing and Aerial Photo-interpretation**
	• Introduction of the Unit • Definition • Introduction • Comparison of advantages of aerial photo-interpretation and remote sensing • Conclusion & Real life applications
2.	**Basic Principles of Remote Sensing**
	• Introduction of the Unit • Electromagnetic radiation and EM spectrum • Atmospheric windows • Interaction of EM spectrum with ground objects • Conclusion & Real life applications
3.	**Remote Sensing Platforms and Sensors**
	• Introduction of the Unit • Multiple imaging sensor System • Landsat • SPOT • IRS • Conclusion & Real life applications
4.	**Interpretation of Data Products**
	• Introduction of the Unit • Photographic and digital data

	• False colour composites • Image resolution • Elements of interpretation of satellite imagery • Conclusion & Real life applications
5.	**Application of Remote Sensing**
	• Introduction of the Unit • Preparation of geomorphologic maps • Preparation of land use/land cover maps • Forest management • Watershed management • Wildlife management • Conclusion & Real life applications

C. RECOMMENDED STUDY MATERIAl:

Sr.No	Reference Book	Author	Edition	Publication
1.	*Principles of Geographic Information systems*	Burrough, P.A. and McDonnell, R.A.	2001	New York Oxford University Press
2.	*Principles of Geographical Information Systems for land Resource Assessment*	Burroughs, P. A.	1986	Oxford University Press
3.	*Introduction to Geographic Information Systems*	Chang, Kang-taung	2002	Tata
4.	*Fundamentals of Satellite Remote Sensing.*	Chuvieco,E. and Huete,A.	2009	CRC Press.
5.	*GIS and Public Health*	Cromley, E, K. and McLafferty,S.L.	2002	New York. The Guilford Press

Code: BESCES5103	ORGANIC CHEMISTRY	3.0 Credits [LTP: 3-0-0]

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.

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

a. 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

C. RECOMMENDED STUDY MATERIAL:

	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.

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 Arun Bahl	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: BESCES5104	PHYSICAL CHEMISTRY	3.0 Credits [LTP: 3-0-0]

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.

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.

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Fundamentals of Molecular Spectroscopy	C.N. 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

- 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

Code: BESCES5105	OOPS USING JAVA	3.0 Credits [LTP: 3-0-0]

COURSE OUTCOMES:

Student will be able to

:

CO105.1: Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects.

CO105.2: Understand dynamic memory management techniques using pointers, constructors, destructors

CO105.3: Describe the concept of function overloading, operator overloading, virtual functions and polymorphism.

CO105.4: Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming.

CO105.5:Demonstrate the use of various OOPs concepts with the help of Java Programming.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	**Introduction to Object Oriented Programming**	8
2	**Basic Java Programming**	10
3	**Java Packages and Interfaces**	10
3	**Exceptions and I/O Handling**	10
5	**User Interface and Advanced Concepts**	10

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction to Object Oriented Programming**
	• Introduction to Unit • Classes and Objects • Object Oriented Programming Concepts • Access Specifiers and Access Modifiers • Introduction to Java, Java Virtual Machine • Conclusion & Real life applications
2.	**Basic Java Programming**
	• Introduction to Unit • Variables • Data Types • Control flow statements – if, else, switch, for, while • Arrays • Strings • Conclusion & Real life applications
3.	**Java Packages and Interfaces**

	• Introduction to Unit • Java classes, Java methods, Packages, Interfaces • Java.util, java.io, java.net, java.sql, java.applet, etc • Collection Framework • Generics • Wrapper classes • Conclusion of the Unit
4.	**Exceptions and I/O Handling**
	• Introduction to Unit • Errors and Exceptions • Exception handling • Streams, Readers and Writers • Programming with Files • Multithreaded programming • Networking – Socket Programming • Conclusion & Real life applications
5.	**User Interface and Advanced Concepts**
	• Introduction to Unit • User Interface Components • AWT • Swing • Event Handling • Layouts, Forms • Applets • Annotations • Conclusion & Real life applications

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Publication
1	Java Complete Reference	Herbert Schildt	TMH
2	SAMS teach yourself Java-2	Rogers Cedenhead and Leura Lemay	3rd Edition, Pub. Pearson Education.

Code: BESCES5106 FUNDAMENTALS OF CLOUD COMPUTING 3.0 Credits [LTP: 3-0-0]

COURSE OUTCOMES:

Student will be able to:

CO106.1: Compare the strengths and limitations of cloud computing
CO106.2: Identify the architecture, infrastructure and delivery models of cloud computing
CO106.3: Apply suitable virtualization concept.
CO106.4: Choose the appropriate cloud player, Programming Models and approach.
CO106.5: Address the core issues of cloud computing such as security, privacy and interoperability

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**

C RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication

1.	Operations Research – An Introduction	H.A. Taha	**3rd ed**	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

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

Code: BESCES5201 ENVIRONMENTAL SCIENCE LAB 1 Credits [LTP: 0-0-2]

COURSE OUTCOMES

Students will be able to:

CO201.1: Understand the procedure for taking good soil sample.
CO201.2: Explain the principles of the soil analysis to reduce the environmental impacts due to soil amendments.
CO201.3: Acquire the ability to understand, explain and use instrumental techniques for soil analysis
CO201.4: Interpretation of satellite imagery.
CO201.5: Apply subject knowledge and skill to Interpret complex satellite imaginary.

1	Determination of pH of in soil
2	Determination of moisture percentage in soil
3	Determination of calcium and magnesium in soil
4	Determination of organic carbon in soil
5	Determination of conductivity of soil
6	Extraction of trace elements with EDTA in soil
7	Determination of Nitrite Nitrogen in Soil/Water
8	Interpretation of Satellite imagery for Identification of water resources
9	Interpretation of Satellite imagery for Urban Planning
10	Interpretation of Satellite imagery for Classification and identification of vegetation cover
11	Report on role of Remote Sensing in Disaster Management
12	Prediction of drought based on soil moisture index using remote sensing data

Code: BESCES5202	CHEMISTRY LAB	1 Credits [LTP: 0-0-2]

COURSE OUTCOMES

Students will be able to:

CO202.1: Understand chemical and molecular processes that take place in organic chemical reactions in synthesis.
CO202.2: Explain the principles of the chromatographic techniques.
CO202.3: Acquire the ability to understand, explain and use instrumental techniques for chemical analysis
CO202.4: Prepare water quality assessment report
CO202.5: Apply subject knowledge and skill to solve complex problems with defined solutions

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: BESCES5203 JAVA PROGRAMMING LAB 1 Credits [LTP: 0-0-2]

COURSE OUTCOME:

Student will be able to:

CO203.1: Implement object oriented programming concept using basic syntaxes of control structure, strings and function for developing skills of logic building activity.
CO203.2: Identify classes, objects, members of a class and the relationships among them needed for a finding the solution to specific problem.
CO203.3: Demostrate how to achieve reusability using inheritance interfaces and packages and describes faster application development can be achieved.
CO203.4: Demonstrate understanding and use of different exception handling mechanisms and concept of multithreading for robust faster and efficient application development.
CO203.5: Identify and describe common abstract user interface comments to design GUI in JAVA using Applet & AWT along with response to events.

Part A	
	1. A. Write a program to print "Hello World" in Java. . B. Write a program to add two numbers C. Write a program to demonstrate the different access specifiers 2. A. Write a program to demonstrate inheritance, abstraction, encapsulation and Polymorphism. B. Write a program to find the factorial of n numbers C. Write a program to calculate Fibonacci series D. Write a program to add n numbers and series 3. A. Write a program to create an array and store elements into the array. B. Write a program to find the sum of elements in an array C. Write a program to demonstrate switch case, if, if-else and for loop. 4. A. Write a program to demonstrate the working of methods. B. Write a program which has four methods – add(), subtract(), multiply() and divide() and demonstrate a simple console calculator. C. Write a program to accept command line arguments and display them to the user Write a program which uses different packages 5. A.Write a program to create a package. B. Write a program to handle different exceptions 6. A. Write a program to demonstrate try-catch, throw and throws. B. Write a program to accept input from the user using streams
Part B	

	7.Write a program to read a file 8. Write a program to write into a file 9. A. Write a program to demonstrate client server communication (socket programming) B. Write a program to create threads and manipulate them 10. Write a program to create a user interface to check user authentication. 11. Write a program to create a registration form and save the details into a file 12. Write a program to create a small animation using applets

Code: BULCHU5201	PROFESSIONAL SKILLS-I	1 Credit [LTP: 0-0-2]

COURSE OUTCOMES

Students will be able to:

CO201.1: Compare the professional and personal approach towards any task and demonstrate their understanding by displaying professional attitude in the assigned tasks.

CO201.2: Recognize, explain, and use the formal elements of specific genres of organizational communication: reports, proposals, memorandums, web pages, wikis, blogs, business letters, and promotional documents etc.

CO201.3: Prepare and deliver a clear and fluent demonstrative, informative, and persuasive presentation and enlarge their vocabulary by keeping a vocabulary journal.

CO201.4: Demonstrate preparedness for any type of interview from classic one-on-one interview to panel interviews, Phone/Skype interviews, Behavioral/Situational etc. along with sharping 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.

CO201.5: Understand negotiation and time management to identify steps for proper negotiation preparation & learn bargaining techniques and strategies of inventing options for mutual gain and move negotiations from bargaining to closing.

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1	**Professional Attitude & Approach**	**6**
2	**Professional Writing-I**	**8**
3	**Presentation Skills: Structure Study**	**2**
4	**Interview Skills & Group Discussion**	**4**
5	**Negotiation Skills & Time Management**	**4**

B. DETAILED SYLLABUS

LIST OF LABS	
1.	Professional & Ethical Approaches : Degree of adherence, Business world & meeting deadlines
2.	Job Hunting and Networking: Skill Branding & Usage of Online Platforms
3.	Trust Building & Cultural Etiquettes
4.	Professional Writing-I: Direct-Indirect approaches to Business Writing-Five main stages of writing Business Messages.
5.	Professional Email Writing
6.	Resume Building-I: Difference between C.V. & Resume, formats, points to cover, practice sessions
7.	E-Learning & E-Content Development-I
8.	Presentation Skills: format & structure of presentations, using tools & techniques
9.	Job Interviews I: Preparation and Presentation
10.	Advanced Group Discussion – I
11.	Negotiation Skills & and Conflict Resolution-I
12.	Professional Code of Ethics & Effective Time Management

Code: BESCES5401	**INDUSTRIAL TRAINING & SEMINAR**	**1 Credit [LTP: 0-0-2]**

COURSE OUTCOMES

Students will be able to:

CO401.1: Develop advanced and lifelong learning skills.
CO401.2: Extend the boundaries of knowledge through research and development.
CO401.3: Write formatted report for explaining the work during industrial training and describing the experience.
CO401.4: Understand basis of professional practice, administrative functions and company culture.
CO401.5: Develop greater clarity about academic & career goals and explore options in career plans.

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 shall be done 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-mentioned work. The departmental panel shall display the proper schedule for the class/ one to one interaction/presentation for all the students.

Code: BESCES5601	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 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.

Code: BESCES6101	Disaster Management	3.0 Credits [LTP: 3-0-0]

COURSE OUTCOMES

The Students will be able to:

CO101.1: Point out the man-made and natural disaster.
CO101.2: Explanation the Risk and Vulnerability Analysis
CO101.3: Point out the Concept, Nature and plan of Disaster Preparedness
CO101.4: Point out the Disaster Preparedness according to Communication, Participation, and Activation of Emergency.
CO101.5: Development of Long-term Counter Disaster Planning and Role of Educational Institute

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	**Introduction on Disaster**	8
2.	**Risk and Vulnerability Analysis**	7
3.	**Disaster Preparedness and Response Preparedness-I**	7
4.	**Disaster Preparedness and Response Preparedness-II**	7
5.	**Rehabilitation, Reconstruction and Recovery**	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction on Disaster**
	• Introduction of the Unit • Different Types of Disaster : • Natural Disaster: such as Flood, Cyclone, Earthquakes, Landslides etc • Man-made Disaster: such as Fire, Industrial Pollution, Nuclear Disaster, Biological Disasters, Accidents (Air, Sea, Rail & Road), Structural failures(Building and Bridge), War & Terrorism etc. Causes, effects and practical examples for all disasters. • Conclusion & real life application
2.	**Risk and Vulnerability Analysis**
	• Introduction of the Unit • Risk : Its concept and analysis • Risk Reduction • Vulnerability : Its concept and analysis • Strategic Development for Vulnerability Reduction • Conclusion & real life application
3.	**Disaster Preparedness and Response Preparedness-I**
	• Introduction of the Unit • Disaster Preparedness: Concept and Nature

	• Disaster Preparedness Plan • Prediction, Early Warnings and Safety Measures of Disaster. • Role of Information, Education, Communication, and Training • Role of Government, International and NGO Bodies. • Role of IT in Disaster Preparedness • Role of Engineers on Disaster Management • Conclusion & real life application
4.	**Disaster Preparedness and Response Preparedness-II**
	• Introduction of the Unit • Disaster Response : Introduction • Disaster Response Plan • Communication, Participation, and Activation of Emergency Preparedness Plan • Search, Rescue, Evacuation and Logistic Management • Role of Government, International and NGO Bodies • Psychological Response and Management (Trauma, Stress, Rumor and Panic) • Relief and Recovery • Medical Health Response to Different Disasters • Conclusion & real life application
5.	**Rehabilitation, Reconstruction and Recovery**
	• Introduction of the Unit • Reconstruction and Rehabilitation as a Means of Development. • Damage Assessment • Post Disaster effects and Remedial Measures. • Creation of Long-term Job Opportunities and Livelihood Options, • Disaster Resistant House Construction • Sanitation and Hygiene • Education and Awareness • Dealing with Victims' Psychology, • Long-term Counter Disaster Planning • 10. Role of Educational Institute • Conclusion & real life application

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Disaster Management and Preparedness	Schneid, T.D. & Collins, L.	2001	Lewis Publishers, New York, NY
2.	Introduction to International Disaster Management	Coppola D. P.	2007	Butterworth Heinemann
3.	Hazards Vulnerability and Environmental Justice	Cutter, S.L.	2012	EarthScan, Routledge Press
4.	Introduction to Environmental Geology	Keller, E. A.	1996	Prentice Hall, Upper Saddle River, New Jersey

5.	Natural Hazards Analysis: Reducing the Impact of Disasters	Pine, J.C.	2009	CRC Press, Taylor and Francis Group
6.	Environmental Hazards: Assessing Risk and Reducing Disaster	Smith, K.	2001	Routledge Press

Code: BESCES6102 Statistical Approaches And Modelling In Environmental Sciences 3.0 Credits [LTP: 3-0-0]

COURSE OUTCOMES

The Students will be able to:

CO102.1: Discuss types of variables, scales of measurement central tendency and dispersion
CO102.2: Apply the basic concept of probability theory, sampling theory
CO102.3: Analyze the correlation, regression, tests of hypothesis
CO102.4: Study the environmental models, linear, simple and multiple regression models
CO102.5: Study the Lotka-Voltera model and Leslie's matrix model

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	**Attributes and Variables**	7
2.	**Probability & Distribution**	8
3.	**Correlation & Tests of Hypothesis**	7
4.	**Environmental Models**	7
5.	**Models of Population Growth**	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Attributes and Variables**
	• Introduction of the Unit • Types of variables, • Scales of measurement • Measurement of central tendency and dispersion • Standard error • Measure of Skewness and Kurtosis • Conclusion & real life application
2.	**Probability & Distribution**
	• Introduction of the Unit • Basic concept of probability theory • Sampling theory • Distributions - Normal, log-normal, Binomial, Poisson, t, Z and F-distribution. • Conclusion & real life application
3.	**Correlation & Tests of Hypothesis**
	• Introduction of the Unit • Correlation • Regression • Tests of hypothesis (t-test, 2-test ANOVA: one-way and two-way); • Significance and confidence limits.

C. RECOMMENDED STUDY MATERIAL

	• Conclusion & real life application
4.	**Environmental Models**
	• Introduction of the Unit • Statistical Models in Earth Sciences • Linear, simple and multiple regression models • Validation and forecasting. • Conclusion & real life application
5.	**Models of Population Growth**
	• Introduction of the Unit • Models of population growth and interactions: • Lotka-Voltera model • Leslie's matrix model • Conclusion & real life application

Sr.No	Reference Book	Author	Edition	Publication
1.	Environmental Statistics: Methods and Applications:	Vic Barnett	2003	Wiley
2.	Biostatistical Analysis	Zar, I.H.	2010	Prentice Hall Publication
3.	Introduction of the Unit of environmental models	B.K. Sahu	2015	B S Publications

Code: BESCES6103	INORGANIC CHEMISTRY	3.0 Credits [LTP: 3-0-0]

COURSE OUTCOMES

The students will be able to:

CO103.1: Describe the 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.

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	Latest	Chapman & Hall, London
2.	Modern Inorganic Chemistry	R. C. Aggarwal	Latest	Kitab Mahal, Allahabad
3.	Basic Inorganic Chemistry	F. A. Cotton, G. Wilkinson, and Paul L. Gaus	Latest	John Wiley & Sons, New York

Code: BESCES6104	PHYSICAL CHEMISTRY	3.0 Credits [LTP: 3-0-0]

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.

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

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

Unit	Unit Detail
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

Code: BESCES6105	E-COMMERCE	3.0 Credits [LTP: 3-0-0]

Course Outcomes:

Student will be able to:

CO105.1:Understanding of the foundations and importance of E-commerce

CO105.3: Understanding of latest technologies of IT services

CO105.3:Enhanced understanding of IT development and its management skills

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	Publication
1	E Commerce: Business, Technology, Society	Kenneth C. Laudon & Carol G. Traver	Pearson Education
2	E-Commerce: Concepts, Models, Strategies	C.S.V. Murthy	Himalaya Publishing House

Code: BESCES6106	AI & MACHINE LEARNING	3.0 Credits [LTP: 3-0-0]

Course Outcomes:

Student will be able to:

CO106.1: Understanding of the foundations and importance of E-commerce

CO106.2: Understanding of latest technologies of IT services

CO106.3: Enhanced understanding of IT development and its management skills

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: BESCES6201	ENVIRONMENTAL SCIENCE LAB	1 Credit [LTP: 0-0-2]

COURSE OUTCOMES

Students will be able to:

CO201.1: Understand nutrient importance in soil.
CO201.2: Understand the different factors that contribute to increase the soil quality
CO201.3: Acquire the ability to understand, explain and use instrumental techniques for soil analysis
CO201.4 Applying subject knowledge and skill to make disaster management repots
CO201.5: Preparation of disaster management repots

LIST OF EXPERIMENTS

1	Determination of total phosphate in soil
2	Determination of chloride in soil
3	To determine moisture content and water holding capacity of grassland and woodland soil
4	Determination of carbonate and bicarbonate in soil
5	Determination of porosity of soil
6	Self-explanatory regarding steps involved in disaster management at authority level
7	Preparation of report on national and international agencies working on the concept of Disaster Management
8	Determination of heavy metals in soil by atomic absorption spectroscopy
9	To estimate the Important Value Index (IVI) for grassland species on the basis of relative frequency, relative density and relative dominance in grassland.
10	To study Global calibration model of UV-Vis spectroscopy for COD estimation in sewage water sample
11	To determine the quantity of oil and grease present in the given sample of water by partition gravimetric method
12	Determination of Total organic (TOC) in sewage water sample

Code: BESCES6202	CHEMISTRY LAB	1 Credit [LTP: 0-0-2]

COURSE OUTCOMES

Students will be able to:

CO202.1: Understand chemical and molecular processes that take place in inorganic chemical reactions in synthesis.
CO202.2: Analyze and present experimental results and draw sound conclusions based on experimental evidence.
CO202.3: Acquire the ability to understand, explain and use instrumental techniques for chemical analysis
CO202.4 Applying subject knowledge and skill to solve complex problems with defined solutions
CO202.5: Understand the different factors that contribute to the adsorption.

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: BESCES6203	PYTHON PROGRAMMING LAB	1 Credit [LTP: 0-0-2]

Course Outcomes:

Student will be able to:

CO203.1: develop proficiency in creating based applications using the Python Programming Language.

CO203.2: understand the various data structures available in Python programming language

CO203.3: do testing and debugging of code written in Python

CO203.4: draw various kinds of plots using Python Lab

CO203.5:do text filtering with regular expressions in Python

List of Programs

Part A	
	1. Write a program to demonstrate basic data type in python 2. Write a program to compute distance between two points taking input from the user 3. Write a Program for checking whether the given number is an even number or not. 4. Find the sum of all the primes below two million. 5. Write and run a Python program that outputs the value of each of the following expressions: 5.0/9.0 5.0/9 5/9.0 5/9 9.0/5.0 9.0/5 9/5.0 9/5 Based on your results, what is the rule for arithmetic operators when integers and floating point numbers are used? 6. Write and run a Python program that asks the user for a temperature in Celsius and converts and outputs the temperature in Fahrenheit. (Use the formula given in the example above and solve for tempFin terms of tempC.) 7. Here is an algorithm to print out n! (n factorial) from 0! to 19!: 1. Set f = 1 2. Set n = 0 3. Repeat the following 20 times: a. Output n, "! = ", f b. Add 1 to n

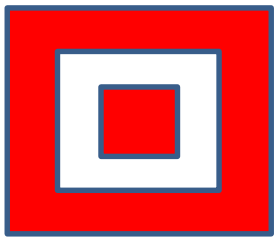
c. Multiply f by n

Using a for loop, write and run a Python program for this algorithm.

8. Modify the program above using a while loop so it prints out all of the factorial values that are less than 1 billion.
9. Modify the first program so it finds the minimum in the array instead of the maximum.
10. (Harder) Modify the first program so that it finds the **index** of the maximum in the array rather than the maximum itself.

Part B

11. Modify the bubble sort program so it implements the improvements discussed in class. (HINT: To exit the main loop if the array is already sorted, simply change the loop variable to equal the last value so the loop ends early.)
12. Draw the Target symbol (a set of concentric Squares, alternating red and white) in a graphics window that is 200 pixels wide by 200 pixels high. Hint: Draw the largest circle first in red, then draw the next smaller circle in white, then draw the next smaller circle in red. Graphical objects drawn later appear "on top of" graphical objects drawn earlier.



13. Try entering the following literal values at the prompt. (Hit ENTER after each)

-5
-4.2
4.5
4.14
0.90

Something odd should occur. *Describe it on paper.*

Code: BULCHU6201 PROFESSIONAL SKILLS-II 1 Credit [LTP: 0-0-2]

COURSE OUTCOMES

Students will 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
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+**

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
3	Resume Building-II: Revising & Updating
4	E-Learning & E-Content Development-II
5	Presentation Skills in Professional Setting
6	Job Interviews II: Preparation and Presentation for Mock Interviews
7	Advanced Group Discussion-II: Analysis of professional GD Videos and Practices on Topics/Video/Article based topics
8	Negotiation Skills & and Conflict Resolution-II
9	Change and Transition Management
10	Team Building Strategies: Project Management
11	Career Awareness & Productive Mindset

Code: BESCES6401	DISSERTATION	2 Credits [LTP: 0-0-4]

COURSE OUTCOMES

Students will be able to:

CO401.1: Identify literature for review and research methods.
CO401.2: Apply knowledge and understanding in relation to the agreed area of study.
CO401.3: Communicate in written form by integrating, analysing and applying key texts and practices.
CO401.4: Develop responses on the basis of the evaluation and analysis undertake.
CO401.5: Demonstrate advanced critical research skills in relation to career development or work-related learning studies.

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 with plagiarism report
5	Final presentation

Code: BESCES6601	Talent Enrichment Programme (TEP-VI)	1Credit

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 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.