SANJAY GHODAWAT UNIVERSITY KOLHAPUR

Sanjay Ghodawat University (SGU) is established in the Academic Year 2017-18, as a State Private University under Govt. of Maharashtra Act No. XL of 2017 dated 3rd May 2017, with the approval of the UGC and the state Government. "For the true measure of giving is giving without measure." Spread across 150 Acres, Sou. Sushila Danchand Ghodawat Charitable Trust's Sanjay Ghodawat University (SGU) is situated in serene atmosphere amidst idyllic hills and lush green meadows to study in harmony with Nature. The Institution aspires to run along the lines of best-in- the-world education and become a world-class institution where teaching-learning process gets a far deeper meaning. SGU always stands as the guiding star of brilliance, quality and deliverance beyond expectations. Innovativeness and Creativity are the hallmarks of a genius enterprise and SGU stands to be a stage where these qualities would be nurtured, encouraged and blossomed. The genius is incomplete without the sense of social responsibility and SGU's ultimate goal remains the development of an attitude of gratitude that freely gives back without expectations.

The Sanjay Ghodawat University stands as a beacon of light to guide the younger generation of the day on the right path to fulfillment in career and life. The USP of the University is its research based curriculum and academically oriented teaching staff. The world class ambience and infrastructure helps the students to easily accommodate themselves in an environment that is conducive to the teaching-learning process. Hands on experience, challenge based case studies, maximum participation of students in the classroom, use of modern digital technology, smart classrooms, solution oriented thinking promotion, stress on research and innovation, international tie ups, choice based credit system for flexibility in choosing areas of interest etc. are some of the features of the University.

The university will help students develop as a unique individual-to be educated as a whole person, intellectually, emotionally, socially, ethically, and spiritually. The educational program designs are worked out meticulously in line with best in class universities with special focus on:

- Flexible Choice Based Credit System
- OBE - Outcome Based Education System
- Experiential Learning
- Project Based Learning
- Case Based Learning

- Training need analysis based on Performance Appraisal System
- Active Learning tools for effective delivery
- Mentoring / Proctorship
- On line learning /Self learning platforms
- Flipped Classroom concept
- Effective Student Feedback Mechanism

VISION

Internationally recognized university of excellence in creating and disseminating knowledge through value-based quality education leading to betterment of mankind.

MISSION

- To prepare students for life-long learning and leadership in a global academic culture
- To create intellectual manpower relevant to the industry and society at large
- To collaborate with institutions of international repute for academic excellence
- To promote research and development through conducive environment
- To encourage entrepreneurship and skill development programs

CORE VALUES

- Integrity
- Transparency
- Accountability
- Equality
- Empathy
- Stewardship

QUALITY POLICY

Sanjay Ghodawat University is committed to establish high standards in value-based quality education to enhance and nurture young minds to excel in their chosen profession and develop into socially responsible citizens through resourceful collaboration, innovation and research

About School of Science

Since inception of Sanjay Ghodawat Institute in 2009, now Sanjay Ghodawat University has made constant efforts to provide quality education and a platform for development of students. School of Science currently offers BSc, MSc and PhD programs in but not limited to Physics, Chemistry and Mathematics. These programs have right blend of academia, research and industry providing an excellent opportunity for students to learn and flourish their career. Because of collaborations of School of Science with institutes, research laboratories and industries, students get number of opportunities of live projects, internships and placements. Our programs aim to provide skill based theoretical, practical and scientific knowledge to students. Our courses are focused towards development of following skills of students. Our courses are focused towards development of following skills of students.

Intellectual skills:

1. Ability to demonstrate understanding of a broad set of knowledge concerning the fundamentals in the basic areas of the discipline.
2. Ability to apply their knowledge to design, carries out, record and analyze the results of experiments.
3. Skills to communicate the results of their work.

Practical skills:

1. Skills in the monitoring of properties by observation and measurement, and the systematic and reliable recording and documentation.
2. Skills in the operation of standard instrumentation.
3. Skills required for the conduct of documented laboratory procedures involved.

Transferable skills:

1. Skills of both oral and written communication.
2. Problem solving skills.
3. Mathematical skills, correct use of units and data presentation.
4. Information retrieval skills.
5. IT skills.
6. Interpersonal skills such as interaction with others and team work.
7. Time management and organizational skills.
8. Skills related to ethical, social and professional understanding.

About Department of Physics

The Department of Physics is established in Academic Year 2017-18 under School of Science in the Sanjay Ghodawat University, Kolhapur. The department runs three courses under graduate, post graduate and Ph.D. The department consists of well-equipped laboratories and well qualified faculty members to handle the UG as well as PG courses. The department aims at developing the practical approach through skill enhancement courses, certifications course and project oriented learning. The research attitude is developed among students through research inclined courses and projects. The continuous development of quality research areas and exposure to research at reputed Institutes or Universities through internship would help in developing the careers of the next generation Physicists.

About Department of Chemistry

Chemistry is central science that deals with everyday life. Chemistry is all about knowing, measuring and making material. It can be making molecules, modifying and studying their properties. Department of Chemistry, Sanjay Ghodawat University aims to become world class teaching and Research Centre. Students can make their bright career in chemistry with our graduate, post graduate and PhD programs in chemistry. Deep understanding of chemistry can enable our graduates to take up new challenges in all aspects of chemistry that includes organic synthesis, chemical analysis, catalysis, nanotechnology, biochemistry etc. Our focused skill enhancement courses develop intellectual, practical and transferable skills of students.

About Department of Mathematics

The Department of Mathematics in Sanjay Ghodawat University was established in the year 2017. The Department offers Bachelor of Science (B.Sc.) and Master of Science (M.Sc.) in Mathematics with the major objective of developing a center of excellence especially in Mathematical Sciences and Applications.

The department offers opportunities for the education and research in a wide range of areas in Mathematics such as: Algebra and Analysis, Differential Equations and their applications, Discrete Mathematics and applications, Operations Research and Mathematical Software's etc.

The department has qualified and well experienced faculty members. Also the department has a computer lab where students can develop their programming skills by practicing in various software's viz. MATLAB, Sage, WxMaxima, C/C++, GAP, GeoGebra, LaTex etc. The department of Mathematics aims to prepare students who are oriented towards research and teaching in both fundamental and advanced areas of Mathematical Sciences.

CHOICE BASED CREDIT SYSTEM (CBCS)

The credit based semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The choice based credit system provides a 'cafeteria' type approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning.

University Grants Commission has come up with the Choice Based Credit System (CBCS) programme in which the students have a choice to choose from the prescribed courses, which are referred as core, elective or minor or soft skill courses and they can learn at their own pace and the entire assessment is graded-based on a credit system. The basic idea is to look into the needs of the students so as to keep up-to-date with development of higher education in India and abroad. CBCS aims to redefine the curriculum keeping pace with the liberalization and globalization in education. CBCS allows students an easy mode of mobility to various educational institutions spread across the world along with the facility of transfer of credits earned by students.

Where the students can choose the prescribed courses, as the core, and elective or soft skill courses, from a range of options, rather than to simply consume what the curriculum offers. They can learn at their own pace and the assessments are graded based on a credit system. It provides an opportunity for students to have a choice of courses or subjects within a programmed resembling a buffet, against the mostly fixed set of subjects now being offered (except for the limited choice of electives in professional degrees and postgraduate programmers) with the flexibility to complete the programmed by earning the required number of credits at a pace decided by the students.

The UGC has always initiated measures to bring efficiency and excellence in the Higher Education System of India. The basic motive is to expand academic quality in all aspects, right from the curriculum to the learning-teaching process to examination and evaluation systems. However, so far multiple methods are followed by different universities across the country towards examination, evaluation and grading system. Considering this diversity, the implementation of the choice based credit system seems to be a good system in assessing the overall performance of a student in a universal way of a single grading system.

OUTCOME BASED EDUCATION (OBE) MODEL

Sanjay Ghodawat University (SGU) has implemented OBE model of education, which is a learner centered approach. SGU has witnessed a sea change in the entire academic systems with implementation of all three components of OBE – Design, Delivery and Assessment. The SGU model of autonomy focuses on experiential learning which believes in learning by doing. This is achieved through hands on experience, industrial assignments, mini projects and live problem solving and collaboration with industries.

SGU is set in to dynamics of transformation and witnessing a shift in focus from teaching to learning and entire academic system of SGU is designed to provide multiple learning opportunities for students to acquire and demonstrate the Knowledge, Skills and Attitudes (KSA) for rewarding career.

The Vision and Mission of the Management, contribution from eminent BOG members and knowledgeable members of Academic Council and Board of Studies, the motivation and drive of the Director, the relentless efforts of the fellow Deans and Head of Departments and all teaching and non-teaching staff along with commitment to learning of students made it possible to successfully transform the institute and stand out to carve a niche for itself as an Institute of repute.

OBE is an approach of curriculum design and teaching that focuses on what students should be able to do (attained) at the end of course/ program. Outcome based education (OBE) is student-centered instruction model that focuses on measuring student performance through outcomes. Outcomes include knowledge, skills and attitudes (KSA). Its focus remains on evaluation of outcomes of the program by stating the knowledge, skill and behavior a graduate is expected to attain upon completion of a program and after 4 – 5 years of graduation. In the OBE model, the required knowledge and skill sets for a particular degree is predetermined and the students are evaluated for all the required parameters (Outcomes) during the course of the program.

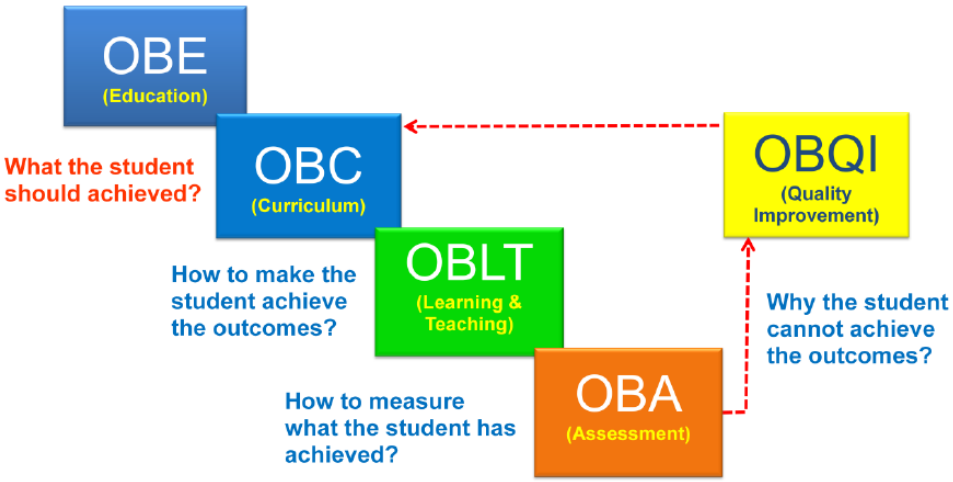
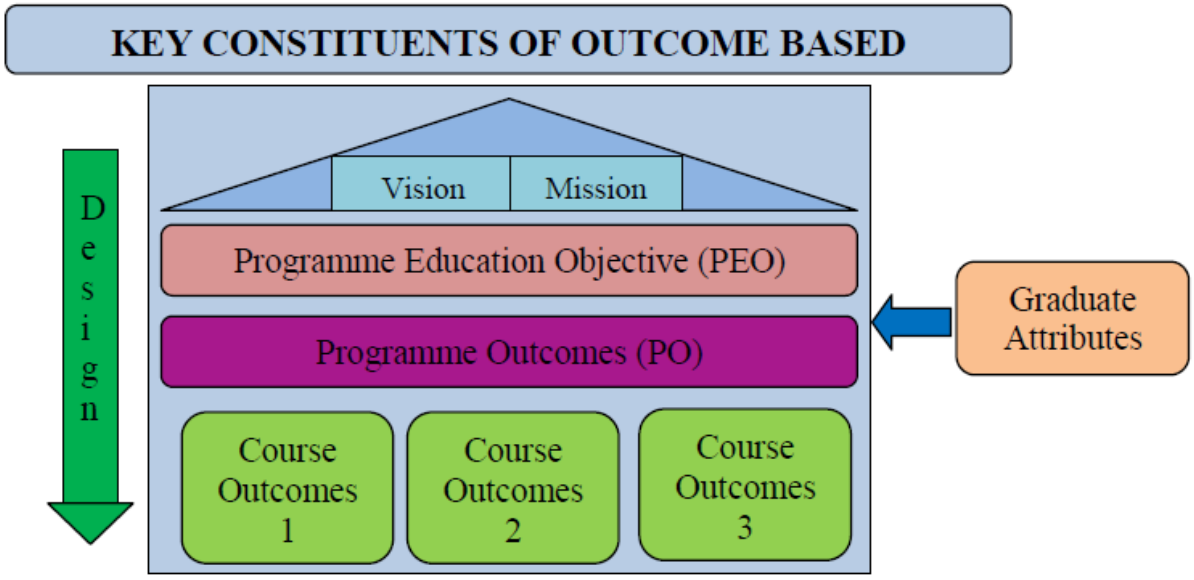


Figure 1: OBE flows and desciption

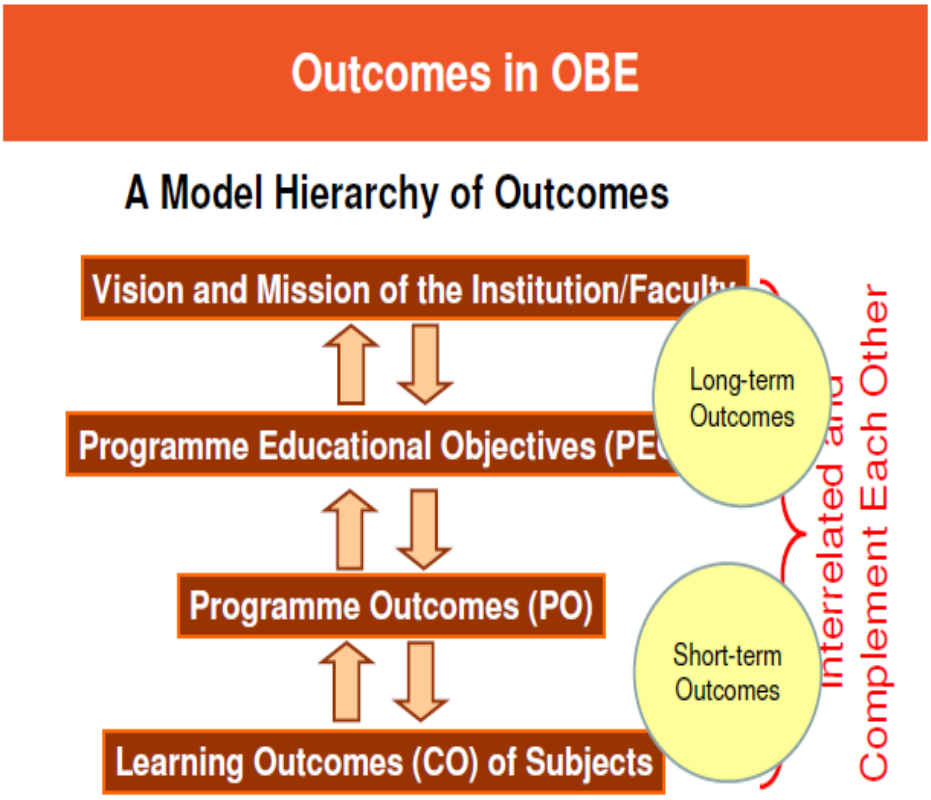


The OBE model measures the progress of the graduate in three parameters, which are

- Program Educational Objectives (PEO)
- Program Outcomes (PO)
- Course Outcomes (CO)

Program Educational Objectives (PEO) is broad statements that describe the career and professional accomplishments that the program is preparing the graduates to achieve. PEO's are measured 4-5 years after graduation. Program outcomes are narrower statements that describe what students are expected to know and be able to do by the time of graduation. They must reflect the Graduate attributes. Course outcomes are the measurable parameters which evaluates each student's performance for each course that the student undertakes in every semester.

The various assessment tools for measuring Course Outcomes include Tests and End Semester Examinations, Tutorials, Assignments, Project work, Labs, Presentations, Employer/Alumni Feedback etc. These course outcomes are mapped to Graduate attributes and Program outcomes based on relevance. This evaluation pattern helps Institutions to measure the Program Outcome. The Program Educational Objective is measure through Employer satisfaction survey (Yearly), Alumni survey (Yearly), Placement records and higher education records.



Special Features of OBE

- OBE is an educational process that focuses on what students **can do**or the **qualities** they should develop after they are taught.
- OBE involves the restructuring of curriculum, assessment and reporting practices in education to reflect the achievement of high order learning and mastery rather than accumulation of course credits.
- Both structures and curricula are designed to achieve those **capabilities** or **qualities**.
- Discourages traditional education approaches based on direct instruction of facts and standard methods.
- It requires that the students demonstrate that they have learnt the required skills and content.

Sanjay Ghodawat University Kolhapur

(Established as a State University under Government of Maharashtra Act No XL dated 3rd May 2017)

Academic and Examination Rules and Regulations

Approved in the sixth Academic Council Meeting held on 17th February, 2020
and to be implemented from academic year 2020-21. [Version R1]

Sanjay Ghodawat University Kolhapur

Kolhapur - Sangli Highway, A/p Atigre - 416 118,
Tal. - Hatkanangale, Dist. Kolhapur,
Maharashtra, India

(Implemented from Academic year 2020-21)

Academic and Examination Rules and Regulations

1.0 Preamble

The Sanjay Ghodawat University (SGU) stands as a beacon of light to guide the younger generation of the day on the right path to fulfillment in career and life. Outcome Based Education (OBE) model is adopted to enhance the effectiveness of teaching learning process and Credit Based semester system is implemented.

The focus of the University is its research based curriculum and academically oriented teaching staff. The world class ambience and infrastructure helps the students to easily accommodate themselves in an environment that is conducive to the teaching- learning process. Hands on experience, challenge based case studies, maximum participation of students in the classroom, use of modern digital technology, smart classrooms, solution oriented thinking promotion, stress on research and innovation, international tie ups, choice based credit system for flexibility in choosing areas of interest etc. are some of the features of the University.

Vision of SGU is internationally recognized university of excellence in creating and disseminating knowledge through value-based quality education leading to betterment of mankind. To achieve the vision SGU will develop state-of-the-art infrastructure that promotes conducive ambience promoting innovation and research. Create intellectual manpower relevant to the industry and society at large. Foster mutually beneficial partnership with alumni, industry and academia. Inculcate ethics and values to develop socially responsible citizens and promote entrepreneurship.

SGU is offering various programs through schools such as School of Technology, School of Commerce and Management, School of Sciences and School of Arts.

SGU has implemented the outcome based Education (OBE) system and Credit based Evaluation System in all the schools.

The rules and regulations mentioned in this document are applicable to all the Under Graduate (UG) and Post Graduate programs offered by the Sanjay Ghodawat University from the academic year 2018-19. The rules and regulations stated here under are subjected to revisions / refinements, updates and modifications and amendments by academic council (AC) from time to time and applicable to all batches including those already undergoing programs at different year and are binding on all stakeholders including students, faculty, parents and University authorities.

The academic programs of the University shall be governed by rules and regulations approved by the academic council from time to time. Academic council is the supreme and statutory academic body that governs all academic matters of the university and the decisions of the academic council are final and binding in the matters related to academics.

2.0 Definition of Terms

1. **University:** University means Sanjay Ghodawat University, Kolhapur
2. **Academic Year:** The period of the year during which students attend university for all academic activities, usually it starts from first of July and ends on 30th of June next year.
3. **Semester:** Academic Year is divided in to 2 parts called Semester, Odd Semester which starts from July and Even Semester which starts from January.
4. **Duration of Semester:** Total duration of semester is usually 20 weeks per semester including instructions, examination and evaluation. Total instructional days are 90 per semester.
5. **Course:** It is a Subject that is offered in a semester. The course may consist of Theory/Practical/Project/Seminar during semester. Usually taught by instructor in a class. e.g. Physics, Chemistry, Engineering Mechanics, Workshop etc.
6. **Program:** Collection of Courses is called Program. For example, B Tech in Mechanical Engineering, M Tech in Civil Engineering, Bachelor of Business Administration. Bachelor of Science etc.
7. **Department:** Department is a unit of the school which offers one or more programs.
8. **Contact Hours:** Time of students in class/laboratory with instructor. Usually in the range of 20-30 Hrs. /Week. For the purpose of uniformity one contact hour is measured as 60 minutes
9. **Academic Council (AC):** Means apex academic body governing the academic programs responsible for framing policy, rules and regulations.
10. **Board of Examination (BOE):** Central body responsible for framing policy, rules and regulations for Examination.
11. **Board of Studies (BOS):** Departmental academic body to govern the academics of programs (BOS) offered by department.

3.0 Curriculum:

Every program has a prescribed structure which, in general, is known as Curriculum. It prescribes courses to be studied in each semester. The booklet containing courses structure along with detail syllabus for each course of each program is updated periodically and made available on the website.

3.1 Semesters:

SGU implements a credit based semester system. The academic year is divided into two regular semesters. The semesters that begin in July are known as Odd semester and the semester that begin in January are known as even semesters. Total duration of each semester is generally of 20 weeks including the period of examination, evaluation and grade declaration.

3.2 Course Credit System/Structure:

In general, a certain quantum of work measured in terms of credits is laid down as the requirement for a particular program. Calculation of number of credits for a course in any semester is as per Table 3.1

Table 3.1: Calculation of number of credits for a course

Sr. No.	Course	Credits
1	Lecture of 1 hour/week	**1**
2	Tutorial of 1 hour/week	**1**
3	Practical / Laboratory / Drawing/mini-project of two hours/ week	**1**
4	Seminar (1 hour per week)	**1**

There are mainly two types of courses- viz. Theory courses and Laboratory courses. Generally a theory course consists of Lecture hours (L) and Tutorial hours (T). Tutorial hours may not be assigned to a particular theory course if it has a separate laboratory course. Laboratory course consists of practical hours (P) for which a student works in a Laboratory/Drawing Hall/Workshop. The other courses required to be taken by a student include seminar, mini project, and project at various levels of the program.

A student shall earn credits for a particular course by fulfilling the minimum academic requirements for attendance and evaluation. No credits shall be awarded if a student satisfies the minimum attendance requirements but fails to meet minimum evaluation requirements.

The total number of credits required for completing a program shall be mentioned in the course structure. The total number of credits in a semester which a student registers shall generally be 20--25. The maximum number of credits per semester shall not exceed 30

3.3 Audit Course:

3.3.1 A student may have to register for an audit course in a semester which could be institute requirement or department requirement.

3.3.2 An audit course may include either a) a regular course required to be done as per structure or required as pre-requisite of any higher level course or b) the programs like practical training, industry visits, societal activities etc.

3.3.3 Audit course shall not carry any credits but shall be reflected in Grade Card as "PP"/"NP" depending upon the satisfactory performance in the semester evaluation as per the course curriculum structure.

4.0 Course Registration:

4.1 Every student must register for the courses that he/she wants to study for earning credits at the beginning of each semester on the prescribed dates announced from time to time and shall be mandatory for every student till he/she completes the program. Only after registration his/her name shall appear in the roll list of each of such courses.

4.2 Students shall be required to fill up a Course Registration Form which shall be made available to them by the Student section of Administration office after payment of required fees.

4.3 Registration, according to rules, should be carried out as per the schedule given in academic calendar. Late registration may be permitted only for valid reasons and on payment of late registration fees. In any case, registration must be completed before the prescribed last date for registration, failing which his/her studentship shall be liable to be cancelled. Students having dues outstanding towards the institute or hostel shall be permitted to register only after clearing such dues.

4.4 In-absentia registration may be allowed only in rare cases at the discretion of the Dean Academics and with prior permission.

4.5 For registration in an odd semester, the student must have earned all the credits of the pre-previous year and at least 75% 2/3rd of the credits previous year. For example, for registration of the 5th semester courses (i.e. 3rd year of program), a student must have earned all the credits of the first year and 2/3rd of the credit second year. Similarly, for registration of the 7th semester courses (i.e. 4th year of program), a student must have earned all the credits of the second year and 2/3rd of the credits third year. However, if 2/3rd of the calculation turns out to be a mixed number (integer + fraction) then only the integer part of that number shall be considered for taking decision related with this clause.

4.6 A student registered in odd semester shall be eligible to register for the courses offered in the even semester of that year irrespective of his/her SGPA or the number of credits earned by him/her in that odd semester.

5 .0 Lateral Entry for B Tech Programs

Post diploma students in engineering and B.Sc. Graduates can have lateral entry at third semester of the program. Such admissions are governed by the rules of regulatory bodies like AICTE New Delhi and Directorate of Technical Education Maharashtra state and Sanjay Ghodawat University for Admission criteria and shall undergo all academic requirements as specified by the Academic council.

For such students there shall not be First Year Performance Index (FYPI). Semester Performance Index (SGPA) and Cumulative Performance Index (CGPA) shall be calculated from the third semester onwards taking into consideration the courses undergone by them at Sanjay Ghodawat University Kolhapur.

Registration of the students not covered by the cases mentioned above shall be decided by the Academic Council. Such students shall undergo the academic program as specified by the Academic Council. Such odd entry students shall not be eligible for any medals or awards instituted by the institute.

6.0 Change of Program:

This is applicable to B Tech Programs only. Students shall be eligible to apply for Change of Program after completing the first two semesters. The following rules/ guidelines shall be used for considering their applications for change:

6.1 The change of program shall be permitted strictly on merit basis subject to the rules of admissions prevailing at the time of such change.

6.2 Students without fail grades and/or backlogs shall be eligible to apply for change of program and can give their choices in the order of preference.

6.3 The request for change of program by a student from program A to program B shall be considered if number of students of program B does not exceed the sanctioned capacity of program B and also the minimum strength required to run the program as decided by Academic Council.

6.4 All such transfers can be effected only once at the beginning of the second academic year of the 4-year UG program. No application for change of program during subsequent academic years shall be entertained.

7. Facilitation to Students:

7.1 Faculty Advisor:

On joining the institute, a student or a group of students shall be assigned to a faculty advisor who shall be mentor for a student throughout his/her tenure in the institute. A student shall be expected to consult the faculty advisor on any matter relating to his/her academic performance and the courses he/she may take in various semesters / summer term. A faculty advisor shall be the person to whom the parents/guardians should contact for performance related issues of their ward. The role of a faculty advisor is as outlined below:

The role of the Faculty Adviser is outlined below:

a. Guide the students about the rules and regulations governing the courses of study for a particular degree.
b. Advise the students for registering courses as per curriculum given. For this purpose, the Faculty Adviser has to discuss with the student his/her academic performance during the previous semester and then decide the number and nature of the courses for which He /She can register during the semester as per the curriculum.
c. Approve the registration of the students.
d. Advice students to overload/ drop one or more courses/activities based on her/his academic performance as per the prescribed rules.
e. At the end of the first semester/year, the Faculty Adviser may even advise a reduced load program for a poorly performing student.

f. Pay special attention to weak students and carefully monitor performance of students recommended for slow track option.
g. Advice students for Course Adjustment / Dropping of courses during the Semester within the stipulated time frame given in the Academic calendar.
h. Advice students seeking semester drop either during the ongoing semester or before the commencement of the semester. FA has to ensure strict compliance of rules and regulations laid down for this purpose. Recommend the cases to the appropriate authorities for consideration.
i. Make revised plan of study for weak/bright students based on their semester wise performance.
j. Suggest modalities for course/credit requirements for the students recommended for exchange program.
k. Guidance and liaison with parents of students for their performance.
l. To ensure that students are not permitted to reregister for courses, which they have already passed.
m. Inform students that any academic activity (course / Lab. / seminar / project / noncredit requirement etc.) undergone without proper registration will not be counted towards the requirements of his/her degree.
n. Strictly warn students that if she/he fails to register during any semester without prior approval, his/her studentship is liable to be cancelled.
o. Keep the students updated about the Academic Administration of the University.

7.2. Helping Weaker Students:

A student with backlog/s should continuously seek help from his/her faculty advisor, Head of the Department and the Dean of respective schools. Additionally, he/she must also be in constant touch with his/her parents/local guardians for keeping them informed about academic performance. The university also shall communicate to the parents/guardians of such student at-least once during each semester regarding his/her performance in in-in various tests and examination and also about his/her attendance. It shall be expected that the parents/guardians too keep constant touch with the concerned faculty advisor or Head of the Department, and if necessary - the Dean of the respective school.

8.0 Discipline and Conduct:

8.1 Every student shall be required to observe discipline and decorous behavior both inside and outside the campus and not to indulge in any activity, which shall tend to bring down the prestige of the university.

8.2 Any act of indiscipline of a student reported to the Dean, Student Development, shall be discussed in a Disciplinary Action Committee of the institute. The Committee shall enquire into the charges and recommend suitable punishment if the charges are substantiated.

8.3 If a student while studying in the university is found indulging in anti-national activities contrary to the provisions of acts and laws enforced by Government, he/she shall be liable to be expelled from the institute without any notice.

8.4 If a student is involved in any kind of ragging, the student shall be liable for strict action as per provisions in the Maharashtra anti-ragging act.

8.5 If any statement/information supplied by the student in connection with his/her admission is found to be false/ incorrect at any time, his/ her admission shall be cancelled and he/she shall be expelled from the university and fees paid shall be forfeited.

8.6 If a student is found guilty of malpractice in examinations, then he/she shall be punished as per the recommendations of the Grievance Redressed Committee (CRC) constituted by Board of Examinations.

8.7 Every admitted student shall be issued photo identification (ID) card which must be retained by the student while he/she is registered at Sanjay Ghodawat University Kolhapur. The student must have valid ID card with him/her while in the University Campus.

8.8 Any student who alters or intentionally mutilates an ID card or who uses the ID card of another student or allows his/her ID card to be used by another, student shall be subjected to disciplinary action.

8.9 The valid ID card must be presented for identification purpose as and when demanded by authorities. Any student refusing to provide an ID card shall be subjected to disciplinary action.

8.10 Students should switch off the Mobiles during the Instructional hours and in the academic areas of university Building, Library, Reading room etc. Strict action will be taken if students do not adhere to this.

8.11 During the conduct of any Tests and Examination students must not bring their mobiles. A student in possession of the mobile whether in use or switched off condition will face disciplinary action and will be debarred from appearing for the Test / Examination.

9.0 Academic Calendar

The academic activity of the University are regulated by Academic Calendar and is made available to the student's/ faculty members and all other concerned in electronic form or hard copy. It shall be mandatory for students / faculty to strictly adhere to the academic calendar for completion of academic activities.

10. Attendance:

10.1 Regular 100% attendance is expected from all students for every registered course in lectures, tutorial, laboratory, projects, mini-projects and other courses mentioned in program curriculum. Hence, attendance is compulsory and shall be monitored during the semester rigorously. Students shall be informed at the end of every month if they are failing short of attendance requirements.

10.2 A Maximum of 25% absence for the attendance may be permitted only on valid grounds such as illness, death in family of blood relations (Father, Mother, Sister, and Brother) and

any other emergency reason which is beyond the control of the student and shall be approved by the authorities in respective departments.

10.3 If a student fails to put up 75% attendance individually in each course, the student will be put under X grade category and student will be debarred form attending the End Semester Examination (ESE) and Re-Exam for that semester in that course. However, student has an option to re-register for the course whenever it is offered next time or he can appear for 100% examination for which he will be awarded two grade penalties. Student's FET, CAT1 and CAT2 marks are treated as null and void.

10.4 The maximum number of days of absence for students participating in Co-curricular activities /Sports/ Cultural events during a semester shall not exceed 10. Any waiver in this context shall be on the approval of the Academic council only after the recommendation by Dean Academics of the university.

The HOD and Dean of the respective school shall report and recommend to Academic council the cases of students not having 75% attendance as per the records of course instructor. After rigorously analyzing these cases AC may take a decision to debar such student from End-Semester Examination (ESE) for that course. Such a student shall re-register for that course as and when it is offered next. ISE and MSE evaluations of such a student for this course during regular semester shall be treated as null & void.

10.5 A student remaining absent during ESE of a course either on medical ground (Accident and/or hospitalization of a student) or any other emergency circumstances (death of immediate close relative i.e. father, mother, brother and sister) or due to representing University at university/state level in sports/co-curricular activities shall be treated as per the rules of Sec 13.6.2 and 12.1.2

The critical cases of absenteeism which are not covered by any of the above clauses shall be reported by concerned Head of Department to Academic dean and all such cases the decision of Academic council is final**.**

11. Modes of Assessment:

11.1 Assessment of Theory Courses:

11.1.1 A student shall be evaluated for his/her academic performance in a theory course through Faculty Evaluation Theory (FET), Continuous Assessment Tests (CAT1 and CAT2) and End Semester Examination (ESE).

11.1.2 The relative weightage for the theory courses having ESE shall be generally as shown in the Table 11.1.2

Table 11.1.2: Weightage for the theory courses in %

Exam→ Credits↓	FET	CAT1	CAT 2	ESE

4	20	15	15	50
2	20	-----	30	50

The details of the weightage of each course shall be listed in the structures of each program

11.1.3 FET shall be based on student's performance in assignments, quizzes, seminars, Course projects and field assignments, term papers, etc. The mode of FET shall be decided and announced by the Course Instructor at the beginning of the course.

11.1.4 CAT1 shall generally be of one-hour duration for each course and shall be held as per the schedule declared in the Academic calendar for that Semester.

11.1.5 CAT2 shall generally be of one-hour duration for each course and shall be held as per the schedule declared in the Academic calendar.

11.1.6 ESE is of three hours comprehensive examination for 4 credits course's is of two hours comprehensive examination for 2creditscourse.

Table 11.1.6: Unit wise distribution in exams will be based on following table.

Total Number of Units	Units for CAT1	Units for CAT 2	Mark weightage for units in ESE
6	1 & 2	3 & 4	Equal weightage for all unit
5	1	2 & 3	Equal weightage for all unit
4	1	2	Equal weightage for all unit
3	Nil	1	Equal weightage for all unit
2	Nil	1	Equal weightage for all unit

11.1.7 All examinations and evaluations shall be compulsory. Credits for a course shall be awarded only if a student satisfies evaluation criteria and acquires the necessary minimum grade.

11.1.8 There shall be no re-examination for CAT1 and CAT2 of the courses having all the three components of evaluation viz. FET, CAT1 CAT2 and ESE. However, a student remaining absent for CAT1 and CAT2 for representing the University in state level or university level sports/co-curricular activities. (on prior recommendation and approval) or on valid grounds such as illness, death in family or other emergency reason which is beyond

control of a student (on approval by the head of department and dean of respective school shall be considered for Make- up examinations).

11.1.9 A student remaining absent for ESE of a course either due to medical reason (Accident and/or hospitalization of a student) or other emergency circumstances (death of immediate close relative i.e. father, mother, brother and sister) or due to representing Sanjay Ghodawat University at University/State/National/International level in sports/co-curricular activities shall be awarded with grade "I". Such a student shall be allowed to appear for make-up examination scheduled along with re-examinations of other courses. The student shall apply to COE with proper documentary evidence to appear for make-up examination. After make-up examination, a student shall be entitled to an appropriate grade as per Table I of Sec. 11.1.2 based on his/her performance during the regular semester and in make-up examination.

11.2 Assessment of Laboratory Courses:

11.2.1 The assessment of laboratory course shall be continuous and based on turn-by-turn supervision of the student's work and the quality of his/her work as prescribed through laboratory journals and his/her performance in viva-voce examinations uniformly distributed throughout the semester. Where ESE for the laboratory course is specified ESE shall be based on performing an experiment followed by an oral examination. The relative weightage for FEP and ESE for assessment of laboratory courses shall be 50% each for FEP and ESE and a minimum performance of 40% in both ISE and ESE separately shall be required to get the passing grade.

11.2.2 ESE for laboratory course shall normally be held before the ESE for theory courses and shall be conducted by a panel of examiners appointed by COE from the panel of experts approved by BOS. This activity shall be coordinated by Department Examination Coordinator (DEC) in consultation with HOD of the respective department.

11.2.3 Student failed in ESE of a laboratory course in a regular semester shall be eligible to appear for 100% examination conducted along with ESEs of laboratory courses of the subsequent semester. Such examination shall be fairly comprehensive (generally of 3 hours similar to POE i.e. Practical-Oral-Examinations) to properly judge his/her practical skill and theoretical knowledge for that laboratory course. He /She shall suffer one grade penalty.

12.0 The Grading System:

Absolute Grading System (AGS) is adopted based on absolute numerical marks obtained by the student during all stages of evaluation for a course.

12.1 Award of Grade (Regular Semester):

12.1.1 For every course registered by a student in a semester, he/she shall be assigned a grade based on his/her combined performance in all components of evaluation scheme of a

course as per the structure. The grade indicates an assessment of the student's performance and shall be associated with equivalent number called a grade point.

12.1.2 The academic performance of a student shall be graded on a ten-point scale. The Absolute Grading System is followed. Letter grades, the guidelines for conversion of marks to letter grades and their equivalent grade points are as given in Table.

Table 12.1.2: Grade Table for Regular Semester

Marks Obtained	Grade Letter GL	Grade Point GP	Performance Description
90-100	**O**	**10**	Outstanding
80-89	**A+**	**09**	Excellent
70-79	**A**	**08**	Very Good
60-69	**B+**	**07**	Good
50-59	**B**	**06**	Above Average
45-49	**C**	**05**	Average
40-44	**P**	**04**	Pass
00-39	**F**	**00**	Fail
-	**AB**	**00**	Absent
-	**X**	**00**	Detained (Failed)
-	**Satisfactory**	**-**	Pass in Non-Credit Courses
-	**Un Satisfactory**	**-**	Failed in Non-Credit Courses

12.1.3 A student shall pass the course if he/she gets any grade in the range "O" to “P".

12.1.4 “FF" grade shall be awarded to a student in a course if he/she gets less than 40% marks jointly in the FET, CAT1, and CAT2 & ESE for a theory course and in FEP& ESE for a laboratory course. A course shall then be eligible to apply for re-examination. A student failed in laboratory course shall be eligible to apply only for 100% examination conducted with the laboratory examinations of the subsequent semester. In both cases, a student has to suffer one grade penalty.

13 Assignment of X Grade

Grade "X" in a regular course shall be given to a student if he/she falls in any of the following categories.

13.1 A student does not maintain the minimum 75% attendance in any of the theory or laboratory courses.

13.2 A student has not completed most of the Evaluations like FET, CAT1 and CAT2 due to non-medical reasons (for example when a student has missed all or most of the components of internal evaluation conducted by the instructor in that semester).

13.3 The performance of a student is less than 40% in FET, CAT1 and CAT2 Combined.

13.4 A student is guilty of any academic malpractice during semester (Such cases shall be dealt by Grievance Redressed and Discipline Committee).

In above four cases grade "X" shall be declared one week before ESE and intimated to the Academic Office and COE immediately thereafter. Such a student shall not be permitted to take the ESE of that course.

13.5 Grade "X" may be given to a student if

13.5.1 A student eligible for ESE remains absent for ESE of a course with no written intimation to Exam Cell within four days after the respective ESE is over.

13.5.2 A student is guilty of any academic malpractice during examination. (Such cases shall be dealt by Grievance Redressal Committee).

In 13.5.2 grade "X" in that course shall be declared after Grievance Redressed Committee confirms the academic malpractice.

In above two cases when a student gets "X " grade in a course, then this shall be treated as "FF" for the purpose of calculation of Semester Performance Index (SGPI) and First Year Performance Index (FYPI) or Cumulative Performance Index (CGPI).

13.6 Following rules apply to the student who has obtained grade "X" in a regular semester:

13.6.1 A student obtaining grade "X" in a course in a regular semester or during examination shall be not be allowed to appear for End semester examination and also Re ESE conducted before the beginning of the next semester. His/her FET, CAT1 and CAT2 evaluations for all courses shall be treated as null and void. His/her needs to re-register for courses of that semester in the next academic year whenever they are offered and undergo all evaluations along with fresh regular students for which he will get one grade penalty.

13.6.2 Grade "I" shall be declared in a theory/laboratory course if a student has satisfactory performance FET, CAT1, CAT2 and has fulfilled the 75% attendance requirement, but has not appeared for ESE due to genuine reasons. Such students shall be eligible for the make-up examination of ESE only on medical grounds/valid reasons and on production of authentic medical certificate or other supporting document/s (as required by the University) to the COE within ten days after the respective examination is over. The application form with requisite amount of fees must be submitted to the Exam Cell before

the last date of filling such application forms for make-up examinations. These examinations shall be based on 100% syllabus and shall be scheduled before the commencement of the subsequent semester for theory courses and along with ESEs of laboratory courses of the subsequent semester. A student with "I" grade when appears for the make-up examination shall be eligible to obtain a regular performance grade ("O" to "F") as per Table 11.1.2 depending on his/her overall performance in FET, CAT 1, CAT 2 and make-up examination. If a student fails to appear for make-up examination too, a grade "XX" shall be awarded to him/her. Thus "I" is only a temporary grade and shall be replaced by a valid grade only after make-up examination.

13.6.3 There shall be a few audit courses as per the policies of the institute or as decided by DPC of respective program. The grade "PP" (Passed)/ "NP" (Not Passed) shall be awarded for such courses depending upon the performance of a student evaluated by the faculty in-charge. No grade points shall be associated with these grades and performance in these courses shall be not taken into account in the calculation of the performance indices (SGPI, CGPI). However, the award of the degree shall be subject to obtaining a "PP" grade in all such courses.

14. Award of Grades for Re-Examination:

14.1 A student who has obtained grade "F" in regular semester shall be eligible to appear for re-examination conducted before the commencement of the next regular semester. In such cases FET, CAT1 and CAT2 marks are carried forward and a student has to suffer one grade penalty

14.2 A student shall apply for re-examination before the last date of such application and shall appear for re-examination.

14.3 50% weightage similar to ESE shall be given to re-examination and there is one grade penalty.

14.4 A student who has obtained "F" grade in ESE of a regular semester and has not availed re-examination option or a student who has obtained "F" grade in both ESE and re-examination shall be eligible to choose one of the two options below to clear his/her backlog:

- Re-registration for the next regular semester course whenever that course is offered.
- Appearing for ESE of the course when conducted...
  A student detained in a regular semester due to either a) by obtaining "X" grade or b) by involvement in academic malpractice or c) by breaking the institute code of conduct and discipline can re-register for the course when offered next.

Following rules apply for these cases:

14.5 In first case i.e. Re- registration the earlier performance of a student in all the evaluations of that course shall be treated as null and void. The student has to undergo all the evaluations after re-registration.

15. Grades for Third and Subsequent attempts:

If A student opts for ESE or Re ESE who previously had obtained grade "F" in a course in two attempts, his/her FET, CAT1 and CAT2 performance of the regular semester shall be considered for evaluation and His/her has to suffer two grade penalty for the third attempt and for 4th and subsequent attempts shall be awarded a grade "P" or "F" or "X" based on his/her performance. However, if a student takes more than three chances (regular examination being the first chance, re-examination being the second chance, to clear a course, then the maximum passing grade that he/she can get shall be only "P". Thus a student has to suffer a grade penalty by accepting a lower grade than that obtained in the regular examination, re-examination, or examination for a re-registered course.

16. CALCULATION OF PERFORMANCE INDICES:

16.1. Semester Grade Point Average (SGPA)

The performance of a student in a one specific semester is indicated by SGPA. SGPA is a weighted average of the grade points obtained in all courses registered by the students during the semester. SGPA can be calculated by following equation.

$$SGPA = S_i = \frac{\sum_{i=1}^{n} C_i P_i}{\sum_{i=1}^{n} C_i}$$

Where, i = 1, 2, 3……. n is number of courses during semesters. C = No of credits associated with that course and P = Grade point earned in that course. SGPA will be rounded off to two decimal places.

16.2 Cumulative Grade Point Average (CGPA)

The total cumulative performance of a student at the end of specific semester is indicated by CGPA. An up-to-date assessment of the overall performance of a student for the courses from the first semester onwards till completion of the program shall be obtained by calculating Cumulative Grade Point Average (CGPA).

CGPA is a weighted average of the SGPA obtained in all semesters by the students during the semesters. CGPA can be calculated by following equation.

$$CGPA = \frac{\sum_{j=1}^{n} C_j S_j}{\sum_{j=1}^{n} C_j}$$

Where, j = 1, 2, 3……. n is number of semester during program. C = Total No of credits in the semester for which CGPA is to be calculated.

CGPA will be rounded off to two decimal places.

Conversion of CGPA to percentage marks for CGPA ≥ 4.5 can be obtained using equations. Percentage marks = (CGPA x 10) – 7.5.

16.3 For the students acquiring "I" grade (which is only a temporary grade) in any of the courses, SGPA, CGPA shall be calculated only after make-up examination.

17. First Year Performance Index (FYPI): (Applicable for B. Tech Programs Only)

17.1 For a student registered in Sanjay Ghodawat University Kolhapur right from the First semester, First-Year-Performance-Index (FYPI) shall be calculated as weighted average of the grade points obtained in all the courses registered by him/her in semesters I and II only.

$$\text{FYPI} = \frac{\sum_{i} C_i g_i}{\sum_{i} C_i}$$

Where summation is for all the courses registered by a student in first two semesters. FYPI shall be calculated when for the second semester is calculated. FYPI shall be rounded off to two decimal places.

17.2 FYPI shall reflect all the courses undergone by a student in the first year including the courses in which he/she has failed. FYPI may get modified in the subsequent semesters whenever a student clears his/her first year backlog courses.

17.3 If a student has been awarded "I" grade in the regular semester course of the first year then, FYPI shall be calculated after the make-up examination on the basis of the grade obtained by that student in a make-up examination.

17.4 If a student has obtained grade "F" or "X" at any time in any of the courses registered by him, then zero grade points corresponding to these grades shall be taken into consideration for calculation of FYPI.

18 Maximum Duration for Completing the Program

Maximum duration for completing any program UG/PG offered by Sanjay Ghodawat University is respective program duration plus two additional years.

Maximum duration for getting the B. Tech degree for students admitted in the first semester of UG program is, program duration plus two additional years (i.e. 12 Semesters and 6 academic years) For lateral entry student academic admitted in the third semester shall be (10 Semester and 5 Years).

The maximum duration of the program includes the period of withdrawal, absence and different kind of leaves permission to student but excludes the period of rustication of the student from the university however genuine case a confidential of valid reason may be referred to academic council for extending this limit by additional criteria

19 NFTE (Not Fit for Technical Education) (Applicable to B Tech program only)

It is mandatory for the student to earn all credits of first year specified for semester I & II or eligible for ATKT as per the rules to seek admission to semester III of second year in three years from the date of admission to avoid NFTE. If a student fails to become eligible for admission to Semester III in three year form the date of his admission, he shall be declared as "Not Fit for Technical Education" leading to discontinuation of his/her registration with the university. Such cases should be put up in the academic council.

20. Academic Progress Rules (ATKT Rules):

20.1 A student shall be allowed to register for the courses of the next year's odd semester only if he/she has earned all the credits of the previous year and has earned at least $2/3^{rd}$ credits of the current year. If $2/3^{rd}$ calculation turns out to be a mixed number (integer + fraction) then only the integer part of that number shall be considered for deciding the eligibility for ATKT.

(a) At the end of 1^{st} year a student shall be allowed to keep terms (ATKT) to 2^{nd} year of study provided he/she attends course work prescribed for 1^{st} year with prescribed attendance and successfully earned at least $2/3^{rd}$ of the total credits specified for 1^{st} year program.

For Example: Total credits for B. Tech first year 2017-18, are 45 (Total of Semester I and II). A Student should earn minimum $2/3^{rd}$ of the 45 Credits i.e. A student can go to next higher class with a maximum backlog of $1/3^{rd}$ credits of semester I & II of the first year.

Student, who fails to earn those credits, cannot register for next semester, either it can re-registrar for the course and credits or can use the next opportunity to earn the credits when exams are conducted.

(b) At the end of 2^{nd} year a candidate shall be allowed to keep terms to 3^{rd} year of study provided he/she attends course work prescribed for 2^{nd} year with prescribed attendance, and successfully cleared 1^{st} year program and at least $2/3^{rd}$ of total credits prescribed for 2^{nd} year program.

(c) At the end of 3^{rd} year a candidate shall be allowed to keep terms to final year of study provided he/she attendants course work prescribed for 3^{rd} year with prescribed attendance, and

should have completed 2nd year program and 2/3rd of total credits prescribed for 3rd year program.

All such candidates fulfilling the above criteria shall be declared as FAILED, ATKT.
A student shall be allowed to take admission for odd semester of next academic year only if he/ she have earned all the credits of the previous year and 2/3rd happens to be a decimal, it is rounded to only integer part.

21. Semester Grade Report:

21.1 Semester grade report reflects the performance of a student in that semester (SGPI) and also his/her cumulative performance for the first year (FYPI) and also the cumulative performance since the third semester of his/her study (CGPA).

21.2 The semester grade card issued at the end of each semester/ summer term to each student shall contain the following.

- The credits for each course registered for that semester.
- Any audit course/s undertaken by a student in a Semester.
- The letter grade obtained in each course.
- The total number of credits earned by a student for the first year separately.
- The total number of credits earned by a student since the 3rd semester onwards.
- SGPI, FYPI, CGPI.
- A list of backlog courses, if any.
- Remarks regarding eligibility of registration for the next semester.

21.3 Semester grade card shall not indicate class or division or rank however a conversion from grade point index to percentage based on CGPI shall be indicated on the final grade card of the program.

22 Award of Degree:

Following rules prevail for the award of degree.

- A student has registered and passed all the prescribed courses under the general institutional and departmental requirements.
- A student has obtained CGPI $\geq$ 4.75.
- A student has paid all the institute dues and satisfied all the requirements prescribed.
- A student has no case of indiscipline pending against him/her.
- Academic Council shall recommend the award of degree to a student who is declared to be eligible and qualified for above norms.

23 Grace Marks

- Maximum total grace marks will be 1 % of the total theory credit courses x 100 subjected
- To maximum 6 marks in that semester.
- Grace marks will be given candidate for change in grades for theory credit

courses.

- Fail to pass grade only and will be reflected in final ESE marks.
- The grace marks are applicable only for maximum 1/3rd courses (rounded to higher Integer part i.e. if there are 4 theory courses then 4/3 = 1.33 = 2 courses).
- Maximum grace marks will be distributed in maximum courses
- Benefit of grace marks is not applicable for any medal/award.
- Applicable to theory and (Theory + Practical Courses). If is not applicable for Practical courses.
- Scheme for grace marks only can be used when the student will pass in all courses of that semester.

24. CGPA Improvement Policy for Award of Degree:

An opportunity shall be given to a student who has earned all the credits required by the respective program with CGPA greater than or equal to 4.00 but less than 4.75 to improve his/her grade by allowing him/her to appear for ESE examinations of maximum two theory courses of seventh semester. Such examinations shall be scheduled along with re-examinations/make-up examinations. However, CGPA shall be limited to 4.75 even though the performance of a student as calculated through modified CGPA becomes greater than 4.75.

Conclusions:

The academic policies regarding conduct of programs in Sanjay Ghodawat University Kolhapur are published in this document. The Academic Council shall reserve the right to modify these policies as and when required from the point of view of achieving academic excellence. In special and abnormal cases (i.e. the cases not covered through above rules) the decision of the (Chairman, Academic Council shall be final and shall be binding on all concerned.

Chairman
Academic Council

First Year B.Sc.: Semester I										
Course Code	**Course Title Pass**	**L**	**T**	**Pr**	**C**	**Evaluation Scheme**				
						Component	**Exam**	**WT**	**Min Passing (%)**	
PHS101 (PC|SS)	Physics I	4	-	-	4	Theory	FET	20	40	40
							CAT I	15		
							CAT II	15		
							ESE	50	40	
CHS101 (PC|SS)	Chemistry I	4	-	-	4	Theory	FET	20	40	40
							CAT I	15		
							CAT II	15		
							ESE	50	40	
MTS101/ BOS101 (PC|SS)	Mathematics I / Botany-I	4	-	-	4	Theory	FET	20	40	40
							CAT I	15		
							CAT II	15		
							ESE	50	40	
AES101 (UC|SA)	English Communication	2	-	-	2	Theory	FET	20	40	40
							CAT	30	40	
							ESE	50	40	
AES103 (UC|SA)	English Communication Lab	-	-	4	2	Practical	FEP	50	40	40
							POE	50	40	
PHS103 (PC|SS)	Physics Lab I	-	-	4	2	Practical	FEP	50	40	
							POE	50	40	
CHS103 (PC|SS)	Chemistry Lab I	-	-	4	2	Practical	FEP	50	40	40
							POE	50	40	
MTS103/ BOS103 (PC|SS)	Mathematics Lab I / Botany Lab I	-	-	4	2	Practical	FEP	50	40	40
							POE	50	40	
Total		14	00	16	22	Total Hrs.: 30, Total Credits: 22				

L: Lecture, T: Tutorial, Pr: Practical, C: Credits, Th.: Theory, WT: Weight Age PC: Program Core, PE: Program Elective, UC: University Core, UE: University Elective ST: School of Technology, SS: School of Sciences, SC: School of Commerce, SM: School of Management, SA: School of Arts; FET: Faculty Evaluation Theory, FEP: Faculty Evaluation Practical's; CAT: Continuous Assessment Test, ESE: End Semester Examination.

First Year B.Sc.: Semester II										
Course Code	Course Title	L	T	Pr	C	Evaluation Scheme				
						Component	Exam	WT	Min Passing (%)	
PHS102 (PC|SS)	Physics II	4	-	-	4	Theory	FET	20	40	40
							CAT I	15		
							CAT II	15		
							ESE	50	40	
CHS102 (PC|SS)	Chemistry II	4	-	-	4	Theory	FET	20	40	40
							CAT I	15		
							CAT II	15		
							ESE	50	40	
MTS102/ BOS102 (PC|SS)	Mathematics II / Botany-II	4	-	-	4	Theory	FET	20	40	40
							CAT I	15		
							CAT II	15		
							ESE	50	40	
AES102 (UC|SS)	Environmental Studies	3	-	-	3	Theory	FET	20	40	40
							CAT I	15		
							CAT II	15		
							ESE	50	40	
AES104 (UC|SS)	Environmental Studies Project	-	-	2	1	Practical	FEP	50	40	40
							POE	50		
PHS104 (PC|SS)	Physics Lab II	-	-	4	2	Practical	FEP	50	40	40
							POE	50	40	40
CHS104 (PC|SS)	Chemistry Lab II	-	-	4	2	Practical	FEP	50	40	40
							POE	50	40	
MTS104/ BOS 104 (PC|SS)	Mathematics Lab II/ Botany Lab II	-	-	4	2	Practical	FEP	50	40	40
							POE	50	40	
Total		14	00	16	22	Total Hrs.: 30, Total Credits: 22				

Second Year B.Sc. (Chemistry): Semester III										
Course Code	Course Title	L	T	Pr	C	Evaluation Scheme				
						Component	Exam	WT	Min passing (%)	
PHS 201 (PC|SS)	Physics III	4	-	-	4	Theory	FET	20	40	40
							CAT I	15		
							CAT II	15		
							ESE	50	40	
CHS 201 (PC|SS)	Chemistry III	4	-	-	4	Theory	FET	20	40	40
							CAT I	15		
							CAT II	15		
							ESE	50	40	
MTS 201/ BOS 201 (PC|SS)	Mathematics III / Botany-III	4	-	-	4	Theory	FET	20	40	40
							CAT I	15		
							CAT II	15		
							ESE	50	40	
CHS 203/ CHS209 (PC|SS)	Basic Analytical Chemistry/ Fuel Chemistry	2	-	-	2	Theory	FET	20	40	40
							CAT	30		
							ESE	50	40	
PHS 205 (PC|SS)	Physics Lab III	-	-	4	2	Practical	FEP	50	40	40
							POE	50	40	
CHS 205 (PC|SS)	Chemistry Lab III	-	-	4	2	Practical	FEP	50	40	40
							POE	50	40	
MTS 205 / BOS 205 (PC|SS)	Mathematics Lab III / Botany Lab III	-	-	4	2	Practical	FEP	50	40	40
							POE	50	40	
CHS 207/ CHS 211 (PC|SS)	Basic Analytical Chemistry Lab/ Fuel Chemistry Lab	-	-	2	1	Practical	FEP	50	40	40
							POE	50	40	
CIS 201 (UC|SA)	Constitution of India & Professional Ethics	-	-	-	NC	Theory	ESE	100		40
Total		14	00	14	21	Total Hrs.: 28, Total Credits: 21, Audit: 01				

Second Year B.Sc. (Chemistry): **Semester IV**										
Course Code	**Course Title**	**L**	**T**	**Pr**	**C**	**Evaluation Scheme**				
						Component	**Exam**	**WT**	**Min passing (%)**	
PHS 202 (PC|SS)	Physics IV	4	-	-	4	Theory	FET	20	40	40
							CAT I	15		
							CAT II	15		
							ESE	50	40	
CHS 202 (PC|SS)	Chemistry IV	4	-	-	4	Theory	FET	20	40	40
							CAT I	15		
							CAT II	15		
							ESE	50	40	
MTS 202/ BOS 202 (PC|SS)	Mathematics IV/ Botany IV	4	-	-	4	Theory	FET	20	40	40
							CAT I	15		
							CAT II	15		
							ESE	50	40	
CHS 204/ CHS 210 (PC|SS)	Green methods in Chemistry/ Computational Chemistry	2	-	-	2	Theory	FET	20	40	40
							CAT	30		
							ESE	50		
PHS 206 (PC|SS)	Physics Lab IV	-	-	4	2	Practical	FEP	50	40	40
							POE	50	40	
CHS 206 (PC|SS)	Chemistry Lab IV	-	-	4	2	Practical	FEP	50	40	40
							POE	50	40	
MTS 206 BOS 206 (PC|SS)	Mathematics Lab IV/ Botany Lab IV	-	-	4	2	Practical	FEP	50	40	40
							POE	50	40	
CHS 208/ CHS 212 (PC|SS)	Green methods in Chemistry Lab/ Computational Chemistry Lab	-	-	2	1	Practical	FEP	50	40	40
							POE	50	40	
Total		14	00	14	21	Total Hrs.: 28, Total Credits: 21				

Third Year B.Sc. (Chemistry): Semester V										
Course Code	Course Title	L	T	Pr	C	Evaluation Scheme				
						Component	Exam	WT	Min passing (%)	
CHS301 (PC|SS)	Organic Chemistry	4	-	-	4	Theory	FET	20	40	40
							CAT I	15		
							CAT II	15		
							ESE	50	40	
CHS303 (PC|SS)	Inorganic Chemistry	4	-	-	4	Theory	FET	20	40	40
							CAT I	15		
							CAT II	15		
							ESE	50	40	
(PC|SS)	Discipline Specific Elective-I**	4	-	-	4	Theory	FET	20	40	40
							CAT I	15		
							CAT II	15		
							ESE	50		
(UC|SS)	Skill Enhancement Course- III*	2	-	-	2	Theory	FET	20	40	40
							CAT	30		
							ESE	50		
CHS 317 (PC|SS)	Organic Chemistry Lab	-	-	4	2	Practical	FEP	50	40	40
							POE	50	40	
CHS319 (PC|SS)	Inorganic Chemistry Lab	-	-	4	2	Practical	FEP	50	40	40
							POE	50	40	
(PC|SS)	Discipline Specific Elective-I Lab**	-	-	4	2	Practical	FEP	50	40	40
							POE	50	40	
(PC|SS)	Skill Enhancement Course-III Lab*	-	-	2	1	Practical	FEP	50	40	40
							POE	50	40	
CHS 333 (PC|SS)	Mini Project Phase I	-	-	2	1	Practical	FEP	50	50	50
							POE	50	50	
Total		14	00	16	22	Total Hrs.: 30, Total Credits: 22				

Third Year B.Sc. (Chemistry): Semester VI										
Course Code	**Course Title**	**L**	**T**	**Pr**	**C**	**Evaluation Scheme**				
						Component	**Exam**	**WT**	**Min passing (%)**	
CHS302 (PC|SS)	Physical Chemistry	4	-	-	4	Theory	FET	20	40	40
							CAT I	15		
							CAT II	15		
							ESE	50	40	
CHS304 (PC|SS)	Analytical Chemistry	4	-	-	4	Theory	FET	20	40	40
							CAT I	15		
							CAT II	15		
							ESE	50	40	
(PC|SS)	Discipline Specific Elective-II**	4	-	-	4	Theory	FET	20	40	40
							CAT I	15		
							CAT II	15		
							ESE	50	40	
(UC|SS)	Skill Enhancement Course- IV*	2	-	-	2	Theory	FET	20	40	40
							CAT	30		
							ESE	50	40	
CHS318 (PC|SS)	Physical Chemistry Lab	-	-	4	2	Practical	FEP	50	40	40
							POE	50	40	
CHS320 (PC|SS)	Analytical Chemistry Lab	-	-	4	2	Practical	FEP	50	40	40
							POE	50	40	
(PC|SS)	Discipline Specific Elective-II Lab**	-	-	4	2	Practical	FEP	50	40	40
							POE	50	40	
(PC|SS)	Skill Enhancement Course-IV Lab *	-	-	2	1	Practical	FEP	50	40	40
							POE	50	40	
CHS334 (PC|SS)	Mini Project Phase II	-	-	2	1	Practical	FEP	50	50	50
							POE	50	50	
Total		14	00	16	22	Total Hrs.: 30, Total Credits: 22				

*Select from pool of **Skill Enhancement Courses** below.

Select from pool of **Discipline Specific Elective Courses below.

Pool of skill enhancement courses

Sr. No	Course code (Theory)	Course code (Practical)	Course Name	Semester
1	CHS 203	CHS 207	Basic Analytical Chemistry	SEM- III
2	CHS 209	CHS 211	Fuel Chemistry	
3	CHS 204	CHS 208	Green Methods in Chemistry	SEM-IV
4	CHS 210	CHS 212	Computational Chemistry	
5	CHS 313	CHS 329	Pharmaceutical Chemistry	SEM-V
6	CHS 315	CHS 331	Mathematics for chemistry	
7	CHS 314	CHS 330	Pesticide Chemistry	SEM-VI
8	CHS 316	CHS 332	Chemistry of Cosmetics & Perfumes	

Pool of Discipline Specific Electives

Sr. No	Course code (Theory)	Course code (Practical)	Course Name	Semester
1	CHS 305	CHS 321	Analytical Methods in Chemistry	SEM-V
2	CHS 307	CHS 323	Chemistry of Materials	
3	CHS 309	CHS 325	Polymer science and technology	
4	CHS 311	CHS 327	Sustainable chemistry	
5	CHS 306	CHS 322	Utility of Industrial Chemistry	SEM-VI
6	CHS 308	CHS 324	Chemical products of Industrial Relevance	
7	CHS 310	CHS 326	Instrumental Methods of chemical Analysis	
8	CHS 312	CHS 328	Molecules of Life	

Note: Student should complete at least one NPTEL/SWAYAM/MOOC course for the completion of UG degree.

Total credits: 130

Sanjay Ghodawat University Kolhapur

School of Science Program: M. Sc.

Syllabus Structure for First Year B. Sc. R1

PHS 201: Physics-III (Thermal Physics and Statistical Mechanics)

(Version 1.0, Program Core, School of Sciences)

Lect.	Tut.	Pract.	Credits	Evaluation Scheme				
				Component	Exam	WT	Min Pass (%)	
4	-	-	4	Theory	FET	20	40	40
					CAT-I	15		
					CAT-II	15		
					ESE	50	40	

Course description: This course provides an intermediate-level presentation of basic principles of statistical physics with applications to scientific inference, stochastic phenomena and thermodynamics. Classical thermodynamics describes the equilibrium properties and phase transformations of macroscopic physical systems in terms of relations independent of any atomic model of matter. Statistical physics, by contrast, provides a fundamental theoretical foundation for the thermodynamic relations in terms of the specific statistical laws obeyed by the elementary particles of matter and general considerations of probability theory.

Course Outcomes: At the end of this course students will able to,

CO1	Understand[2] various laws of thermodynamics.
CO2	Apply[3] laws of thermodynamics to derive thermodynamic relations.
CO3	Categorize[4] distribution of particles/gas molecules using different distribution laws.
CO4	Apply[3] thermodynamic and statistical concepts to solve numerical.

Syllabus

Units	Description	Hours
I	**Laws of Thermodynamics: Thermodynamic Description of system** Thermodynamic state of system, Thermal equilibrium, Zeroth Law of thermodynamics, Internal energy of a system, First law of thermodynamics, Various Thermo dynamical processes, Applications of First Law: General Relation between CP & CV, Work done during Isothermal and Adiabatic Processes, Compressibility & Expansion Coefficient, Conversion of heat into work, Reversible & irreversible processes.	15
II	**Thermodynamic Potentials:** Carnot's cycle, Second law of thermodynamics, Carnot's theorem, Entropy, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third	15

law of thermodynamics, Unattainability of absolute zero, Thermodynamical functions: Enthalpy, Gibbs, Helmholtz and Internal Energy, Maxwell's relations, First and second TdS equations, Clausius- Clapeyron Equation, Expression for (CP – CV), CP/CV, Joule-Thompson Effect.

III **Kinetic Theory of Gases:** 15

Derivation of Maxwell's law of distribution of velocities and its experimental verification, Doppler Broadening of Spectral Lines and Stern's Experiment, Mean, RMS and Most Probable Speeds. Degrees of freedom, Law of equipartition of energy (no derivation) and its applications to specific heat of gases, Mean free path (Zeroth Order),

Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), mono-atomic and diatomic gases.

IV **Theory of Radiation:** 15

Blackbody radiation, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh-Jeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's law.

Statistical Mechanics:

Macrostate and Microstate, Phase space, Entropy and Thermodynamic probability, Maxwell-Boltzmann law - distribution of velocity - Quantum statistics - Fermi-Dirac distribution law - electron gas - Bose-Einstein distribution law, comparison of three statistics.

Reference Books:

1. Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.
2. A Treatise on Heat, Meghnad Saha, and B.N. Srivastava, 1969, Indian Press.
3. Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications.
4. Heat and Thermodynamics, M.W.Zemasky and R. Dittman, 1981, McGraw Hill 13
5. Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W.Sears & G.L.Salinger. 1988, Narosa
6. Thermal Physics, A. Kumar and S.P. Taneja, 2014, R. chand Publications.

CHS 201: Chemistry-III

(Version 1.0, Program Core, School of Sciences)

Lect.	Tut.	Pract.	Credits	Evaluation Scheme				
				Component	Exam	WT	Min Pass (%)	
4	-	-	4	Theory	FET	20	40	40
					CAT-I	15		
					CAT-II	15		
					ESE	50	40	

Course Description: This course is at odd semester of second year of BSc. It is a foundation course in Chemistry and may be pre-requisites for other courses. It covers fundamental concepts of organic and physical chemistry.

Course Outcomes: At the end of this course students will able to

CO1	Define[1] phase transformation, phase equilibria and application[3] in day to day life processes
CO2	Explain[2] chemistry of solutions.
CO3	Discribe[2] reactivity of carboxylic acids and amines.
CO4	Explain[2] the conductivity and electrochemistry.
CO5	Discribe[3] properties of biomolecules.

Syllabus (Theory)

Units	Description	Hours
I	**Phase Equilibrium:** Gibb's phase rule and significance of terms involved in the phase rule, understanding the number of phases, number of components and number of degrees of freedom of a one and two component system (with examples), Gibbs Phase Rule and its thermodynamic derivation. Derivation of Clausius–Clapeyron equation and its importance in phase equilibria. Phase diagrams of one-component systems (water and sulphur systems). Condensed phase rule, Two component systems involving formation of eutectic solids. Phase diagram of Lead-silver system and its significance in the industrial process of de-silverization of lead. Two components systems involving formation of solids having congruent melting point, $FeCl_3$-H_2O system, Two components systems involving formation of solids having incongruent melting point. **Solutions:** Thermodynamics of ideal solutions, Raoult's law, Ideal solutions, deviations from Raoult's law, Non-ideal solutions. Phase diagram of solutions of two components exhibiting positive deviation and negative deviations with examples, Vapour pressure-composition and Vapour pressure-temperature phase diagram of deal and non-ideal solutions. Azotropic mixtures and their separation by distillation	15
II	**Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure**. **Carboxylic acids and their derivatives:**	15

Introduction of Carboxylic acids (aliphatic and aromatic), Preparation: Acidic and Alkaline hydrolysis of esters. Reactions: Hell – Vohlard - Zelinsky Reaction. **Carboxylic acid derivatives (aliphatic):** (Upto 5 carbons) Preparation: Acid chlorides, Anhydrides, Esters and Amides from acids and their interconversion. Reactions: Comparative study of nucleophilicity of acyl derivatives. Reformatsky Reaction, Perkin condensation.

Amines and Diazonium Salts Amines (Aliphatic and Aromatic): (Upto 5 carbons) Preparation: from alkyl halides, Gabriel's Phthalimide synthesis, and Hofmann Bromamide reaction.

Reactions: Hofmann vs. Saytzeff elimination, Identification of primary, seconday and tertiary amines, Hinsberg test with HNO_2, Schotten – Baumann Reaction. Electrophilic Aromatic substitution (case aniline): nitration, bromination, sulphonation.

Diazonium salts Amines: Preparation: from aromatic amines. *Reactions*: conversion to benzene, phenol, dyes.

III Electrolytic Conductivity of solution 15

Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Kohlrausch law of independent migration of ions. Transference number and its experimental determination using Hittorf and Moving boundary methods. Ionic mobility. Applications of conductance measurements: determination of degree of ionization of weak electrolyte, solubility and solubility products of sparingly soluble salts, ionic product of water, hydrolysis constant of a salt. Conductometric titrations, acid-base, strong acid-strong base, weak acid-strong base and weak acid-weak base titrations, precipitation titration.
(Numeric Problems)

IV Amino Acids, Peptides and Proteins: 15

Introduction, Preparation of Amino Acids: Strecker synthesis, Gabriel's phthalimide synthesis. Zwitterion, Isoelectric point and Electrophoresis. *Reactions of Amino acids*: ester of –COOH group, acetylation of –NH2 group, complexation with Cu2+ ions, ninhydrin test.

Proteins*:* Primary, Secondary, Tertiary and Quaternary Structure of proteins. Determination of Primary structure of Peptides by Edmann degradation (N-terminal) and C–terminal (thiohydantoin and with carboxypeptidase enzyme). Synthesis of simple peptides (upto dipeptides) by N-protection (t-butyloxycarbonyl and phthaloyl) and C-activating groups and Merrifield solid-phase synthesis.

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 polysacharrides (starch and cellulose) excluding their structure elucidation.

Text Books

01 Barrow, G.M. Physical Chemistry Tata McGraw-Hill (2007

02 Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

Reference Books

01 Castellan, G.W. Physical Chemistry 4th Ed. Narosa (2004).

02 Petrucci, R.H. General Chemistry, 5th Ed., Macmillan Publishing Co.: New York (1985).

03 Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

04 Bassett, Denney-Jeffer and Mendham, Vogel's Textbook of Quantitative Inorganic Analysis,(5th edition Revised Copy) Longmann Scientific and Technical jointly with John Wiley and Sons Inc.(PDF soft Copy available free on internet)

05 Nelson, D. L. & Cox, M. M. Lehninger's Principles of Biochemistry 7th Ed., W. H. Freeman.

06 Berg, J.M., Tymoczko, J.L. &Stryer, L. Biochemistry, W.H. Freeman, 2002.

MTS 201 Mathematics-III (Real Analysis) (NEW)

(Ver. 1.0, Program Core, School of Science)

Lect.	Tut.	Pract.	Credits	Evaluation Scheme				
				Component	Exam	WT	Min Pass (%)	
4	-	-	4	Theory	FET	20	40	40
					CAT-I	15		
					CAT-II	15		
					ESE	50	40	

Course Description: This course is at odd semester of second year B.Sc. It is a pure and core course in Mathematics. It covers functions, Archimedean property, sequence and series and their convergence.

Course Outcomes: At the end of this course students will able to

CO1 :	Classify[2] types of functions.
CO2 :	Apply[3] Archimedean property for a set of real numbers.
CO3 :	Analyze[4] a nature of sequence.
CO4 :	Test[4] for convergence of series.
CO5 :	Find[3] the Riemann integrals.

Syllabus (Theory)

Units	Description	Hours
I	**Sets and Functions:** Sets and Functions, Types of Sets, Operations on sets, Special types of functions (injective, surjective, bijective), Inverse functions, composition of functions, Restrictions of function, well ordering property of $\mathbb{N}$, Mathematical Induction, Finite and infinite sets, examples of countable and uncountable sets, Cantor's theorem.	12
II	**The Real Numbers:** The Algebraic and Order Properties of $\mathbb{R}$, Bernoulli's inequality, Real line, Absolute Value and the Real Line, The Completeness Property of $\mathbb{R}$, bounded sets, suprema and infima, Applications of the Supremum Property, Interval.	12
III	**Sequence:** Sequences of real number, constant sequence, Fibonacci sequence, convergent and divergent sequence, Uniqueness of limits, Squeeze theorem (statement only), increasing and decreasing sequence, Monotone Sequences, Monotone convergence sequence, Subsequences and the Bolzano-Weierstrass Theorem, The Cauchy Criterion, Properly Divergent Sequences.	12
IV	**Infinite Series:**: Introduction to Infinite Series, Geometric series, p-series, harmonic series, comparison test, Limits, Limit theorems, Limits of functions, Absolute Convergence , Root test, Ratio test, alternating series, Leibnitz's test (Tests of convergence without proof), Tests for Non-absolute Convergence, Dirichlet's and Abel's tests (without proof)	12

V	**The Riemann integral:** Partition and Tagged partition, Riemann sum, Definition of Riemann integral, Properties of the integral, Boundedness theorem, Riemann integrable functions, Cauchy Criterion, The Squeeze theorem, Classes of Riemann integrable functions, The additivity theorem, The fundamental theorem, Substitution theorem.	12

Textbook:

1. R.G. Bartle and D. R Sherbert: Introduction to Real Analysis, John Wiley and Sons (Asia) P. Ltd., 2000.

References:

1. R.R. Goldberg: Methods of real analysis, OXFORD & IBH Publishing Co. Pvt. LTD.
2. T. M. Apostol: Calculus (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.
3. K.A. Ross: Elementary Analysis- The Theory of Calculus Series- Undergraduate Texts in Mathematics, Springer Verlag, 2003.

BOS 201: Botany-III

(Version 1.0, Program Core, School of Sciences)

Lect.	Tut.	Pract.	Credits	Evaluation Scheme				
				Component	Exam	WT	Min Pass (%)	
4	-	-	4	Theory	FET	20	40	40
					CAT-I	15		
					CAT-II	15		
					ESE	50	40	

Course Description: This course is at odd semester of second year of BSc. It is a foundation course in Botany and may be pre-requisites for other courses. It covers fundamental concepts of plant anatomy, growth and metabolite regulation, ecological behavior of plants and their evolution and also methods of plant growth.

Course Outcomes: At the end of this course students will able to

CO1	Understand[2] the structural organization in plants.
CO2	Explain[2] the growth and adaptive functions of plants.
CO3	Discribe[2] plant reproductive physiology and its development.
CO4	Discribe[2] the physiology and regulation of growth in plants.

Syllabus (Theory)

Units	Description	Hours
I	**Meristematic and permanent tissue:** Root and shoot apical meristems, simple and complex tissues**.** **Organs:** Structure of dicot, monocot root, stem and leaf.	16
II	**Secondary growth:** Vascular cambium-structure and function, seasonal activity, secondary growth in root and stem (Sapwood) **Adaptive and Protective systems:** Epidermis, cuticle, stomata, general account of hydrophytes and xerophytes.	14
III	**Structural organization of flowers:** Structure of anther/pollen. Structure and types of ovules. Types of embryo sacs, ultrastructure of mature embryo sac. **Pollination and fertilization:** Mechanism and Adaptations in pollination, Double fertilization, seed structure, dispersal mechanisms of the seed.	12
IV	**Embryo and Endosperm:** Endosperm types, structure and functions, dicot and monocot embryo, embryo endosperm relationship. **Apomyxis and Polyembryony:** Definition, types and its practical applications.	18

Reference Books:

1. Buchanan, B.B Grussem and Jones, R.L, Biochemistry of plants, American society of plant Physiologists, Maryl and USA, 2000.
2. Collins, H.A and Edwards, D.H Lefebvre, D.D and Layzell D.B (eds), Plant metabolism, 2nd Edition Longman, Essex, England, 1997.
3. W.S Hiiman, The physiology of flowering.
4. Mukherjee and Ghosh, Plant Physiology- New Central book agency, Kolkata, 2006.
5. M.C Dash, Fundamentals of Plant Ecology, Tata McGraw and Hill publications, New Delhi, 1993.

CHS 203: Basic Analytical Chemistry

(Version 1.0, Program Core, School of Sciences)

Lect.	Tut.	Pract.	Credits	Evaluation Scheme				
				Component	Exam	WT	Pass	
2	-	-	2	Theory	FET	20	40	40
					CAT	15		
					ESE	50	40	

Course Description: This course is at odd semester of second year of BSc. It is a skill enhancement course in Chemistry. It covers fundamental concepts of analysis of chemical compounds.

Course Outcomes: After the end of this course students will able to

CO1	Describe[1] basics of analytical chemistry.
CO2	Discuss[2] the analysis of soil and water.
CO3	Describe[1] basics of chromatography.
CO4	Apply[3] knowledge for analysis of real samples.

Syllabus (Theory)

Units	Description	Hours
I	**Basic Analytical Chemistry** **Introduction:** Origin of analytical chemistry: concept of Fundamental & derive Units, Origin of Fundamental units (Derive from standard physical phenomenon). Introduction to Analytical Chemistry and its interdisciplinary nature. Concept of sampling. Importance of accuracy, precision and sources of error in analytical measurements. Presentation of experimental data and results, from the point of view of significant figures. **Chromatography:** Definition, general introduction, principles of chromatography, types of chromatography (definitions only), paper chromatography, thin layer chromatography (TLC) and its application in chemical and food industries, forensic science..	15
II	**Analysis of soil:** Soil sampling, composition, texture and structure, of soil, determination of pH, electrical conductivity, moister, total nitrogen, phosphorous, sulfur, organic carbon, potassium & micronutrients. **Analysis of water:** Definition of pure water, sampling methods, determination of water quality parameters physical, chemical and biological (turbidity, temperature, color, electrical conductivity, odor, solids, pH, salinity, alkalinity, hardness, dissolved oxygen, Bacteria). Water pollution, sources responsible for water pollution, water purification methods.	15

Reference Books:

1. F. J. Welcher, Standard Methods of Chemical Analysis, Volume, 2 and 3, 6th edition Krieger Publishing Company
2. Skoog, D.A.; West, D.M. & Holler, F.J. Fundamentals of Analytical Chemistry 6th Ed., Saunders College Publishing, Fort worth (1992).
3. Nathaniel Howell Furman, Standard Methods of Chemical Analysis, Volume 3 7th edition
4. Willard, H. H., Merritt, L. L., Dean, J. & Settoe, F. A. Instrumental Methods of Analysis. 7th Ed. Wadsworth Publishing Co. Ltd., Belmont, California, USA, 1988.
5. B. K. Sharma, Industrial Chemistry including chemical engineering, GOEL Publishing House.
6. I. C. Gupta, N. P. S. Yaduvanshi, S. K. Gupta, Standard methods for analysis of soil plant and water, Scientific publisher India.
7. Amparo Salvador, Alberto Chisvert Analysis of Cosmetic Products 2nd edition, Elsevier,
8. Harris, D. C. Quantitative Chemical Analysis, W. H. Freeman.
9. Dean, J. A. Analytical Chemistry Notebook, McGraw Hill.
10. Day, R. A. & Underwood, A. L. Quantitative Analysis, Prentice Hall of India.
11. Freifelder, D. Physical Biochemistry 2nd Ed., W.H. Freeman and Co., N.Y. USA (1982).
12. Cooper, T.G. The Tools of Biochemistry, John Wiley and Sons, N.Y. USA. 16 (1977).
13. Skoog, D.A. Holler F.J. &Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed.

CHS 209: Fuel Chemistry

(Version 1.0, Program Core, School of Sciences)

Lect.	Tut.	Pract.	Credits	Evaluation Scheme				
				Component	Exam	WT	Min Pass (%)	
4	-	-	4	Theory (100)	FET	20	40	40
					CAT-I	15		
					CAT-II	15		
					ESE	50	40	

Course description: This course help student to acquire skills to determine petroleum, lubricants and petrochemical Industry.

Course Outcomes: At the end of this course students will able to

CO1	Describe[2] the introduction energy sources.
CO2	Explain[2] activity and applications of petroleum, lubricants and petrochemical Industry.

Syllabus (Theory)

Units	Description	Hours
I	**Review of energy sources (renewable and non-renewable**). Classification of fuels and their calorific value. **Coal:** Uses of coal (fuel and nonfuel) in various industries, its composition, carbonization of coal. Coal gas, producer gas and water gas—composition and uses. Fractionation of coal tar, uses of coal tar bases chemicals, requisites of a good metallurgical coke, Coal gasification (Hydro gasification and Catalytic gasification), Coal liquefaction and Solvent Refining.	15
II	**Petroleum and Petrochemical Industry**: Composition of crude petroleum, Refining and different types of petroleum products and their applications. Fractional Distillation (Principle and process), Cracking (Thermal and catalytic cracking), Reforming Petroleum and non-petroleum fuels (LPG, CNG, LNG, bio-gas, fuels derived from biomass), fuel from waste, synthetic fuels (gaseous and liquids), clean fuels. Petrochemicals: Vinyl acetate, Propylene oxide, Isoprene, Butadiene, Toluene and its derivatives Xylene. Bio Diesel, Algae oil, DME, Jet Fuel, Biogas **Lubricants**: Classification of lubricants, lubricating oils (conducting and non-conducting) Solid and semisolid lubricants, synthetic lubricants. Properties of lubricants (viscosity index, cloud point, pore point) and their determination.	15

Reference Books:

1) Stocchi, E. Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK (1990).
2) Jain, P.C. & Jain, M. Engineering Chemistry Dhanpat Rai & Sons, Delhi.
3) Sharma, B.K. & Gaur, H. Industrial Chemistry, GoelPublishing House, Meerut (1996).

CIS201: Constitution of India and Professional Ethics

(Ver1.0, Program Core, School of Sciences)

Lect.	Tut.	Practical	Credits	Evaluation Scheme			
				Component	Exam	WT	%Pass
-	-	-	NC	Theory	ESE	100	40

Course Outcomes: After the end of this course students will able to

CO1	Understand[2] state and central politics, fundamental duties, Union and State Executives
CO2	Explain[3] special provisions, emergency provisions, Human rights, Panchayat Raj.
CO3	Apply[3]Ethics and Social Responsibility in Science practice.
CO4	Understand code of ethics in Science.

Syllabus

Units	Description
I	Historical Background and The Making of the Indian Constitution Salient Features of the Indian Constitution, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy & Relevance of Directive Principles State Policy. Fundamental Duties. Union Executives: President, Prime Minister Parliament Supreme Court of India. State Executives: Governor, Chief Minister, State Legislature High Court of State. Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86th, & 91st, Amendments. The Indian Judiciary System.
II	Special Provision for SC & ST Special Provision for women, Children & Backward Classes. Emergency Provisions. Human Rights – Meaning and Definitions, Legislation Specific Themes in Human Rights- Working of National Human Rights Commission in India. Powers and Functions of Municipalities, Panchyats and Co-Operative Societies.
III	Scope & Aims of Ethics in science, Science and Social values, Ethics standards guidelines and frameworks for Science, Science Society and Social responsibility, Honesty, Integrity & Reliability in Science.
IV	Case Studies, Code of Ethics in Science

References

1. G.B. Reddy and MohdSuhaib, Constitution of India and Professional Ethics, I.K. International Publishing House Pvt. Limited, 2010.
2. M.V. Pylee, “An Introduction to Constitution of India”, Vikas Publishing, 2002.
3. Rotblat, “A Hippocratic Oath for Scientists.” *Science* 286 (1999): 1475
4. Resnik, “Standards of Ethical Conduct in Science.” In *The Ethics of Science* (Routledge, 1998), pp. 53-73

PHS203: Physics Lab-III

(Version 1.0, Program Core, School of Sciences)

Lect.	Tut.	Pract.	Credits	Evaluation Scheme				
				Component	Exam	WT	Min. Pass (%)	
-	-	4	2	Practical	FEP	50	40	40
					POE	50	40	

Course Description:
This course is in the odd semester of second year B.Sc. Selected experiments in thermal physics and statistical analysis will be performed. The results of the experiments should lead the students to form proper physics concepts and provide the basis for further explanations in the lecture class.

Course Outcomes: At the end of the course, student will be able to,

CO1 :	**Understand**[2] the concept of heat transfers.
CO2 :	**Evaluate**[3]the thermal conductivity of any material using different methods.
CO3 :	**Understand**[2] the concept of Stefan's law, Planck's constant and temperature changes arising through black body radiation.

Practical Syllabus

S.N.	Description
1	To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow
2	Measurement of Planck's constant using black body radiation.
3	To determine Stefan's Constant.
4	To determine the coefficient of thermal conductivity of copper by Searle's Apparatus.
5	To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
6	To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's
7	To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
8	To study the variation of thermo emf across two junctions of a thermocouple with
9	To record and analyze the cooling temperature of an hot object as a function of time using a
10	To calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge

- **Industry visit.**

Reference Books:

1. Advanced Practical Physics for students, B. L. Flint & H.T.Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

CHS 205: Chemistry Lab-III

(Version 1.0, Program Core, School of Sciences)

Lect.	Tut.	Pract.	Credits	Evaluation Scheme				
				Component	Exam	WT	Min. Pass (%)	
-	-	4	2	Practical	FEP	50	40	40
					POE	50	40	

Course Description: This course is at odd semester of first year of BSc. It is a foundation course in Chemistry laboratory and it covers basic skills of organic and physical chemistry laboratory.

Course Outcomes: At the end of this course students will able to

CO1	Understand[2] thermo-chemistry.
CO2	Explain[2] the conductivity and electrochemistry.
CO3	Classify[2] organic compound in to Acid, base, Phenol & Neutral
CO4	Discribe[2] properties of biomolecules.

Syllabus

S.N. **Description**

1. **Thermochemistry**
   Phase equilibria
   a) Construction of the phase diagram of a binary system (Phenol-water system) (simple eutectic) using cooling curves.
2. **Conductance**
   I. Determination of cell constant
   II. Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.
3. Perform the following Conductometric titrations: i. Strong acid vs. strong base ii. Weak acid vs. strong base.
4. **Potentiometry**
   Perform the following potentiometric titrations:
   i. Strong acid vs. strong base
   ii. Weak acid vs. strong base
   iii. Potassium dichromate vs. Mohr's salt.
5. Systematic Qualitative Organic Analysis of Organic Compounds possessing monofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.
6. Determination of the concentration of glycine solution by formylation method.
7. a. Titration curve of glycine
   b. Action of salivary amylase on starch
8. a. Effect of temperature on the action of salivary amylase on starch.
   b. Differentiation between a reducing and a non-reducing sugar.

Reference Books

1. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
2. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.
3. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).
4. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry, Universities Press.

MTS205: Mathematics Practical-III (C-programming-I)

(Ver 1.0, Program Core, School of Science)

Lect.	Tut.	Pract.	Credits	Evaluation Scheme				
				Component	Exam	WT	Min. Pass %	
-	-	4	2	Practical	FEP	50	40	40
					POE	50	40	

Course Description: This course is at odd semester of second year B.Sc. It is a computational course in Mathematics. It converse algorithm, flow chart, C-Language and program in C.

Course Outcomes: At the end of this course students will able to

CO1	Develop[3] algorithm
CO2	Construct[3] Flow Chart
CO3	Find[3] Area, Volume and Surface Area of plane and 3D surfaces
CO4	Explain[2] different command in C
CO5	Apply[2] commands to write program

Syllabus (Practical)

List of Practical Session Topics/titles/experiments

S.N. **Description**

1. Problem solving using Computers-Algorithm
2. Problem solving using Computers-Flowchart
3. Introduction to C: (Identifiers, Keywords, Constants, Types of Constants, Variables, Increment-Decrement operators, Mathematical operators, Relational Operator, C-character Set)
4. Data Type:
   Integer, Real, Character, Input and output statements in C, Complete Structure of C.
5. Simple Program in C:
   Formatted I/O function
   (To display WELCOME TO C, Sum/subtraction of two numbers, To print table of any number, Calculating Simple Interest, Conversion of temperature from Celsius to Fahrenheit, Program to calculate sum of marks of 5 subjects and find percentage)
6. Calculate Area and Surface Area of Plane and 3D Surfaces.
   (Circle, Square, Rectangle, Triangle, Cube,)
7. Control Structures (Decision making statements): if , if else, nested if else
   - To print absolute value of the integer.
   - To find out the given number is positive or negative.
   - To find out the given number is even or odd.
   - Program to find out the maximum number from the given two numbers.
   - Program to find out the minimum number from the given three numbers.

- Program to find out roots of Quadratic equation.
- Program to find given year is leap or not.

8. Loop Structure I: for loop

- To generate the even numbers till the specified numbers.
- To calculate X^y .
- Generating n-terms of Fibonacci sequence.
- To construct Pyramid of numbers.

9. Calculating Sum and Product of series up to n-terms.

10. To print stars pattern and number pyramids

Textbook:

1. **YashwantKanetkar:** Let Us C

References:

1. **E Balguruswamy**: Programming in ANSI C.
2. **P.S.V. Srinivasa Rao**: C programming and Data structures(2nd edition)
3. Programming in C- Schuam Outline Series
4. Link http://www.skiet.org/downloads/cprogrammingquestion.pdf

BOS 205: Botany Lab-III

(Version 1.0, Program Core, School of Sciences)

Lect.	Tut.	Pract.	Credits	Evaluation Scheme			
				Component	Exam	WT	Pass
-	-	4	2	Practical	FEP	50	Min 40
					POE	50	

Course Description:
This course is in the even semester of second year B.Sc. This module provides students with practical skills to execute basic experiments in Botany.

Course Outcomes: At the end of this course, students will able to:

CO1 :	**Examine** the growth activities of plants.
CO2 :	**Explain** the morphology of vegetative and reproductive structures of the plant.
CO3 :	**Understand**[2] the concepts of plant development.

Practical Syllabus

S. N.	Name of the Experiment
1	To study meristems through permanent slides.
2	To study tissue: Parenchyma, Sclerenchyma, Collenchyma, Zylem and Phloem (Permanent Slides)
3	Stem: Monocot-Zea mays Dicot-.Helianthus (Permanent Slides)
4	Root: Monocot-Zea mays Dicot-.Helianthus (Permanent Slides)
5	Structure of anther and ovules. (Temporary slide preparation)
6	Structure of anther (young and mature), Tapetum (secretory)
7	Dissection of embryo and endosperm from developing seeds.
8	Pollination types and seed dispersal mechanisms (Photographs and specimen).

- **Field visit.**

Reference Books:

1. Techniques and practices of Plant Biology- Scott RCW 1995, Marcell Decker, Inc, New York.
2. Bhojwani and BhatnagarS,P Embryology of Angiosperms- Vikas Publication house, New Delhi 5th edition,
3. Plant anatomy- Mauceth J.D. The Benjamin Cummings Publishers, USA.

CHS 207: Basic Analytical Chemistry Lab

(Version 1.0, Program Core, School of Sciences)

Lect.	Tut.	Pract.	Credits	Evaluation Scheme				
				Component	Exam	WT	Min. Pass (%)	
-	-	2	1	Practical	FEP	50	40	40
					POE	50	40	

Course Description: This course is at odd semester of second year of BSc. It is a skill enhancement course in Chemistry laboratory and it covers basic analytical chemistry laboratory skills.

Course Outcomes: At the end of this course students will able to

CO1	Examine[3] soil and water parameters.
CO2	Explain[2] Separation technique.
CO3	Examine[3] Consumer products.

Syllabus

S.N.	Description
1.	**Analysis of soil:** 1. Determination of pH of soil samples. 2. Estimation of Calcium and Magnesium ions as Calcium carbonate by Complexometric titration. **Analysis of water:** 1. Determination of pH of a water sample. 2. Determination of acidity and alkalinity of a water sample. 3. Determination of dissolved oxygen (DO) of a water sample. **Analysis of fungicide:** 1. Estimation of Copper from Bordo mixture by colorimetry. 2.
2.	**Analysis of food products:** 1. Identification of adulterants in some common food items like coffee powder, asafoetida, chilli powder, turmeric powder, coriander powder and pulses, etc. 2. Analysis of preservatives and coloring matter. 3. Analysis of Vitamin-C. **Chromatography:** 1. Paper chromatographic separation of mixture of metal ion (Fe^{3+} and Al^{3+}). 2. To compare paint samples by TLC method, Separation of paracetamol and diclofenac by TLC. 3. Ion-exchange: Column, ion-exchange chromatography etc. Determination of ion exchange capacity of anion / cation exchange resin (using batch procedure if use of column is not feasible).

Reference Books:

1. Vogel, A. I. Vogel's Qualitative Inorganic Analysis 7th Ed., Prentice Hall.
2. Vogel, A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Prentice Hall.
3. Robinson, J.W. Undergraduate Instrumental Analysis 5th Ed., Marcel Dekker, Inc., New York (1995)

CHS 211: Fuel Chemistry Lab

(Version 1.0, Program Core, School of Sciences)

Lect.	Tut.	Pract.	Credits	Evaluation Scheme				
				Component	Exam	WT	Min Pass (%)	
4	-	-	4	Theory	FEP	50	40	40
					POE	50	40	

Course description: This course help student to acquire skills to determine properties of crude oil and fuel.

Course Outcomes: At the end of this course students will able to

CO1	Describe[2] Calorific value and heat of combustion of fuel using Bomb Calorimeter.
CO2	Explain[2] Pour point and specific heat activity of crude oil.
CO3	Describe[2] the viscosity and temperature coefficient using Viscometry.

Syllabus (Practical)

S.N.	Description
1	**Bomb Calorimetry:** Determination of Calorific value of fuel of coal by Determination heat of combustion of given solid fuel.
2	**Viscometry:** Determination of viscosity of lubricant oil by Ostwald Viscometer. Determination of temperature coefficient of lubricating oil by viscometry.
3	Determination of Pour point of crude oil. Determination of specific heats of liquid fuels by thermometry.
4	Determination of heat of combustion of solid fuels.

Reference Books:

1) Stocchi, E. Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK (1990).
2) Jain, P.C. & Jain, M. Engineering Chemistry Dhanpat Rai & Sons, Delhi.
3) Sharma, B.K. & Gaur, H. Industrial Chemistry, Goel Publishing House, Meerut (1996).

Semester-II

PHS202: Physics-IV

(Version 1.0, Program Core, School of Sciences)

Lect.	Tut.	Pract.	Credits	Evaluation Scheme				
				Component	Exam	WT	Pass	
4	-	-	4	Theory	FET	20	40	40
					CAT-I	15		
					CAT-II	15		
					ESE	50	40	

Course description: This course taken up with basic properties of waves in general: wave kinematics, standing waves and resonance. Further it contains the sound waves study and the study of ultrasonic and acoustics. The study of interference and diffraction provides the evidence for the wave nature of light. Various examples of interferences are explained at the end.

Course Outcomes: After the end of this course students will able to

CO1	Understand[2] waves in various contexts.
CO2	Apply[3] the basic theory and principles of audible sound and ultrasound in calculations and measurements.
CO3	Explain[2] wave nature of light using diffraction and interference phenomenon.
CO1	Understand[2] waves in various contexts.

Syllabus

Units	Description	Hours
I	**Waves Motion- General**: Transverse waves on a string, Travelling and standing waves on a string, Normal Modes of a string, Group velocity, Phase velocity, Plane waves, Spherical waves, and Wave intensity. **Superposition of Two Collinear Harmonic oscillations**: Linearity and Superposition Principle, (1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats). **Superposition of Two Perpendicular Harmonic Oscillations**: Superposition of Two Mutually Perpendicular Simple Harmonic Motions with Frequency Ratios 1:1 and 1:2 using graphical and Analytical Methods, Lissajous Figures with equal an unequal frequency and their uses.	15
II	**Sound:** Simple harmonic motion, forced vibrations and resonance, Fourier's Theorem,	15

Application to saw tooth wave and square wave, Intensity and loudness of sound, Decibels, Intensity levels, musical notes, musical scale.

Acoustics of buildings:

Reverberation and time of reverberation, Absorption coefficient, Sabine's formula - measurement of reverberation time, Acoustic aspects of halls and auditoria.

Ultrasonic Waves:

Introduction, Production of Ultrasonic Waves by Magnetostriction method and Piezoelectric method, Detection of ultrasonic waves, Properties of Ultrasonic Waves, Applications of Ultrasonic Waves.

III **Wave Optics:** 15

Nature of Light- Theories of Light, Electromagnetic nature of light, Definition and Properties of wave front, Huygens Principle.

Diffraction:

Fraunhofer diffraction: Single slit; Double Slit, Multiple slits, Diffraction Grating, Fresnel Diffraction: Half-period zones, Zone plate, Fresnel Diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis.

IV **Interference:** 15

Interference: Division of amplitude and division of wavefront, Young's Double Slit experiment, Lloyd's Mirror and Fresnel's Biprism, Interference in Thin Films: parallel and wedge-shaped films, Fringes of equal inclination (Haidinger Fringes), Fringes of equal thickness (Fizeau Fringes), Newton's Rings: measurement of wavelength and refractive index.

Michelson's Interferometer:

Idea of form of fringes (no theory needed), Determination of wavelength, Wavelength difference

Polarization:

Transverse nature of light waves, Plane polarized light – production and analysis, Circular and elliptical polarization.

Reference Books:

1. Fundamentals of Optics, F A Jenkins and H E White, 1976, McGraw-Hill
2. Principles of Optics, B.K. Mathur, 1995, Gopal Printing
3. Fundamentals of Optics, H.R. Gulati and D.R. Khanna, 1991, R. Chand Publication
4. University Physics. FW Sears, MW Zemansky and HD Young 13/e, 1986. Addison-Wesley

CHS 202: Chemistry-IV

(Version 1.0, Program Core, School of Sciences)

Lect.	Tut.	Pract.	Credits	Evaluation Scheme				
				Component	Exam	WT	Pass	
4	-	-	4	Theory	FET	20	40	40
					CAT-I	15		
					CAT-II	15		
					ESE	50	40	

Course Description: This course is at even semester of second year of BSc. It is a foundation course in Chemistry and may be pre-requisites for other courses. It covers fundamental concepts of physical and inorganic chemistry.

Course Outcomes: After the end of this course students will able to

CO1	Explain[2] chemistry of transition elements.
CO2	Discribe[2] kinetic theory of gases.
CO3	Explain[2] the coordination chemistry.
CO4	Discribe[2] crystal structure and kinetics of reaction.

Syllabus (Theory)

Units	Description	Hours
I	**Transition Elements (3d series):** General group trends with special reference to electronic configuration, variable valency, colour, magnetic and catalytic properties, ability to form complexes and stability of various oxidation states (Latimer diagrams) for Mn, Fe and Cu. Lanthanides and actinides: Electronic configurations, oxidation states, colour, magnetic properties, lanthanide contraction, separation of lanthanides (ion exchange method only).	15
II	**Kinetic Theory of Gases** Postulates of kinetic theory of gases and derivation of the kinetic gas equation. Deviation of real gases from ideal behavior, compressibility factor, causes of deviation. Virial equation of states, Van der Waal's equation of state for real gass. Boyle's temperature. Van der Waal's excluded volume, relations between Van der Waals constant and virial coefficients, Critical phenomena, critical constants and their calculations from van der waal's equation. Andrew's Isotherms of CO_2. Maxwell-Boltzmann distribution law of molecular velocities and molecular energies, significance of equation. Temperature dependence of distribution. Most probable, average and root mean square velocities, collision diameter and mean free path of molecules. Mean free path of mixture of gases, derivation of number of collisions per unit time per unit volume. Kinetic theory of gas viscosity, effect of temperature and pressure on coefficient of viscosity. (Numerical problems).	15

III Coordination Chemistry: 15

Valence Bond Theory (VBT): Inner and outer orbital complexes of Cr, Fe, Co, Ni and Cu (coordination numbers 4 and 6). Structural and stereoisomerism in complexes with coordination numbers 4 and 6. Drawbacks of VBT. IUPAC system of nomenclature.

Crystal Field Theory:

Introduction and postulates, Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong field ligands. Tetrahedral symmetry. Factors affecting the magnitude of D. Spectrochemical series. Comparison of CFSE for Oh and Td complexes, Tetragonal distortion of octahedral geometry. Jahn-Teller distortion, Square planar coordination.

IV Solids 15

Forms of solids, unit cells, crystal systems, Laws of Crystallography, Law of constancy of interfacial angles, law of Symmetry, law of rational indices. Miller indices, Bravias lattice types, cubic system, inter-planer spacing for the planes (100), (110) and (111) in simple, body centered and face centered cubic lattice and atomic packing in solids, cubic close packing and hexagonal cubic packing, octahedral and tetragonal geometry, packing fraction, coordination number, molecular volume and density of solids, density calculation and method of determination of density of solids. Structure of NaCl, KCl and CsCl. (Numerical problems)

Liquids

Surface tension and its determination using stalagmometer. Viscosity of a liquid and determination of coefficient of viscosity using Ostwald viscometer. Effect of temperature on surface tension and coefficient of viscosity of a liquid.
(Numerical problems).

Reference Books:

1. Barrow, G.M. Physical Chemistry Tata McGraw-Hill (2007).
2. Castellan, G.W. Physical Chemistry 4th Ed. Narosa (2004).
3. Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning India Pvt. Ltd., New Delhi (2009).
4. Mahan, B.H. University Chemistry 3rd Ed. Narosa (1998).
5. Petrucci, R.H. General Chemistry 5th Ed. Macmillan Publishing Co.: New York (1985).
6. Cotton, F.A. & Wilkinson, G. Basic Inorganic Chemistry, Wiley.
7. Shriver, D.F. & Atkins, P.W. Inorganic Chemistry, Oxford University Press.
8. Wulfsberg, G. Inorganic Chemistry, Viva Books Pvt. Ltd.
9. Rodgers, G.E. Inorganic & Solid State Chemistry, Cengage Learning India Ltd., 2008.

MTS202 Mathematics-IV (Algebra)

(Ver 1.0, Program Core, School of Science)

Lect.	Tut.	Pract.	Credits	Evaluation Scheme				
				Component	Exam	WT	Min Pass (%)	
4	-	-	4	Theory	FET	20	40	40
					CAT-I	15		
					CAT-II	15		
					ESE	50	40	

Course Description: This course is at even semester of second year B.Sc. It is a pure and core course in Mathematics. It covers group, subgroup and their properties, rings and properties, ideals, maximal ideals, prime ideals.

Course Outcomes: At the end of this course students will able to

CO1 :	Check[4] the given nonempty set is group with suitable binary operations.
CO2 :	Find[3] the order of the group and its elements.
CO3 :	List[4] different types of morphism.
CO4 :	Classify[2] rings.
CO5 :	Solve[3]examples of Maximal Ideal and Prime ideal.

Syllabus (Theory)

Units	Description	Hours
I	Groups, Subgroup, Centre of Group, Normalizer of 'a' in Group and its proof.Coset of H in G, Examples and theorem, Lagrange's theorem, Index of subgroup.	12
II	Permutations, Cyclic Permutations, Disjoint Permutations, Even and odd Permutations. Order of an element, Cyclic Groups and its theorem. Euler's φ function. Euler's Theorem (without Proof), Fermat's Theorem (without Proof) and Examples.	12
III	Normal Subgroup, simple group, quotient group, Homomorphism, Isomorphism, Epimorphism, Monomorphism, Endomorphism and Automorphism. Fundamental Theorem of group homomorphism, Second Theorem of isomorphism, Third Theorem of isomorphism	12
IV	Ring, Commutative ring, Ring with unity and it's Theorem, Zero divisor, Integral Domain, Division Ring, Field and it's theorem, Subring, Characteristic of a ring, sum of two sub rings, Product of rings.	12
V	Ideal, Quotient Rings, Homomorphism, Kernel of homomorphism and it's theorem, Fundamental Theorem of ring homomorphism, First Theorem of isomorphism, Second Theorem of isomorphism, Imbedding ring, Definition and examples of Maximal Ideal and Prime ideal.	12

Textbook:

1. Vijay K Khanna, S.K Bhambri: A Course in Abstract Algebra, 5th edition VikasPublication house P. Ltd.

References:

1. John B. Fraleigh: A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
2. M. Artin: Abstract Algebra, 2nd Ed., Pearson, 2011.
3. Joseph A Gallian: Contemporary Abstract Algebra, 4th Ed., Narosa.

BOS 202: Botany-IV

(Version 1.0, Program Core, School of Sciences)

Lect.	Tut.	Pract.	Credits	Evaluation Scheme				
				Component	Exam	WT	Min Pass (%)	
4	-	-	4	Theory (100)	FET	20	40	40
					CAT-I	15		
					CAT-II	15		
					ESE	50	40	

Course Description: This course is at odd semester of second year of BSc. It is a foundation course in Botany and may be pre-requisites for other courses. It covers the basics of plant physiological processes, cellular structures and their functions and also the role of various metabolites in the physiological processes of plants.

Course Outcomes: At the end of this course students will able to

CO1	Understand[2] the physiological structures in plants.
CO2	Explain[2] the mechanisms of plant nutrition and respiration.
CO3	Discribe[2] the role of enzymes in plants.
CO4	Discribe[2] the importance of growth regulating metabolites.

Syllabus (Theory)

Units	Description	Hours
I	**Plant water relations:** Importance of water, water potential and its components, transpiration and its importance, factors affecting transpiration, root pressure and guttation. **Mineral nutrition:** Essential elements: Micro and macro, criteria for essentiality of elements, role of essential elements, transport of ions across cell membrane, active passive transport, channels and pumps.	16
II	**Translocation in Phloem:** Composition of phloem sap, girdling experiment, pressure flow model, phloem loading and unloading. **Photosynthesis:** Photosynthetic pigments (a and b, Xanthophyll and carotene), Photosystems I and II, antennae molecules, Electron transport system, mechanism of ATP synthesis, C3,C4 and CAM pathways, Photorespiration.	14
III	**Respiration:** Glycolysis, anaerobic respiration, TCA cycle, Oxidative phosphorylation, oxidative pentose phosphate pathway. **Enzymes:** Structure and properties, mechanisms of enzyme catalysis and enzyme inhibition.	12

IV **Nitrogen Metabolism:** 18

Biological nitrogen fixation, ammonia and nitrogen assimilation**.**

Plant Growth Regulators:

Discovery and physiological roles of auxin, gibberellin, cytokinin, ABA and ethylene.

Response of plants to light and temperature: Photoperiodism and Verbalization.

Reference Books:

1. P.S Verma, V.K Agarwal, Plant Cell Biology-(2001)
2. R. Dowben, Biochemistry and Molecular Biology- (1971)
3. A.C Giesse, Cell Physiology- (1979)
4. Lodish H. Berk, A. Zipurski, S. L Matsudiara, P.Baltimore D. and Darnel J. W.H Freeman and Co., Molecular Cell Biology (4^{th} edition), New York, USA.
5. L. W Sharp, Fundamentals of Plant Cytology.

CHS 204: Green Methods in Chemistry

(Version 1.0, Program Core, School of Sciences)

Lect.	Tut.	Pract.	Credits	Evaluation Scheme				
				Component	Exam	WT	Pass	
2	-	-	2	Theory	FET	20	40	40
					CAT	15		
					ESE	50	40	

Course Description: This course is at even semester of second year of BSc. It is a skill enhancement course in Chemistry and introduces methods to reduce generation of water. It covers fundamental concepts of green chemistry.

Course Outcomes: At the end of this course students will able to

CO1	Describe[1] basic principles of green and sustainable chemistry.
CO2	Relate[2] the principles of green chemistry as they apply to old and new processes and products.
CO3	Apply[3] the knowledge of chemistry to systems thinking

Syllabus (Theory)

Units	Description	Hours
I	Introduction and Historical Background of Green Chemistry, Concept of Systems Thinking, Definitions and Need: Flixborough Disaster, Seveso Disaster, DDT, Love canal Incident, Manufacturing of Adipic Acid. Discoveries that built solid foundation of Green Chemistry. Obstacles in pursuit of Green Chemistry. Presidents Green Chemistry Awards, Twelve principles of Green Chemistry, Basic knowledge of atoms, periodic table and molecules. Concept of Sustainability.	15
II	Basic Examples related to Planning a Green Synthesis: Percentage of Atom Utilization, Evaluating the type of reaction involved, Selection of solvents and Reagents, Use of Protecting groups and Catalysts, Energy requirement. Examples of Green Synthesis: Adipic Acid, Catechol, Hofmann Elimination, Synthesis benzoic acid from methyl benzoate, Oxidation of Alcohols to Carbonyl Compounds, Sonochemical Simmon-Smith reaction, Surfactants for CO_2, Safe marine antifoulant. *Green Reactions*: Aqueous phase reactions, Solid state reactions, Photochemical reactions, Microwave assisted reactions, Enzyme catalyzed reactions, Sonication reactions, Ionic Liquids, Preparation using renewable resources.	15

Reference Books:

1. V. K. Ahluwalia Green Chemistry: Environmentally benign Reaction; Ane Books Pvt Ltd.
2. E resource: www.beyondbenign.com
3. P. T. Anastas, J. C. Warner.: Green Chemistry - Theory and Practical, Oxford University Press.

CHS 210: Computational Chemistry

(Version 1.0, Program Core, School of Sciences)

Lect.	Tut.	Pract.	Credits	Evaluation Scheme				
				Component	Exam	WT	Pass	
2	-	-	2	Theory	FET	20	40	40
					CAT	15		
					ESE	50	40	

Course Description: This course is at even semester of second year of BSc. It is a skill enhancement course in Chemistry.

Course Outcomes: At the end of this course students will able to

CO1	Explain[2] basic concepts of computational chemistry.
CO2	Apply[3] knowledge of computational chemistry for predicting properties of molecules.
CO3	Demonstrate[3] ability to use computational tools in chemistry.

Syllabus (Theory)

Units	Description	Hours
I	Introduction to computer and historical perspectives of computational chemistry, concepts of molecular modeling such as bond, bond angle and dihedral angle. use of quantum chemical and molecular mechanics methods in computational chemistry, Schrodinger equation quantum chemical methods for energy calculations, Huckel Molecular Orbital (HMO) theory, Extended Huckel Theory (EHT), MNDO, AM1, PM3, RM1, PM6 methods. Molecular Mechanics, Bond-stretching, Bond-bending, Dihedral motions, Out-of-plane angle potential, Non-bonded interactions, Coulomb interactions. Molecular Mechanics Calculation, Geometry Optimization, Conformation Searches, QSARs.	15
II	Use of computer for predicting IR, Raman, NMR, bonding and structure of simple chemical compounds, Force field methods - force field energy and parameterization, electronic structure methods - SCF techniques, semi-empirical methods, basis sets and their classification, density functional theory and methods. Application of computational chemistry in drug design, CADD, QSAR, pharmacophore modeling.	15

Reference Books:

1. Christopher J. Cramer, Essentials of Computational Chemistry Theories and Models Second Edition, John Wiley & Sons Ltd, England, 2004
2. Alan Hinchliffe,Molecular Modeling for Beginners, Second Edition, John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, United Kingdom, 2008
3. Ramachandran, K. I., Deepa, G., Namboori, K. Computational Chemistry and Molecular Modeling. Coimbatore: Springer, 2008.
4. Errol G. Lewars Computational Chemistry Introduction to the Theory and Applications of Molecular and Quantum Mechanics, Second Edition, Springer Dordrecht Heidelberg London New York, 2011.

PHS204: Physics Lab-IV

(Version 1.0, Program Core, School of Sciences)

Lect.	Tut.	Pract.	Credits	Evaluation Scheme				
				Component	Exam	WT	Min. Pass (%)	
-	-	4	2	Practical	FEP	50	40	40
					POE	50	40	

Course Description:

This course is in the even semester of second year B.Sc. This module is to provide students with practical skills to execute advanced experiments in waves and optics.

Course Outcomes: At the end of this course students will able to:

CO1 :	**Use**[3] spectrometer to calculate the wavelength of different colour using different instruments.
CO2 :	**Calculate**[3] resolving and dispersive power of grating and prism.
CO3 :	**Understand**[2] optical experiments, which will establish the fundamentals of interference and diffraction phenomena

Practical Syllabus

S. N.	Name of the Experiment
1	To investigate the motion of coupled oscillators
2	To study Lissajous Figures
3	Familiarization with: Schuster`s focusing; determination of angle of prism.
4	To determine the Refractive Index of the Material of a given Prism using Sodium Light.
5	To determine Dispersive Power of the Material of a given Prism using Mercury Light
6	To determine the value of Cauchy Constants of a material of a prism.
7	To determine the Resolving Power of a Prism.
8	To determine wavelength of sodium light using Fresnel Biprism
9	To determine wavelength of sodium light using Newton's Rings.
10	To determine wavelength of (1) Sodium & (2) spectrum of Mercury light using plane diffraction Grating
11	To determine the Resolving Power of a Plane Diffraction Grating.

- **Industry visit.**

Reference Books:

1. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practical's, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi

CHS 206: Chemistry Lab-IV

(Version 1.0, Program Core, School of Sciences)

Lect.	Tut.	Pract.	Credits	Evaluation Scheme				
				Component	Exam	WT	Min. Pass (%)	
-	-	4	2	Practical	FEP	50	40	40
					POE	50	40	

Course Description: This course is at even semester of second year of BSc. It is a foundation course in Chemistry laboratory and it covers basic skills of physical and inorganic chemistry laboratory.

Course Outcomes: At the end of this course students will able to

CO1	Disdingwish[2] Cation and anion.
CO2	Estimate[2] cations from its compound.
CO3	Discribe[2] physical properties (Surface tension and Viscosity) of liquid.
CO4	Discuss[2] Chemical Kinetics.

Practical Syllabus

S.N. **Description**

1. Semi-micro qualitative analysis out of the following:
Cations: NH^{4+}, Pb^{2+}, Ag^{+}, Bi^{3+}, Cu^{2+}, Cd^{2+}, Sn^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Cr^{3+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, K^{+}
Anions: $CO3^{2-}$, S^{2-}, SO^{2-}, $S2O3^{2-}$, NO^{3-}, $CH3COO^{-}$, Cl^{-}, Br^{-}, I^{-}, $NO3^{-}$, $SO4^{2-}$, $PO4^{3-}$, $BO3^{3-}$, $C2O4^{2-}$, F^{-}
(Spot tests should be carried out wherever feasible)

2. Draw calibration curve (absorbance at λ_{max} vs. concentration) for various concentrations of a given coloured compound (KMnO4/ CuSO4) and estimate the concentration of the same in a given solution.

3. Estimation of total hardness of a given sample of water by Complexometric titration.

4. Estimation of (i) Mg^{2+}or (ii) $Zn^{2+}$by Complexometric titrations using EDTA.

5. Surface tension measurement (use of organic solvents excluded).
a) Determination of the surface tension of a liquid or a dilute solution using a stalagmometer. b) Study of the variation of surface tension of a detergent solution with concentration.

6. Viscosity measurement (use of organic solvents excluded).
a) Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer.
b) Study of the variation of viscosity of an aqueous solution with concentration of solute.

7. **Chemical Kinetics**
Initial rate method:
Iodide-persulphate reaction

8. Integrated rate method:
Acid hydrolysis of methyl acetate with hydrochloric acid.

Reference Books

1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
3. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).

MTS206: Mathematics Practical IV (C-Programming –II)

(Ver. 1.0, Program Core, School of Science)

Lect.	Tut.	Pract.	Credits	Evaluation Scheme				
				Component	Exam	WT	Min. Pass. (%)	
-	-	4	2	Practical	FEP	50	40	
					POE	50	40	40

Course Description: This course is at even semester of second year B.Sc. It is computational course in Mathematics. It covers Matrix operation, finding values of series, and mathematical methods in C programming.

Course Outcomes: At the end of this course students will able to

CO1	Find[3] Number of days in months.
CO2	Find[3] Sums and product of series up to n terms.
CO3	Apply[2] String Library function.

Syllabus (Practical)

S.N **Description**

1. Loop Structure II: while and do while loop,
   - To print reverse number
   - Calculating GCD and LCM of two numbers
   - To reverse the given number, To generate Prime numbers till the specified number
   - To generate Pascal's Triangle
   - To find the sum of 1+2+3+……+n using while loop
   - Calculating sum and sine, Cosine and exponential series using while and do while loop
2. Loop Structure III:
   Break, Continue, Go to, switch statements
   - To display month days if month number is entered using switch statement
   - To find maximum of two numbers using go to statement
   - Testing number to be maximum or not using continue and break statement
   - Testing given number is to be Prime or not
   - Use switch statement to display Monday to Sunday
3. Array-One Dimensional:
   - Declaration ,i/p and o/p of one dimensional array,
   - C-program to find maximum and minimum elements in the given array,
   - Sorting of an Array(Bubble Sort method
4. Array-Two Dimensional:
   - Declaration ,i/p and o/p of two dimensional array,
   - To find number of Pass and fail from the given marks
5. Pointer:

- Program to find maximum number in array using pointer
- Program to find sum of two numbers using Pointer

6. Matrix Algebra:
    - C-program to display matrix,
    - Matrix addition and subtraction,
    - Product of matrices and transpose
7. Function:
    - Types of function with simple programs,
    - C program to find value of nCr
    - Generate Pascals-Tringle
    - Find square of number using function
    - Table of numbers using function
8. Solving an Algebraic Equations using Remainder Theorem
9. Drawing Conic sections
   (Arc , Circle, ellipse)
10. Using String Library Functions
    - To display input and output of string
    - Copy one string to another
    - Revert the string
    - Join two strings

Textbook:

1. **YashwantKanetkar:** Let Us C

References:

1. **E Balguruswamy**: Programming in ANSI C.
2. **P.S.V. Srinivasa Rao**: C programming and Data structures(2nd edition)
3. Programming in C- Schuam Outline Series
4. Link http://www.skiet.org/downloads/cprogrammingquestion.pdf

BOS 206: Botany Lab-IV

(Version 1.0, Program Core, School of Sciences)

Lect.	Tut.	Pract.	Credits	Evaluation Scheme			
				Component	Exam	WT	Pass
-	-	4	2	Practical (100)	FEP	50	Min 40
					POE	50	

Course Description:

This course is in the even semester of second year B.Sc. This module provides students with practical skills to execute experiments in Botany to understand the effect of environmental factors on plants, plant physiology and its processes.

Course Outcomes: At the end of this course, students will able to:

CO1 :	Examine the effect of environmental factors on plants.
CO2 :	Examine the physiological characters of plants.
CO3 :	Understand[2] the biochemical nature of enzymes in plants.

Syllabus

S. N.	Name of the Experiment
1	To study the osmotic potential of plant by plasmolysis method.
2	Separation of chloroplast pigments from leaf using solvent extraction method.
3	Separation of amino acids by paper chromatography method.
4	To study the effect of light intensity and bicarbonate concentration on O2 evolution in photosynthesis,
5	To study the effect of two environmental factors (light and wind) on transpiration.
6	To demonstrate the effect of auxins on rooting of a plant,
7	To demonstrate the activity of catalase and study the effect of pH and enzyme concentration.

- **Mini Project Report.**

Reference Books:

1. Ninfa A.J and Balloue D.P, Fundamental laboratory approaches of Biochemistry, FitzgTerald Science press, Maryland, USA, (1998).
2. Taiz L, Zeiger E, Sinaeur Associates, Plant Physiology, USA (5th edition)

CHS 208: Green Methods in Chemistry

(Version 1.0, Program Core, School of Sciences)

Lect.	Tut.	Pract.	Credits	Evaluation Scheme				
				Component	Exam	WT	Min. Pass (%)	
-	-	2	1	Practical	FEP	50	40	40
					POE	50	40	

Course Description: This course is at even semester of second year of BSc. It is a skill enhancement course in Chemistry laboratory and it covers basic Green chemistry laboratory skills.

Course Outcomes: At the end of this course students will able to

CO1	Apply[3] knowledge of green chemistry and relate them to green process matrices.
CO2	Demonstrate[3] their understanding of green chemistry

Practical Syllabus

S.N.	Description
1.	Preparation of acetanilide
2.	Synthesis of dibenzalpropanone
3.	Bromination of trans-stilbene
4.	Benzil - Benzilic acid rearrangement
5.	Photoreduction of benzophenone to benzopinacol
6.	Thiamine hydrochloride catalyzed synthesis of benzoin
7.	Preparation of Iron/Manganese(III) acetylacetonate
8.	Ionic Liquid, 1-methyl-3-pentyl-imidazolium bromide, [pmIm]Br and its application
9.	Tetrabutylammonium tribromide (TBATB) and its application
10.	Atom economy: Two reactions for comparison.
11.	Preparation and characterization of biodiesel from vegetable oil.
12.	Determining the amount of acid in ketchup and hot sauce
13.	Determination of amount of ascorbic acid in a vitamin C tablet by redox titration.

Reference Books:

1. S. Chandrasekaran, Monograph on Green Chemistry Laboratory Experiments, Green Chemistry Task Force Committee, DST.
2. V. K. Ahluwalia, Green Chemistry:Environmentally benign Reaction; Ane Books Pvt Ltd.
3. Sally A. Henrie, Kathleen Cooper, Kelsey Denny, Rachael Harris, Samantha Howard, Michael Jones, Patrick Jones, Kelsie Wood; Green Chemistry Laboratory Manual for General Chemistry; CRC Press, Tayler & Francis Group.
4. P. T. Anastas, J. C. Warner.: Green Chemistry - Theory and Practical, Oxford University Press.

CHS 212: Computational Chemistry Lab

(Version 1.0, Program Core, School of Sciences)

Lect.	Tut.	Pract.	Credits	Evaluation Scheme				
				Component	Exam	WT	Min. Pass (%)	
-	-	2	1	Practical	FEP	50	40	40
					POE	50	40	

Course Description: This course is at even semester of second year of BSc. It is a skill enhancement course in Chemistry laboratory and it covers basic Computational Chemistry laboratory skills.
Course Outcomes: At the end of this course students will able to

CO1	Understand[1] use of tools in computational chemistry.
CO2	Apply[2] tools of computational chemistry for predicting molecular properties.

Practical Syllabus

S.N.	Description
1	Introduction of computational chemistry software e.g. MOPAC, SPARTAN, Gaussian,
2	2D and 3D structure building of chemical compounds.
3	Quantum chemical single point energy calculation, geometry optimization of ethylene in comparison of fluoro ethylene.
4	Electrostatic contact potential, HUMO and LUMO calculation of chemical compounds.
5	Molecular docking of protein and drug compound.
6	Demo of molecular dynamics simulations using free software e.g. GROMACS, NAMD.

Reference Books:

1. Christopher J. Cramer, Essentials of Computational Chemistry Theories and Models Second Edition, John Wiley & Sons Ltd, England, 2004
2. Alan Hinchliffe,Molecular Modeling for Beginners, Second Edition, John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, United Kingdom, 2008.
3. Andrew R. Leach, Molecular Modeling. Principles and Applications (2nd Edition), Pearson education Ltd., 1996, 2001
4. Hui-Wen Shih, Mac.Millan Group, Fundamentals of Computational Chemistry. A Guide for Organic Chemists, June 17, 2009.
5. Ramachandran, K. I., Deepa, G., Namboori, K. Computational Chemistry and Molecular Modeling. Coimbatore: Springer, 2008.
6. Frank Jensen, Introduction toComputational Chemistry, John Wiley & Sons Ltd the Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England, 2007
7. Donald W. Rogers, Computational Chemistry Using the PC Third Edition, John Wiley & Sons, Inc., 2003
8. Errol G. Lewars Computational Chemistry Introduction to the Theory and Applications of Molecular and Quantum Mechanics, Second Edition, Springer Dordrecht Heidelberg London New York, 2011.

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