**GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT (GITAM)**
**(Deemed to be University, Estd. u/s 3 of UGC Act 1956)**
**VISAKHAPATNAM HYDERABAD BENGALURU**

**Accredited by NAAC with 'A$^{+}$' Grade**

# REGULATIONS AND SYLLABUS

**of**

## B.Sc., Physical Sciences

**(W.e.f 2019-20 Admitted batch)**

**Website: www.gitam.edu**

**Bachelor of Science**
**(B.Sc., Physical Sciences)**

**REGULATIONS**
**(W.e.f. 2019-20 admitted batch)**

## ADMISSION

1.1 Admission into **B.Sc. Physical Sciences** program of GITAM University is governed by GITAM University admission regulations.

## ELIGIBILITY CRITERIA

2.1. A pass in Intermediate with a minimum aggregate of 50% marks / a pass in any with minimum aggregate of 50% marks along with Mathematics, Physics and Chemistry or equivalent thereof.

2.2. Admission into **B.Sc., Physical Sciences** (**Bachelor of Science -Physical Sciences**) will be based on an All India GITAM Science Admission Test (GSAT) conducted by GITAM University and the rule of reservation, wherever applicable.

## CHOICE BASED CREDIT SYSTEM

Choice Based Credit System (CBCS) is introduced with effect from the admitted Batch of 2015-16 based on UGC guidelines in order to promote:

Student Centered Learning
Cafeteria approach
Inter-disciplinary learning

Learning goals/ objectives and outcomes are specified leading to what a student should be able to do at the end of the program.

## STRUCTURE OF THE PROGRAM

4.1 The Program Consists of

Foundation Courses (compulsory) which give general exposure to a Student in communication and subject related area.

Core Courses (compulsory).

Discipline centric electives which

are supportive to the discipline

give expanded scope of the subject

give their disciplinary exposure

nurture the student skills

Open electives are of general nature either related or unrelated to the discipline.

Practical Proficiency Courses, Laboratory and Project work.

4.2 Each course is assigned a certain number of credits depending upon the number of contact hours (lectures/tutorials/practical) per week.

4.3 In general, credits are assigned to the courses based on the following contact hours per week per semester.

One credit for each Lecture / Tutorial hour per week.

One credit for two hours of Practical per week.

Eight credits for project.

4.4 The curriculum of the six semesters **B.Sc., Physical Sciences** program is designed to have a total of 122 credits for the award of **B.Sc., Physical Sciences** degree.

**MEDIUM OF INSTRUCTION**

The medium of instruction (including examinations and project reports) shall be in English.

**REGISTRATION**

Every student has to register himself / herself for each semester individually at the time specified by the Institute / University.

## 7. ATTENDANCE REQUIREMENTS

7.1. A student whose attendance is less than 75% in all the courses put together in any semester will not be permitted to attend that end - semester examination and he/she will not be allowed to register for subsequent semester of study. He/she has to repeat the semester along with his / her juniors.

7.2. However, the Vice Chancellor on the recommendation of the Principal / Director of the Institute/School may condone the shortage of attendance to the students whose attendance is between 66% and 74% on genuine grounds and on payment of prescribed fee.

## 8. EVALUATION

8.1 The assessment of the student's performance in a Theory course shall be based on two components: Continuous Evaluation (40 marks) and Semester-end examination (60 marks).

8.2 A student has to secure an aggregate of 40% in the course in continuous and semester end examinations the two components put together to be declared to have passed the course, subject to the condition that the candidate must have secured a minimum of 24 marks (i.e. 40%) in the theory component at the semester-end examination.

8.3 Practical/ Viva voce etc. course are completely assessed under Continuous Evaluation for a maximum of 100 marks and a student has to obtain a minimum of 40% to secure Pass Grade. Details of Assessment Procedure are furnished below in Table 1.

**Table 1: Assessment Procedure**

| S. No. | Component of assessment | Marks allotted | Type of Assessment | Scheme of Examination |
|---|---|---|---|---|
| 1 | Theory | 40 | Continuous evaluation | (i) Three mid semester examinations shall be conducted for 15 marks each. The performance in best two shall be taken into consideration. (ii) 5 marks are allocated for quiz. (iii) 5 marks are allocated for assignments. |
| | | 60 | Semester-end examination | The semester-end examination shall be for a maximum of 60 marks. |
| | Total | 100 | | |
| 2 | Practicals | 100 | Continuous evaluation | 60 marks for performance, regularity, record/ and case study. Weightage for each component shall be announced at the beginning of the semester. 40 marks (30 marks for experiment(s) and 10 marks for practical Viva-voce.) for the test conducted at the end of the Semester conducted by the concerned lab Teacher. |
| | Total | 100 | | |

**RETOTALING & REVALUATION**

9.1 Retotaling of the theory answer script of the semester-end examination is permitted on request by the student by paying the prescribed fee within one week after the announcement of the results.

9.2 Revaluation of the theory answer scripts of the semester-end examination is permitted on request by the student by paying the prescribed fee within one week after the announcement of the result.

**PROVISION FOR ANSWER BOOK VERIFICATION & CHALLENGE EVALUATION:**

10.1 If a student is not satisfied with his/her grade after revaluation, the student can apply for, answer book verification on payment of prescribed fee for each course within one week after announcement of revaluation results.

10.2 After verification, if a student is not satisfied with revaluation marks/grade awarded, he/she can apply for challenge valuation within one week after announcement of answer book verification result/ two weeks after the announcement of revaluation results, which will be valued by the two examiners i.e., one Internal and one External examiner in the presence of the student on payment of prescribed fee. The challenge valuation fee will be returned, if the student is succeeded in the appeal with a change for a better grade.

## 11. SUPPLEMENTARY EXAMINATIONS & SPECIAL EXAMINATIONS:

11.1 The odd semester supplementary examinations will be conducted on daily basis after conducting regular even semester examinations in April/May.

11.2 The even semester supplementary examinations will be conducted on daily basis after conducting regular odd semester examinations during November/December

11.3 A student who has completed his/her period of study and still has "F" grade in final semester courses is eligible to appear for Special Examination normally held during summer vacation.

## 12. PROMOTION TO THE NEXT YEAR OF STUDY

12.1 A student shall be promoted to the next academic year only if he/she completes the academic requirements of 60% of the credits till the previous academic year.

12.2 Whenever there is a change in syllabus or curriculum he/she has to continue the course with new regulations after detention as per the equivalency established by the BoS to continue his/her further studies.

## 13. BETTERMENT OF GRADES

13.1 A student who has secured only a pass or second class and desires to improve his/her class can appear for betterment examinations only in 'n' (where 'n' is no.of semesters of the program) theory courses of any semester of his/her choice, conducted in summer vacation along with the Special Examinations.

13.2 Betterment of Grades is permitted 'only once', immediately after completion of the program of study.

## REPEAT CONTINUOUS EVALUATION:

14.1 A student who has secured 'F' grade in a theory course shall have to reappear at the subsequent examination held in that course. A student who has secured 'F' grade can improve continuous evaluation marks upto a maximum of 50% by attending special instruction classes held during summer.

14.2 A student who has secured 'F' grade in a practical course shall have to attend Special Instruction classes held during summer.

14.3 A student who has secured 'F' grade in a combined (theory and practical) course shall have to reappear for theory component at the subsequent examination held in that course. A student who has secured 'F' grade can improve continuous evaluation marks upto a maximum of 50% by attending special instruction classes held during summer.

14.4 The RCE will be conducted during summer vacation for both odd and even semester students. Student can register a maximum of 4 courses. Biometric attendance of these RCE classes has to be maintained. The maximum marks in RCE be limited to 50% of Continuous Evaluation marks. The RCE marks are considered for the examination held after RCE except for final semester students.

14.5 RCE for the students who completed course work can be conducted during the academic semester. The student can register a maximum of 4 courses at a time in slot of 4 weeks. Additional 4 courses can be registered in the next slot.

14.6 A student is allowed to Special Instruction Classes (RCE) 'only once' per course.

## 15. GRADING SYSTEM

15.1 Based on the student performance during a given semester, a final letter grade will be awarded at the end of the semester in each course. The letter grades and the corresponding grade points are as given in Table 2.

**Table 2: Grades & Grade Points**

| Sl.No. | Grade | Grade Points | Absolute Marks |
|---|---|---|---|
| 1 | O (outstanding) | 10 | 90 and above |
| 2 | A+ (Excellent) | 9 | 80 to 89 |
| 3 | A (Very Good) | 8 | 70 to 79 |
| 4 | B+ (Good) | 7 | 60 to 69 |
| 5 | B (Above Average) | 6 | 50 to 59 |
| 6 | C (Average) | 5 | 45 to 49 |
| 7 | P (Pass) | 4 | 40 to 44 |
| 8 | F (Fail) | 0 | Less than 40 |
| 9 | Ab. (Absent) | 0 | - |

15.2 A student who earns a minimum of 4 grade points (P grade) in a course is declared to have successfully completed the course, subject to securing an average GPA (average of all GPAs in all the semesters) of 5 at the end of the Program to declare pass in the program.

Candidates who could not secure an average GPA of 5 at the end of the program shall be permitted to reappear for a course(s) of their choice to secure the same.

## 16. GRADE POINT AVERAGE

16.1 A Grade Point Average (GPA) for the semester will be calculated according to the formula:

$$GPA = \frac{[C*G]}{C}$$

Where

C = number of credits for the course,
G = grade points obtained by the student in the course.

16.2 To arrive at Cumulative Grade Point Average (CGPA), a similar formula is used considering the student's performance in all the courses taken, in all the semesters up to the particular point of time.

16.3 CGPA required for classification of class after the successful completion of the program is shown in Table 3.

**Table 3: CGPA required for award of Class**

| Class | CGPA Required |
|---|---|
| First Class with Distinction | ≥ 8.0* |
| First Class | ≥ 6.5 |
| Second Class | ≥ 5.5 |
| Pass Class | ≥ 5.0 |

* In addition to the required CGPA of 8.0 or more the student must have necessarily passed all the courses of every semester in first attempt.

**ELIGIBILITY FOR AWARD OF THE B.Sc Physical Sciences DEGREE**

17.1 Duration of the program: A student is ordinarily expected to complete **B.Sc Physical Science** program in six semesters of three years. However a student may complete the program in not more than five years including study period. However the above regulation may be relaxed by the Vice Chancellor in individual cases for cogent and sufficient reasons.

17.2 A student shall be eligible for award of the **B.Sc Physical Science** Degree if he / she fulfills all the following conditions.

Registered and successfully completed all the courses and projects if applicable.

Successfully acquired the minimum required credits as specified in the curriculum corresponding to the branch of his/her study within the stipulated time.

Has no dues to the Institute, hostels, Libraries, NCC / NSS etc, and

No disciplinary action is pending against him / her.

17.3 The degree shall be awarded after approval by the Academic Council.

**18. DISCRETIONARY POWER:**

Not with standing anything contained in the above sections, the Vice Chancellor may review all exceptional cases, and give his decision, which will be final and binding.

**B.Sc., Physical Science – Scheme of Instruction**

**I Semester**

**B. Sc., Physical Science (Physics, Mathematics, Electronics)**

| Course Code | Subject | Category | Instruction Hours/week | | Credits | Scheme of Instruction | | |
|---|---|---|---|---|---|---|---|---|
| | | | L | P | 20 | CE | SE | Total Marks |
| SFC 101 | English for Communication– I | AECC | 3 | 0 | 2 | 40 | 60 | 100 |
| SPH 103 | Mechanics | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 123 | Mechanics Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH 107 | Basic Circuit Theory | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 127 | Basic Circuits Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH 101 | Differential Calculus | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 121 | Differential Calculus Tutorial | PPC | 2 | 0 | 2 | 100 | -- | 100 |

**B. Sc., Physical Science (Physics, Mathematics, Chemistry)**

| Course Code | Subject | Category | Instruction Hours/ week | | Credits | Scheme of Instruction | | |
|---|---|---|---|---|---|---|---|---|
| | | | L | P | | CE | SE | Total Marks |
| SFC 101 | English for Communication– I | AECC | 3 | 0 | 2 | 40 | 60 | 100 |
| SPH 101 | Differential Calculus | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 121 | Differential Calculus Tutorial | PPC | 2 | 0 | 2 | 100 | -- | 100 |
| SPH 103 | Mechanics | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 123 | Mechanics Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH 105 | Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 125 | Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |

**B. Sc.,Physical Science (Physics, Mathematics, Computer Science)**

| Course Code | Subject | Category | Instruction Hours/week | | Credits | Scheme of Instruction | | |
|---|---|---|---|---|---|---|---|---|
| | | | L | P | | CE | SE | Total Marks |
| SFC 101 | English for Communication– I | AECC | 3 | 0 | 2 | 40 | 60 | 100 |
| SPH 101 | Differential Calculus | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 121 | Differential Calculus Tutorial | PPC | 2 | 0 | 2 | 100 | -- | 100 |
| SPH 103 | Mechanics | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 123 | Mechanics Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH 109 | Object Oriented Programming in C++ | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 129 | Object Oriented Programming in C++ Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |

**II Semester**

**B. Sc. Physical Science (Physics, Mathematics, Electronics)**

| Course Code | Subject | Category | Instruction Hours/week | | Credits | Scheme of Instruction | | |
|---|---|---|---|---|---|---|---|---|
| | | | L | P | 20 | CE | SE | Total Marks |
| SFC 102 | Environmental Science | AECC | 3 | 0 | 2 | 40 | 60 | 100 |
| SPH 104 | Waves and Optics | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 122 | Waves and Optics Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH 108 | Electronic Devices & Circuits | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 126 | Electronic Devices & Circuits Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH 102 | Differential Equations | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 120 | Differential Equations Tutorial | PPC | 2 | 0 | 2 | 100 | -- | 100 |

**B. Sc., Physical Science (Physics, Mathematics, Chemistry)**

| Course Code | Subject | Category | Instruction Hours/week | | Credits | Scheme of Instruction | | |
|---|---|---|---|---|---|---|---|---|
| | | | L | P | | CE | SE | Total Marks |
| SFC 102 | Environmental Science | AECC | 3 | 0 | 2 | 40 | 60 | 100 |
| SPH 104 | Waves and Optics | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 122 | Waves and Optics Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH 106 | Chemical Energetics, Equilibria & Functional Organic Chemistry | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 124 | Chemical Energetics, Equilibria & Functional Organic Chemistry Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH 102 | Differential Equations | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 120 | Differential Equations Tutorial | PPC | 2 | 0 | 2 | 100 | -- | 100 |

**B. Sc. Physical Science (Physics, Mathematics, Computer Science)**

| Course Code | Subject | Category | Instruction Hours/week | | Credits | Scheme of Instruction | | |
|---|---|---|---|---|---|---|---|---|
| | | | L | P | | CE | SE | Total Marks |
| SFC 102 | Environmental Science | AECC | 3 | 0 | 2 | 40 | 60 | 100 |
| SPH 104 | Waves and Optics | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 122 | Waves and Optics Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH 102 | Differential Equations | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 120 | Differential Equations Tutorial | PPC | 2 | 0 | 2 | 100 | -- | 100 |
| SPH 110 | Data Structures And File Processing | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 128 | Data Structures And File Processing Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |

**III SEMESTER**

**B. Sc. Physical Science (Physics, Mathematics , Electronics)**

| Course Code | Subject | Category | Instruction Hours/week | | Credits | Scheme of Instruction | | |
|---|---|---|---|---|---|---|---|---|
| | | | L | P | 22 | CE | SE | Total Marks |
| SPH 203 | Thermal Physics and Statistical Mechanics | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 223 | Thermal Physics and Statistical Mechanics Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH 207 | Digital Electronics | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 227 | Digital Electronics Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH 201 | Real Analysis | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 221 | Real Analysis Tutorial | PPC | 2 | 0 | 2 | 100 | -- | 100 |
| SFC203 | English for Communication– II | AECC | 3 | 0 | 2 | 40 | 60 | 100 |
| **Choose any one** | | | | | | | | |
| SSE 271 | Physics Workshop Skill | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 273 | Basic analytical chemistry | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 275 | Logic and sets | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 277 | Computer Graphics | SEC | 2 | 0 | 2 | 100 | -- | 100 |

**III SEMESTER**

**B. Sc., Physical Science (Physics, Mathematics ,Chemistry)**

| Course Code | Subject | Category | Instruction Hours/week | | Credits | Scheme of Instruction | | |
|---|---|---|---|---|---|---|---|---|
| | | | L | P | | CE | SE | Total Marks |
| SPH 203 | Thermal Physics and Statistical Mechanics | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 223 | Thermal Physics and Statistical Mechanics Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH 205 | Solutions, phase equilibrium, conductance, electro chemistry & functional group organic chemistry-II | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 225 | Solutions, phase equilibrium, conductance, electro chemistry & functional group organic chemistry-II Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH 201 | Real Analysis | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 221 | Real Analysis Tutorial | PPC | 2 | 0 | 2 | 100 | -- | 100 |
| SFC203 | English for Communication– II | AECC | 3 | 0 | 2 | 40 | 60 | 100 |
| **Choose any one** | | | | | | | | |
| SSE 271 | Physics Workshop Skill | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 273 | Basic analytical chemistry | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 275 | Logic and sets | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 277 | Computer Graphics | SEC | 2 | 0 | 2 | 100 | -- | 100 |

**III SEMESTER**

**B. Sc., Physical Science (Physics, Mathematics, Computer Science)**

| Course Code | Subject | Category | Instruction Hours/week | | Credits | Scheme of Instruction | | |
|---|---|---|---|---|---|---|---|---|
| | | | L | P | | CE | SE | Total Marks |
| SPH 203 | Thermal Physics and Statistical Mechanics | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 223 | Thermal Physics and Statistical Mechanics Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH 201 | Real Analysis | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 221 | Real Analysis Tutorial | PPC | 2 | 0 | 2 | 100 | -- | 100 |
| SPH 209 | Design and Analysis of Algorithms | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 229 | Design and Analysis of Algorithms Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SFC203 | English for Communication– II | AECC | 3 | 0 | 2 | 40 | 60 | 100 |
| **Choose any one** | | | | | | | | |
| SSE 271 | Physics Workshop Skill | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 273 | Basic analytical chemistry | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 275 | Logic and sets | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 277 | Computer Graphics | SEC | 2 | 0 | 2 | 100 | -- | 100 |

**IV SEMESTER**

**B. Sc., Physical Science (Physics, Mathematics , Electronics)**

| Course Code | Subject | Category | Instruction Hours/week | | Credits | Scheme of Instruction | | |
|---|---|---|---|---|---|---|---|---|
| | | | L | P | **20** | CE | SE | Total Marks |
| SPH 204 | Electricity & Magnetism | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 222 | Electricity & Magnetism Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH 208 | Analog & Digital IC Applications | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 226 | Analog & Digital IC Applications Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH 202 | Algebra | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 220 | Algebra Tutorial | PPC | 2 | 0 | 2 | 100 | -- | 100 |
| **Choose any one** | | | | | | | | |
| SSE 272 | Radiation safety | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 274 | Chemical technology & society | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 276 | Vector calculus | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 278 | Number theory | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 280 | E-Commerce | SEC | 2 | 0 | 2 | 100 | -- | 100 |

**IV SEMESTER**

**B. Sc., Physical Science (Physics, Mathematics,Chemistry)**

| Course Code | Subject | Category | Instruction Hours/week | | Credits | Scheme of Instruction | | |
|---|---|---|---|---|---|---|---|---|
| | | | L | P | | CE | SE | Total Marks |
| SPH 204 | Electricity & Magnetism | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 222 | Electricity & Magnetism Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH 206 | Coordination chemistry, states of matter & chemical kinetics | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 224 | Coordination chemistry, states of matter & chemical kinetics Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH 202 | Algebra | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 220 | Algebra Tutorial | PPC | 2 | 0 | 2 | 100 | -- | 100 |
| **Choose any one** | | | | | | | | |
| SSE 272 | Radiation safety | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 274 | Chemical technology & society | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 276 | Vector calculus | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 278 | Number theory | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 280 | E-Commerce | SEC | 2 | 0 | 2 | 100 | -- | 100 |

**IV SEMESTER**

**B. Sc., Physical Science (Physics, Mathematics, Computer Science)**

| Course Code | Subject | Category | Instruction Hours/week | | Credits | Scheme of Instruction | | |
|---|---|---|---|---|---|---|---|---|
| | | | L | P | | CE | SE | Total Marks |
| SPH 204 | Electricity & Magnetism | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 222 | Electricity & Magnetism Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH 202 | Algebra | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 220 | Algebra Tutorial | PPC | 2 | 0 | 2 | 100 | -- | 100 |
| SPH 210 | Operating Systems | CC | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 228 | Operating Systems Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| **Choose any one** | | | | | | | | |
| SSE 272 | Radiation safety | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 274 | Chemical technology & society | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 276 | Vector calculus | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 278 | Number theory | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 280 | E-Commerce | SEC | 2 | 0 | 2 | 100 | -- | 100 |

**V SEMESTER**

**B. Sc. Physical Science (Physics, Mathematics, Electronics)**

| Course Code | Subject | Category | Instruction Hours/week | | Credits | Scheme of Instruction | | |
|---|---|---|---|---|---|---|---|---|
| | | | **L** | **P** | **20** | **CE** | **SE** | **Total Marks** |
| **Choose any one** | | | | | | | | |
| SPH 351* | Elements of Modern Physics | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 355** | Electronic Devices and Circuits | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 357*** | Materials Science | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| **Choose any one (*corresponding to theory course)** | | | | | | | | |
| SPH321* | Modern Physics lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH325** | Electronic Devices & circuits Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH347*** | Materials Science Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| **Choose any one** | | | | | | | | |
| SPH371 | Microprocessors (Intel 8085) | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH373 | Electronic communications | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH375 | Consumer electronics | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| **Choose any one ($ corresponding to theory course)** | | | | | | | | |
| SPH 327$ | Microprocessors lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH 329$$ | Electronic communications lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH 331$$$ | Consumer electronics lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| **Choose any one** | | | | | | | | |
| SPH361 | Matrices | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH363 | Statics & Dynamics | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH365 | Linear Algebra | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| **Choose any one (@ corresponding to theory course)** | | | | | | | | |
| SPH333@ | Matrices Tutorial | PPC | 2 | 0 | 2 | 100 | -- | 100 |
| SPH335@@ | Statics & Dynamics Tutorial | PPC | 2 | 0 | 2 | 100 | -- | 100 |
| SPH337@@@ | Linear Algebra Tutorial | PPC | 2 | 0 | 2 | 100 | -- | 100 |
| **Choose any one** | | | | | | | | |
| SSE 371 | Applied Optics | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 373 | Pharmaceutical chemistry | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 375 | Theory of Equations | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 377 | Probability and Statistics | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 379 | Combinatorial Optimization | SEC | 2 | 0 | 2 | 100 | -- | 100 |

**V SEMESTER**

**B. Sc., Physical Science (Physics, Mathematics , Chemistry)**

| Course Code | Subject | Category | Instruction Hours/week | | Credits | Scheme of Instruction | | |
|---|---|---|---|---|---|---|---|---|
| | | | **L** | **P** | | **CE** | **SE** | **Total Marks** |
| **Choose any one** | | | | | | | | |
| SPH 351* | Elements of Modern Physics | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 355*** | Electronic Devices and Circuits | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 357** | Materials Science | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| **Choose any one (*corresponding to theory course)** | | | | | | | | |
| SPH321* | Modern Physics lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH325** | Electronic Devices & circuits Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH347*** | Materials Science Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| **Choose any one** | | | | | | | | |
| SPH381 | Analytical methods in chemistry | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH383 | Green chemistry | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| **Choose any one (# corresponding to theory course)** | | | | | | | | |
| SPH 339# | Analytical methods in chemistry lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH 341## | Green chemistry lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| **Choose any one** | | | | | | | | |
| SPH361 | Matrices | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH363 | Statics & Dynamics | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH365 | Linear Algebra | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| **Choose any one (@ corresponding to theory course)** | | | | | | | | |
| SPH333@ | Matrices Tutorial | PPC | 2 | 0 | 2 | 100 | -- | 100 |
| SPH335@@ | Statics & Dynamics Tutorial | PPC | 2 | 0 | 2 | 100 | -- | 100 |
| SPH337@@@ | Linear Algebra Tutorial | PPC | 2 | 0 | 2 | 100 | -- | 100 |
| **Choose any one** | | | | | | | | |
| SSE 371 | Applied Optics | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 373 | Pharmaceutical chemistry | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 375 | Theory of Equations | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 377 | Probability and Statistics | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 379 | Combinatorial Optimization | SEC | 2 | 0 | 2 | 100 | -- | 100 |

**V SEMESTER**

**B. Sc., Physical Science (Physics, Mathematics, Computer Science)**

| Course Code | Subject | Category | Instruction Hours/week | | Credits | Scheme of Instruction | | |
|---|---|---|---|---|---|---|---|---|
| | | | **L** | **P** | | **CE** | **SE** | **Total Marks** |
| **Choose any one** | | | | | | | | |
| SPH 351* | Elements of Modern Physics | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 355** | Electronic Devices and Circuits | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 357*** | Materials Science | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| **Choose any one (*corresponding to theory course)** | | | | | | | | |
| SPH321* | Modern Physics lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH325** | Electronic Devices & circuits Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH347*** | Materials Science Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| **Choose any one** | | | | | | | | |
| SPH361 | Matrices | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH363 | Statics & Dynamics | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH365 | Linear Algebra | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| **Choose any one ( @ corresponding to theory course)** | | | | | | | | |
| SPH333@ | Matrices Tutorial | PPC | 2 | 0 | 2 | 100 | -- | 100 |
| SPH335@@ | Statics & Dynamics Tutorial | PPC | 2 | 0 | 2 | 100 | -- | 100 |
| SPH337@@@ | Linear Algebra Tutorial | PPC | 2 | 0 | 2 | 100 | -- | 100 |
| **Choose any one** | | | | | | | | |
| SPH391 | Data Mining | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH393 | Cryptography | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| **Choose any one (&corresponding to theory course)** | | | | | | | | |
| SPH343& | Data Mining Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH345&& | Cryptography Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| **Choose any one** | | | | | | | | |
| SSE 371 | Applied Optics | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 373 | Pharmaceutical chemistry | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 375 | Theory of Equations | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 377 | Probability and Statistics | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 379 | Combinatorial Optimization | SEC | 2 | 0 | 2 | 100 | -- | 100 |

**VI SEMESTER**

**B. Sc. Physical Science (Physics, Mathematics, Electronics)**

| Course Code | Subject | Category | Instruction Hours/week | | Credits | Scheme of Instruction | | |
|---|---|---|---|---|---|---|---|---|
| | | | **L** | **P** | **20** | **CE** | **SE** | **Total Marks** |
| **Choose any one** | | | | | | | | |
| SPH 352* | Digital and Analog Electronics | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 356** | Electronic Communications | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 358*** | Solid State and Nuclear Physics | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| **Choose any one (*corresponding to theory course)** | | | | | | | | |
| SPH320*** | Solid State and Nuclear Physics lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH322* | Digital and Analog Electronics Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH326** | Electronic Communications Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| **Choose any one** | | | | | | | | |
| SPH372 | Microcontrollers& Applications | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH374 | VLSI Design | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH376 | Mathematical methods and analysis Using MATLAB | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| **Choose any one ($ corresponding to theory course)** | | | | | | | | |
| SPH 328$ | Microcontrollers & Applications Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH 330$$ | VLSI design Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH 332$$$ | MATLAB | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| **Choose any one** | | | | | | | | |
| SPH362 | Numerical methods | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH364 | Complex analysis | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH366 | Linear programming | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| **Choose any one (@ corresponding to theory course)** | | | | | | | | |
| SPH334@ | Numerical methodsTutorial | PPC | 2 | 0 | 2 | 100 | -- | 100 |
| SPH336@@ | Complex analysisTutorial | PPC | 2 | 0 | 2 | 100 | -- | 100 |
| SPH338@@@ | Linear programmingTutorial | PPC | 2 | 0 | 2 | 100 | -- | 100 |
| **Choose any one** | | | | | | | | |
| SSE 372 | Basic instrumentation skills | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 374 | Pesticide chemistry | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 376 | Transportation and game theory | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 378 | Graph theory | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 380 | Concepts of Ethical Hacking | SEC | 2 | 0 | 2 | 100 | -- | 100 |

**VI SEMESTER**

**B. Sc. Physical Science (Physics, Mathematics, Chemistry)**

| Course Code | Subject | Category | Instruction Hours/week | | Credits | Scheme of Instruction | | |
|---|---|---|---|---|---|---|---|---|
| | | | **L** | **P** | | **CE** | **SE** | **Total Marks** |
| **Choose any one** | | | | | | | | |
| SPH 352* | Digital and Analog Electronics | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 356** | Electronic Communications | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 358*** | Solid State and Nuclear Physics | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| **Choose any one (*corresponding to theory course)** | | | | | | | | |
| SPH320*** | Solid State and Nuclear Physics Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH322* | Digital and Analog Electronics Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH326** | Electronic Communications Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| **Choose any one** | | | | | | | | |
| SPH 352* | Digital and Analog Electronics | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 354** | Nuclear and Solid State Physics | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 356*** | Electronic Communications | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| **Choose any one (*corresponding to theory course)** | | | | | | | | |
| SPH322* | Digital and Analog Electronics Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH324** | Nuclear and solid state physics lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH326*** | Electronic Communications Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| **Choose any one** | | | | | | | | |
| SPH382 | Industrial chemicals and environment | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH384 | Instrumental methods of analysis | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| **Choose any one (# corresponding to theory course)** | | | | | | | | |
| SPH 340# | Industrial chemicals and environment Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH 342## | Instrumental methods of analysis Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| **Choose any one** | | | | | | | | |
| SPH362 | Numerical methods | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH364 | Complex analysis | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH366 | Linear programming | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| **Choose any one (@ corresponding to theory course)** | | | | | | | | |
| SPH334@ | Numerical methodsTutorial | PPC | 2 | 0 | 2 | 100 | -- | 100 |
| SPH336@@ | Complex analysisTutorial | PPC | 2 | 0 | 2 | 100 | -- | 100 |
| SPH338@@@ | Linear programmingTutorial | PPC | 2 | 0 | 2 | 100 | -- | 100 |
| **Choose any one** | | | | | | | | |
| SSE 372 | Basic instrumentation skills | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 374 | Pesticide chemistry | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 376 | Transportation and game theory | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 378 | Graph theory | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 380 | Concepts Ethical Hacking | SEC | 2 | 0 | 2 | 100 | -- | 100 |

**VI SEMESTER**

**B. Sc. Physical Science (Physics, Mathematics, Computer Science)**

| Course Code | Subject | Category | Instruction Hours/week | | Credits | Scheme of Instruction | | |
|---|---|---|---|---|---|---|---|---|
| | | | **L** | **P** | | **CE** | **SE** | **Total Marks** |
| **Choose any one** | | | | | | | | |
| SPH 352* | Digital and Analog Electronics | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 356** | Electronic Communications | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH 358*** | Solid State and Nuclear Physics | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| **Choose any one (*corresponding to theory course)** | | | | | | | | |
| SPH320*** | Solid State and Nuclear Physics lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH322* | Digital and Analog Electronics Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH326** | Electronic Communications Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| **Choose any one** | | | | | | | | |
| SPH362 | Numerical methods | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH364 | Complex analysis | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH366 | Linear programming | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| **Choose any one (@ corresponding to theory course)** | | | | | | | | |
| SPH334@ | Numerical methodsTutorial | PPC | 2 | 0 | 2 | 100 | -- | 100 |
| SPH336@@ | Complex analysisTutorial | PPC | 2 | 0 | 2 | 100 | -- | 100 |
| SPH338@@@ | Linear programmingTutorial | PPC | 2 | 0 | 2 | 100 | -- | 100 |
| **Choose any one** | | | | | | | | |
| SPH392 | Information security | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH394 | Database applications | DSE | 4 | 0 | 4 | 40 | 60 | 100 |
| SPH396 | Computer networks | | | | | | | |
| **Choose any one (&corresponding to theory course)** | | | | | | | | |
| SPH344& | Information security Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH346&& | Database applications Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| SPH348&& | Computer networks Lab | PPC | 0 | 4 | 2 | 100 | -- | 100 |
| **Choose any one** | | | | | | | | |
| SSE 372 | Basic instrumentation skills | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 374 | Pesticide chemistry | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 376 | Transportation and game theory | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 378 | Graph theory | SEC | 2 | 0 | 2 | 100 | -- | 100 |
| SSE 380 | Concepts of Ethical Hacking | SEC | 2 | 0 | 2 | 100 | -- | 100 |

**B.Sc., Physical Science**
**SEMESTER-I**
**SFC: 101 English for Communication– I**

Hours per week: 3 End Examination: 60 Marks
Credits: 2 Sessionals: 40 M

**Preamble:** This course has been designed to enrich students' listening, speaking, reading and writing, abilities so they can pursue their personal, academic and career goals through the acquisition and improvement of English language skills. Students engage with the text while reinforcing what is learnt.

**Objective:**

To develop right pronunciation
To enable students to use English in day-to-day communication
To facilitate the use of language without grammatical errors
To expose them to prose and poetry and enable them to learn language through simple literature.
To build advanced vocabulary
To improve reading skills

**UNIT- I The eyes are not here – Ruskin Bond**

Pronunciation: Consonants,**Grammar:** Nouns, **Vocabulary:**Roots forms of words**, Spelling:** Correcting wrong spelling, **Punctuation:**Capitalisation,
**Conversation and Role Play:** Introducing oneself in formal or social contexts,

**Learning outcomes:**
By the end of the course, the student will be able to:

Develop creative communication skills
Understand and use consonant sounds in phonemic language
Use correct spelling and capitalization.
Introduce oneself in the appropriate diction, style and tone.

**UNIT- II Work Brings Solace – APJ Abdul Kalam**

**Pronunciation:** Monophthongs **Grammar:** Pronouns,
**Vocabulary:** Prefixes & Suffixes, **Spelling:** using 'un' and 'dis' to complete antonyms**,**
**Punctuation:** Capitalisation,
**Conversation and Role Play:** starting a conversation/controlling a conversation**,**
**Learning outcomes:**
By the end of the course, the student will be able to:

perceive the content in the academic text and recognize the organization and purpose of reading a text.
determine the meaning of words using roots, *prefixes, and suffixes*. engage in discussion on everyday topics
. *open* and keep *conversations* going.
interrupt and end *conversations* appropriately

**UNIT –III Bangle Sellers – Sarojini Naidu**

**Pronunciation:** Diphthongs **Grammar:** Helping verbs & auxiliary verbs, **Vocabulary:** Homophones, Homographs, Homonyms **Punctuation:** comma & full stop,
**Conversation:** Describing one's college and course of study, **Writing:** Paragraph writing/ Descriptive Writing,

**Learning outcomes:**
By the end of the course, the student will be able to:

Comprehend and interpret poetic diction
define '*diphthong*'; recognize and identify *diphthongs* in speech and text
Demonstrate the use of homophones, homographs, and homonyms in writing.
Recognize and use comma and *full stop* in appropriate places in the text.
Speak about his/her course of study and describe the college he/she is studying in with the right diction and tone.
*Construct a paragraph* on familiar and academic topics using a topic sentence

**UNIT -IV** **The Merchant of Venice (Extract) – William Shakespear**
**Pronunciation:** varied pronunciation of some letters of the alphabet**Grammar:** Main verbs Tenses, **Vocabulary:** Collocations, **Punctuation:** Question mark and Exclamation mark, **Conversation:** Leaving a message and taking an appointment

**Learning outcomes:**
By the end of the course, the student will be able to:

appreciate the varied uses of language in Shakespearean Play
Use present, past and future tenses with appropriate time markers.
Be aware of the different types of collocations and use them appropriately
Recognize and use question mark and *exclamation mark* in appropriate places in the text.
Leave a message and take an appointment in a professional manner

**UNIT- V** **Vocabulary building:** Synonyms, Antonyms, One Word Substitutes, Phrasal Verbs, Idiomatic Expressions, Foreign Phrases

**Learning outcomes:**
By the end of the course, the student will be able to:

Demonstrate understanding of synonyms and antonyms in active learning Strengthen their vocabulary base in one word substitution
Use phrasal verbs in their day to day communication
Familiarize with commonly used idiomatic expressions and use them correctly
Recognize frequently used foreign words and phrases related to areas of immediate relevance.

**Text Books**:
Part – 1 (English for Enhanced Competence (by Sumit Roy, A.Karunakar, A.Aruna Priya)

**Supplementary Reading**:
Communicative skills for Technical Students, M. Faratullah. Orient Longman.

Rizvi,MAshraf. **Effective Technical Communication.** McGraw - Hill.

**B.Sc., Physical Science**
**SEMESTER –I**
**SPH 103: Mechanics**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

Preamble: To introduce operators, simple coordinate systems and its relevance to particles, rigid bodies and extending to strings and bars. Introductory aspects of relativity were realized for energy and mass relation

Objective: The student will determine equation of motion for systems and rigid bodies with concepts of scalar and vector fields. Understand new concepts like Fourier coefficients and special theory of relativity.

**UNIT -I**

**Vector Analysis**

Scalar and vector fields, gradient of a scalar field and its physical significance. Divergence and curl of a vector field with derivations and physical interpretation. Vector integration (line, surface and volume), Statement and proof of Gauss and Stokes theorems., Cartesian, Curvillinear and Spherical coordinate systems.

**Learning Outcomes:**

To understand the significance of scalar and vector fields with its application to line, surface and volume elements (L2)

Make use of different coordinate systems.(L3)

**UNIT – II**

**Mechanics of particles**

Laws of motion, motion of variable mass system, motion of a rocket. Conservation of energy and momentum, Collisions in two and three dimensions, Concept of impact parameter, scattering cross-section, Rutherford scattering-derivation.

**Learning Outcomes:**

To outline the equation of system of particles corresponding to variable mass as consequence of conservation of energy and momentum(L2).

To interpret types of collision in two and three dimensions with its implications to atomic system in determination of respective parameters(L5)

**UNIT - III**

**Mechanics of Rigid bodies:**

Definition of rigid body, rotational kinematic relations, equation of motion for a rotating body, angular momentum, Euler equation, precession of a top. Gyroscope, precession of the equinoxes.

**Complex vibrations**

Fourier theorem and evaluation of the Fourier coefficients, Fourier analysis of - square wave, triangular wave, saw tooth wave.

**Learning Outcomes:**

To develop equation of motion for rotational system and determination of energy for rigid body rotating about an axis. (L3)

Construct Euler equation of motion and its application to top and gyroscope.(L3)

Solve Fourier coefficient and its determination to complex vibrations.(L3)

**UNIT IV**

**Vibrating strings and Bars**

Transverse wave propagation and velocity along a stretched string, Energy transport and transverse impedance. Longitudinal vibrations in bars-wave equation and its general solution. Special cases i) bar fixed at both ends ii) bar fixed at the midpoint iii) bar free at both ends iv) bar fixed at one end.

**Learning Outcomes:**

To analyze of energy and impedance for stretching string in transverse mode of propagation(L4).

To classify longitudinal vibration in bars with its general solution(L2)

**Unit V**

**Introduction to Relativity**

Frame of reference, Galilian transformations, Galilian invariance, Postulates of Special Theory of Relativity, Lorentz transformations of space and time(Qualitative), Length contraction. Time dilation. Relativistic addition of velocities. Variation of mass with velocity, Einstein's Mass energy relation.

**Learning Outcomes:**

1. Introduce the concept of relative terms like rest and motion.(L2)
2.Understanding the postulates of special theory of relativity with emphasis of length contraction and time dilation(L2)

**Course Outcomes:**

On completion of the course, the student is able to

Applying different type of operators and understanding coordinate systems(L2 and L3)

Understand motion of particles and interpret its conservation laws(L2 and

L5) Realize rigid bodies for its equation of motion(L3)

Analyze equation of motion of strings and bars(L4)

Understand the concept of relativity(L2)

**Text Books:**

B.Sc Physics Vol.1, Telugu Academy, Hyderabad

Mechanics & Properties of Matter, J.C. Upadhyaya, Himalaya Publishing House,Mumbai, 2015.

Unified Physics Vol.1, Mechanics, Waves & Oscillations, S.L.Gupta and Sanjeev Gupta, Jai Prakash Nath& Co., Meerut

**Reference Books:**

Fundamentals of Physics Vol. I - Resnick-Halliday-Krane ,Wiley India 2007

College Physics-I. T. Bhimasankaram and G. Prasad. Himalaya Publishing House.

University Physics-FW Sears, MW Zemansky& HD Young, Narosa Publications, Delhi

Mechanics, S.G.Venkatachalapathy, Margham Publication, 2003

**B.Sc. Physical Science**
**SEMESTER –I**
**SPH 123: Mechanics Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks
Credits: 2

**Preamble:** Determination and analyzing physical constants

**Objective:** To find Physical constants and analyze for its accuracy

**List of Experiments**

Determination of 'g' by compound/bar pendulum
Determination of the force constant of spring.
Time period of simple pendulum(L-T and L-$T^2$ graph)
Verification of laws of vibrations of stretched string –sonometer
Determination of velocity of transverse wave along a stretched string-sonometer
Determination of frequency of a electrically driven tuning fork –Melde's experiment.
Rigidity modulus of material of a wire-dynamic method (torsional pendulum)
Fly-wheel
Determination of Y of bar(metal Scale) –cantilever.
Simple pendulum normal distribution of errors-estimation of time period and the error of the mean by statistical analysis

**Course Outcomes**:

Enable to determine physical constants estimate with illustration (L4 and L5)

**B.Sc. Physical Science**
**SEMESTER –I**
**SPH 101: Differential Calculus**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

**Preamble:** Differential Calculus provides information about limits, continuity, differentiation and partial differentiation. The focus of the course is to study the limits and continuity, applications of partial differentiation, tracing of curves in Cartesian coordinates and Polar coordinates and mean value theorem on differentiation.

**Objective:** To introduce

Basic properties of continuity and differentiation
Partial differentiation and application of Euler's theorem
Tracing of curves and to find tangents and normals
Rolle's theorem and mean value theorem
Expansion of the function using taylor's series and Maclaurin's series

**UNIT-I**

Limit and Continuity (ε and δ definition), Types of discontinuities, Differentiability of functions, Successive differentiation, Leibnitz's theorem.

**Learning Outcomes:**

The student will be able to:

Define the basic properties of limits and continuity
Explain different types of discontinuities
Define differentiability of functions and successive differentiation

**UNIT-II**

Partial differentiation, Euler's theorem on homogeneous functions.

**Learning Outcomes:**

The student will be able to:

Define partial differentiation
Evaluate problems on partial differentiation
Apply Euler's theorem on homogeneous functions with the help of partial differentiation

**UNIT-III**

Tangents and normals, Curvature, Asymptotes, Singular points, Tracing of curves, Parametric representation of curves and tracing of parametric curves, Polar coordinates and tracing of curves in polar coordinates.

**Learning Outcomes:**

The student will be able to:

Define tangents and normals
Explain curvature and asymptotes
Trace the parametric curves
Define polar coordinates

**UNIT-IV**

Rolle's theorem, Mean Value theorems, Taylor's theorem with Lagrange's and Cauchy's forms of remainder

**Learning Outcomes:**

The student will be able to:

Explain Rolle's theorem with an application
Explain mean value theorems with some examples
Evaluate Taylor's theorem with Lagrange's and Cauch's forms of remainder

**UNIT-V**

Taylor's series, Maclaurin's series of sin x, cos x, $e^x$, log(l+x), $(l+x)^m$, Maxima and Minima, Indeterminate forms.

**Learning Outcomes:**

The student will be able to:

Explain Taylor's series
Explain Maclaurin's series
Evaluate Maxima and minima of a function

**Text Books :**


Elements of Real Analysis , Shanthi Narayan and Dr. M.D. Raisinghania,S.Chand& Co.

A Text Book of B.Sc. Mathematics Volume-II , V.Venkateswara Rao , N Krishna Murthy, B.V.S.S. Sarma and S. Anjaneya Sastry, S.Chand& Co.

Calculus Single Variable, Howard Anton, Irl Bivens and Stephen Davis,

Calculus and Analytic Geometry, George B. Thomas, Jr. and Ross L. Finney, Pearson Education, 2007, $9^{th}$ edition.

**B.Sc. Physical Science**
**SEMESTER –I**
**SPH 121 Differential Calculus Tutorials**

Hours per week: 2 Continuous Evaluation: 100 Marks
Credits: 2

Problems on Limits and Continuity

Problems on Partial differentiation

Problems on Euler's theorem

Problems on Tangents and normals

Tracing of curves

Problems on Rolle's theorm

Problems on Mean value theorems

Problems on Taylor's theorem

Problems on Taylor's and Maclaurin's series

Problems on Maxima and Minima

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

Evaluate limits and continuity of a function
Solve problems on partial differentiation
Explain applications of Rolle's theorem, Mean value theorems, Taylor's and Maclaurin's series
Define maxima and minima of functions

**B.Sc. Physical Science**
**SEMESTER –I**
**SPH 107: Basic Circuit Theory**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

Preamble: Understanding of Basics of Electronic Circuits and mathematical and graphical solutions to Electrical Circuits.
Objective: To explain the basics of Circuit theory and circuit analysis

**UNIT -I**

**A.C Circuit Fundamentals**

The sinusoidal voltage and current-Average and R.M.S values- phasor representation- T operator, polar and rectangular forms of complex numbers, AC applied to RC, RL and RLC circuits, concept of impedance-power factor in a.c circuits, numerical problems.

**Passive Networks**

Concept of ideal as well as practical voltage and current sources, Regulation Kirchhoff's current law – Kirchhoff's voltage law - Method of solving A.C and D.C circuits by Kirchhoff's laws - Loop analysis - Nodal analysis - numerical problems.

**Learning Outcomes:**

Understanding of the fundamentals of AC, generation of AC and impedance of a circuit
Able to solve the currents and voltages in resistive circuit using nodal and mesh analysis methods

**UNIT - II**

**Network Theorems**

Maximum power transfer theorem -Super position theorem - Thevenin's theorem - Norton's theorem -Milliman theorem-Reciprocity theorem- problem solving applications for all the theorems.

**Learning Outcomes:**

Understand the distribution of currents and voltages in electrical circuits
Able to apply network theorems to solve the resultant currents and voltages in circuit

**UNIT - III**

**RC And RL Circuits**

Transient response of RL and RC circuits with step input, Time constants. Frequency response of RC and RL circuits, their action as low pass and high pass filters. Passive differentiating and integrating circuits .numerical problems.

**Learning Outcomes:**

Understand the Switching characteristics of reactive components like Capacitors and Inductors
Understanding the Frequency response of RL and RC networks and their functioning as Filters and wave shaping networks and also able to solve the numerical problems

**UNIT - IV**

**Resonance in Electric Circuits**

Resonance in series and parallel R- L- C circuits .Resonant frequency, Q-factor,Bandwidth, selectivity, Comparison of series and parallel resonance, Tank circuit-LCoscillations. Numerical problems.

**Learning Outcomes:**

Understand the concept of electrical Resonance and their applications

Able to analyze the RLC circuit and obtain graphical solutions for the Resonance of a circuit

**UNIT - V**

**Cathode Ray Oscilloscope**

CRT and its working, Electron gun, electrostatic andmagnetostatic deflections. Deflection sensitivity, Fluoroscent screen, CRO block diagram, Measurement of voltage, frequency and phase, Function generator-Block diagram and its description.

**Learning Outcomes:**

Understand the basic working principle and internal blocks of CRO Instrument

Basic understanding of measurement of voltage, current, frequency and phase of waveforms

**Course Outcomes:**

Understanding of **How** to generate AC and List the parameters and **recall** the concept of impedance (L1).

**Apply** the concept of Kirchhoff laws to solve the circuit currents and **make use of** network theorems (L3).

Understand **what** is the time response of RC networks and **apply** to solve the transient analysis problems (L1 and L3)

**Analysis** of RLC series and parallel circuit, understand the frequency selection circuit and **Compare** series and parallel resonance (L4 and L5)

Understanding of **How** the CRO works and **make use of** CRO for measuring the frequency voltage and phase of AC (L1 and L3)

**Text Books:**

Electric circuits by David A. Bell 7th edition Oxford higher education

Robert L Boylestad, "Introductory circuit analysis", Universal Book Stall Fifth edition,2003.

Circuit analysis byP.Gnanasivam-Pearson education.

**References:**

Networks, lines&fields by Ryder-PHI

Circuits and Networks-A.Sudhakar and Shyammohan-TMH

Unified electronics (Circuit analysis and electronic devices) by Agarwal-Arora.

**B.Sc. Physical Science**
**SEMESTER –I**
**SPH 127: Basic Circuits Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks
Credits: 2

Preamble: Understand and realize the working of Instruments and Measurement of Voltages and currents in the electrical Circuits and results analysis. To
Objective: Design and analyze the electrical circuits.

**List of Experiments**

ĀĀĀÀĀ'Ā Measurement of D.C & A.C voltage, frequency using CRO.

ĀĀĀÀĀ'Ā Thevenin's theorem - Verification.

Norton's theorem - Verification.

Maximum power transfer theorem - Verification.

CR Circuit - Frequency response ( Low pass and High pass)

LR Circuit- Frequency response ( Low pass and High pass)

LCR Series resonance circuit - frequency response, Determination of Q and Band width

LCR parallel resonance circuit - frequency response, Determination of Q and Band width.

Verification of Kirchhof's laws.

**Course Outcomes:**

Understand **How** Filters work, **classify** the filters **Distinguish** the high pass, low pass filters and Series and parallel resonance (L1, L2 and L3).

**Make use of** CRO for the AC measurements and **apply** the Kirchhoff's laws and Network theorems to solve the currents and voltages (L3).

**Analyze** the electrical circuits using network theorems (L4).

**B.Sc. Physical Science**
**SEMESTER –I**
**SPH 105: Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

**Preamble:** The students of undergraduate program in science in Chemistry need to be conversant with the various fields off chemistry. Therefore, one module each on in general, physical and organic chemistry is introduced which helps the student familiarize with the concepts of chemistry essential for allied and interdisciplinary fields of science.

**Objective:** To introduce the concepts of general chemistry. The students will be conversant with the chemistry of all the elements that is closely knitted with analytical chemistry, physical chemistry and organic chemistry.

**Section A: Inorganic Chemistry-1**

**UNIT-I**

**Atomic Structure:** Review of: Bohr's theory and its limitations, dual behaviour of matterand radiation, de Broglie's relation, Heisenberg Uncertainty principle..

What is Quantum mechanics? Time independent Schrodinger equation and meaning of various terms in it.Significance of $\psi$ and $\psi^2$, Schrödinger equation for hydrogen atom.graphical representation of 1s, 2s, 2p, 3s, 3p and 3d orbitals. Significance of quantum numbers, orbital angular momentum and quantum numbers ml and ms. Shapes of s, p and d atomic orbitals, nodal planes.

Rules for filling electrons in various orbitals, Electronic configurations of the atoms.Stability of half-filled and completely filled orbitals, concept of exchange energy.Relative energies of atomic orbitals, Anomalous electronic configurations.

**Learning Outcomes**

The student will learn about the fundamental assumptions of atomic theory and explain the composition of atoms including electronic configuration.

**UNIT-II**

**Chemical Bonding and Molecular Structure**

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

Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the basisof VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements.

MO Approach: Rules for the LCAO method, bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods (including idea of s- p mixing) and heteronuclear diatomic molecules such as CO, NO and $NO^+$.

**Learning Outcomes**

The students will learn about ionic, covalent bonding in molecules . compare/contrast the properties of molecular and ionic compounds.

**UNIT-III**

**Section B: Organic Chemistry-1**

**Fundamentals of Organic Chemistry**

Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis.

Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals.

Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values. Aromaticity: Benzenoids and Hückel's rule.

**Learning Outcomes**

The students learn about the fundamental concepts of reaction mechanism, reactive species in organic chemistry and concept of aromaticity.

**UNIT-IV**

**Stereochemistry**

Conformations with respect to ethane, butane and cyclohexane.Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations.Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L; cis - trans nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (for upto two C=C systems).

**Aliphatic Hydrocarbons**

Functional group approach for the following reactions (preparations & reactions) to be studied.

**Alkanes:** (Upto 5 Carbons).Preparation:Catalytic hydrogenation, Wurtz reaction, Kolbe'ssynthesis, from Grignard reagent. Reactions: Free radical Substitution: Halogenation.

**Learning Outcomes**

The student shall learn the essential concepts of chirality, configuration, isomerism in organic chemistry and nomenclature of isomers.

Students ill familiarize with the elementary concept of saturated aliphatic hydrocarbons an reactions

**UNIT- V**

**Alkenes:** (Upto 5 Carbons)Preparation:Elimination reactions: Dehydration of alkenes anddehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). Reactions: cis-addition (alk. KMnO4) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis.

**Alkynes**: (Upto 5 Carbons)Preparation:Acetylene from CaC2and conversion into higheralkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides.

Reactions: formation of metal acetylides, addition of bromine and alkaline KMnO4,ozonolysis and oxidation with hot alk. KMnO4.

**Learning Outcomes**

The students will learn synthetic reactions, mechanism and properties of aromatic alcohol, aromatic and aliphatic ether, aldehydes and ketones.

**Reference Books:**


Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.

Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd ed., Wiley.

Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. Inorganic Chemistry:Principles of Structure and Reactivity, Pearson Education India, 2006.

McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.

Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).

Eliel, E.L. Stereochemistry of Carbon Compounds, Tata McGraw Hill education, 2000.

Finar, I.L. Organic Chemistry (Vol. I & II), E.L.B.S.

Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.

Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.

**B.Sc. Physical Science**
**SEMESTER –I**
**SPH 125: Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons Lab**

Hours per week: 4 Continous Evaluation:100 Marks
Credits: 2

**Preamble:** The students of undergraduate program in science in Chemistry need to be conversant with the various basic methodologies of chemistry. Therefore, one module each on in inorganic, physical and organic chemistry is introduced which helps the student familiarize with the techniques essential for developing the foundation of practical chemistry

**Objective:** To make student develop the fundamental skill required for quantitative and qualitative analysis in inorganic and organic chemistry.

**Section A: Inorganic Chemistry - Volumetric Analysis**

Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
Estimation of oxalic acid by titrating it with KMnO4.
Estimation of water of crystallization in Mohr's salt by titrating with KMnO4.
Estimation of Fe (II) ions by titrating it with K2Cr2O7 using internal indicator.
Estimation of Cu (II) ions iodometrically using Na2S2O3.

**Learning Outcomes**

The student will learn about the quantitative analysis concepts of redox chemistry

**Section B: Organic Chemistry**

1.Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing upto two extra elements)

Separation of mixtures by Chromatography: Measure the Rf value in each case (combination of two compounds to be given)

Identify and separate the components of a given mixture of 2 amino acids (glycine, aspartic

acid, glutamic acid, tyrosine or any other amino acid) by paper chromatography

Identify and separate the sugars present in the given mixture by paper chromatography.

**Learning Outcomes**

The students will familiarize the concept of qualitative element detection in organic chemistry essential for functional group analysis. The students will also the elementary idea of the techniques of planar chromatography

**Reference Books:**

Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbookof Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.

**B.Sc. Physical Science**
**SEMESTER –I**
**SPH 109: Object Oriented Programming in C++**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

**Preamble:** C++ is a general purpose programming language and widely used now a days for competitive programming. It has imperative, object-oriented and generic programming features. C++ runs on lots of platform like Windows, Linux, Unix, Mac etc.

To develop logic through algorithms and flowcharts.

To understand the difference between procedure oriented programming and object oriented programming.

To learn the basic concepts , applications of OOPS and practice of object oriented analysis and design in the construction of robust, maintainable programs which satisfy their requirements;

To develop the ability to implement features of object oriented programming to solve real world problems using Inheritance, data abstraction, encapsulation and Polymorphism.

**UNIT- I**

Programming Concepts: Algorithm and its characteristics, pseudo code / flow chart Assignment statement, input/output statements, if, if then else statements.

Introduction to structured programming: Data types- simple data types, floating data types, character data types, string data types, arithmetic operators and operator precedence, variables and constant declarations, expressions, operators, preprocessor directives, creating a C++ program.

Show the logic involved in solving a problem through algorithms and flowcharts.(L1)

Describe the basic concepts of object oriented programming. (L2)

Develop and run simple C++ programs.(L3)

Choose appropriate data type and operators in programs. (L3)

**UNIT- II**

Input/output statements, Expressions, Control Structures if and if … else statement, switch and break statements. For, while and do – while, break and continue statement, nested control statements.

**Learning Outcomes**

By the end of this Unit, the student will be able to

Select the right control structure (L1)

Develop applications by using appropriate concepts. (L3)

**UNIT -III**

Local and global variables, static and automatic variables, enumeration type, Function Prototyping, Function Overloading, one dimensional array, two dimensional array, character array.

**Learning Outcomes**

By the end of this Unit, the student will be able to

What is a local variable and what is a Global variable (L1)

Explain the need of static and Automatic variables.(L2)

Develop the concept of overloading functions.(L2)

Utilize the one dimensional and two dimensional arrays in programming.(L3)

**UNIT- IV**

Object Oriented Concepts: objects, classes, methods, constructors, Destructor, Abstraction, encapsulation, Overloading Unary Operators, Rules for Operator Overloading.

**Learning Outcomes**

By the end of this Unit, the student will be able to

Illustrate the concept of classes and objects (L3)

Develop real world applications by using appropriate concepts.

(L3) Use unary operators for overloading.(L3)

**UNIT- V**

Inheritance – Single, Multiple, Multi Level, Hierarchical, Hybrid Inheritance,static and dynamic binding, Pointers, Virtual Functions and Polymorphism.

By the end of this Unit, the student will be able to

Explain the need of reusability concept with inheritance.(L2)

Summarize different types of inheritance.(L2)

Identify the need of pointer.(L1)

**Course Outcomes:**

Upon completion of the course, the student is able to

Able to emphasize the special features of C++ language.(L4)

Examine the working of Control structures in C++ programs.(L4)

Able to develop and implement classes and objects. (L3)

Understand various Inheritance mechanisms, operator overloading ,polymorphism and apply in applications.(L2)

**Text Book:**

Object Oriented Programming with C++ by E.Balagurusamy, Tata MC Graw Hill, 6th edition, 2013.

**Reference Books:**

Mastering C++ by Venugopal K R, Rajkumar Buyya , Tata Mc Graw Hill, 2nd edition, 2013.

Object Oriented Programming using C++ by B.Chandra, Narosa Publications, 2005.

**B.Sc. Physical Science**
**SEMESTER –I**
**SPH 129 : Object Oriented Programming in C++ Lab**

Hours per week: 4 Continous Evaluation :100 Marks
Credits :2

Write a C++ program to demonstrate the usage of data types & operators.

Write a C++ program to demonstrate Class and Object.

Write a C++ program to demonstrate Control structures.

Write a C++ program to demonstrate operator overloading.

Write a C++ program to demonstrate function overloading using Arrays.

Write a C++ program to demonstrate different types of Arrays.

Write a C++ program to demonstrate Constructors and Constructor overloading.

Write a C++ program to demonstrate Copy constructor and Destructor.

Write a C++ program to demonstrate Single Inheritance, Multiple Inheritance.

Write a C++ program to demonstrate Multi level Inheritance, Hierarchal Inheritance.

Write a C++ program to demonstrate Pointers.

Write a C++ program to demonstrate Run time polymorphism and Compile time Polymorphism.

**Text Book:**

Object Oriented Programming with C++ by E.Balagurusamy,
Tata MC GrawHill, 6th edition, 2013.

**Reference Book:**

Mastering C++ by Venugopal K R, Rajkumar Buyya ,
Tata Mc Graw Hill, 2nd edition, 2013

**B.Sc. Physical Science**
**SEMESTER –II**
**SFC 102: Environmental Science**

Hours per week: 3 End Examination: 60 Marks
Credits: 2 Sessionals: 40 Marks

**Preamble:** The dynamic changes in the Environment require as precise understanding to adjust to the changes. This paper provides a base line understanding of Environmental changes problems.

**Objectives:** To enable student understand importance of environmental science.
To introduce student to ecosystem and its process, sources and effects of Environmental Pollution.
To sensitize student regarding day to day social & environmental issues.

**UNIT -I**

**The multidisciplinary nature of environmental studies**: Definition, Scope and Importance, Need for Public awareness.

**Natural Resources:** Classification, Renewable and Non Renewable Resources.

**Renewable Resources:** Forest, Water and Energy Resources.

**Non Renewable Resources**: Mineral, Food and Land resources, (Uses, reasons for over-utilization and effects)

**Learning Outcome:** By the end of the unit the student
Will understand importance of Environmental Science & Natural Resources

**UNIT -II**

**Eco-system:** Structure of an Ecosystem, Producers, consumers and de-composers, Structure of Terrestrial Ecosystems (Forest Ecosystem, Grassland Ecosystem, and Desert Ecosystem) and Aquatic Ecosystems (Pond Ecosystem and Ocean Ecosystem).

**Function of an ecosystem:** Food chains, food web and ecological pyramids, Energy flow in the ecosystem.

**Learning Outcome:** By the end of the unit the student
Will appreciate ecosystems and its process

**UNIT -III**

**Environmental Pollution:** Causes, effects and control measures of Air, Water, Soil pollution, Thermal pollution and Nuclear hazards and Municipal solid waste management.

**Environmental problems:** Global Environmental Problems, Green house effect, Ozone layer depletion, acid rains and Climate change.

**National Environmental Problems**: Deforestation, Causes and Effects, Environmental Problems associated with dams, mining and environmental effects. **Learning Outcome:** By the end of the unit the student
Will gain knowledge as sources and effects of Environmental Pollution

**UNIT -IV**

**Social Issues and the Environment**: Environmental ethics, Issues and possible solutions. Waste land reclamation, Consumerism and waste products.

**Environmental Legislation:** Environment Protection Act, Air Act, Water Act, Wildlife Protection act and The Biological Diversity Act. Disaster definition, Classification, Disaster Management: Explosion, Earth quake, Hazardous materials spill/release.

**Learning Outcome:** By the end of the unit the student.
Will get exposure towards social problems and gain understand on environmental legislation.

**UNIT -V**

**Human Population and the Environment:** Population growth, variation among nations, Population explosion, Family welfare program. Environment and human health, human rights, value education, HIV/AIDS, Women and Child welfare, Role of information technology in environment and human health.

**Learning Outcome:** By the end of the unit the student

Will be to explain patterns of population growth and problems associated with it.

**Course Outcomes:**

Will understand importance of Environmental Science & Natural Resources

Will appreciate ecosystems and its process

Will gain knowledge as sources and effects of Environmental Pollution

Will get exposure towards social problems and gain understand on environmental legislation

Will be to explain patterns of population growth and problems associated with it

**Text Books:**

Text Book of Environmental studies for Undergraduate courses by Erach Bharucha, Orient Black Swan. 2nd edition.

Environmental Science: A Global Concern by William P. Cunningham and Baraba Woodworth Saigo, McGraw-Hill, 8th edition.

A text book of Environmental Science by P. C. Joshi and Namita Joshi, A.P.H. Publishing Corporation.

A text book of Environmental Science by Arvind Kumar, A.P.H. Publishing Corporation.

**B.Sc. Physical Science**
**SEMESTER –II**
**SPH 104: Waves and Optics**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

**Preamble:** To introduce the concept of waves and understand the phenomena of light by division of amplitude and division of wave front

**Objective:** To visualize wave motion and develop intuition about waves for various light phenomena

**UNIT- I**

**Superposition of Two Collinear Harmonic oscillations**: Linearity and SuperpositionPrinciple. (1) Oscillations having equal frequencies and (2) Oscillations having differentfrequencies (Beats).

**Superposition of Harmonic Oscillations**: Graphical and Analytical Methods.
Lissajous Figures with equal an unequal frequency and their uses.

**Waves Motion- General**: Group velocity, Phase velocity.Plane waves.Spherical waves (complex notation), Wave intensity.

**Learning outcomes**

Understanding superposition principle and realization to harmonic oscillators for determining parameters related to waves (L2)

Analyze the relation between inherent parameters of wave(L4)

**UNIT-II**

**Interference 1(Division of wavefront)**

Principle of superposition, Interference of light, types of interference, Young's experiment, Intensity at a point in a plane, coherence-temporal coherence and spatial coherence-conditions for interference of light, Frenel's Biprism, determination of wavelength of light, determination of thickness of thin film, Llyod's single mirror, Verification of change of phase on reflection.

**Learning Outcomes**

Applying interference of light with concept of wave front with experiments in determination of wavelength, thickness and phase change on reflection.(L3)

Analyze the construction of optical instruments(L4)

**UNIT-III**

**Interference: (Division of Amplitude)**

Oblique incidence of a plane wave on a thin film due to reflected and transmitted light (cosine law) –colors of thin films. Interference by a film with two non-parallel reflecting surfaces (Wedge shaped film). Determination of diameter of wire, Newton's rings in reflected light. Determination of wavelength of monochromatic light, Michelson interferometer-types of fringes, Determination of wavelength of monochromatic light.

**Learning Outcomes**

Applying interference of light with concept of amplitude with experiments relevant to thin films for determination of wavelength , thickness and fringe width. (L3)

Analyze for confirmation for various types of fringes (L4)

**UNIT- IV**

**Diffraction:**

Introduction,distinction between Fresnel and Fraunhoffer diffraction, Fraunhoffer diffraction –Diffraction due to single slit and circular aperture-Diffraction grating -Limit of resolution-Resolving power of grating.

Fresnel's half period zones-area of the half period zones-zone plate-comparison of zone plate with convex lens-fresnel diffraction at a straight edge-difference between interference and diffraction.

**Learning Outcomes**

To demonstrate the concept of diffraction its types to different apertures for optical parameters (L2)

Applying to different zones of diffraction (L3)

Polarized light: methods of polarization polarization by reflection, refraction, double refraction, scattering of light-Brewster's law-Mauls law-Nicol prism polarizer and analyzer-Quarter wave plate, Half wave plate-optical activity and Babinet's compensator.

To understand polarization of light with various phenomena and its activity with optical elements (L2).

Applying to different optical instrument (L3).

Understanding superposition principle and Analyze the relation between inherent parameters of wave(L2 and L4)

Applying and analyze interference of light for optical parameters and construct optical instruments (L3 and L4)

Applying and analyze interference of light for optical parameters and fringes (L3 and L4)

To demonstrate the concept of diffraction and applying to different zones of diffraction (L2 and L3)

To understand polarization of light and utilize to different optical instrument (L2 and L3)

**Text Books:**

BSc Physics, Vol.2, Telugu Akademy, Hyderabad

A Text Book of Optics-N Subramanyam, L Brijlal, S.Chand& Co.

Unified Physics Vol.II Optics & Thermodynamics – Jai Prakash Nath&Co.Ltd., Meerut

Optics,F..A. Jenkins and H.G. White, Mc Graw-Hill

Optics, Ajoy Ghatak,Tata Mc Graw-Hill.

Fundamentals of Physics. Halliday/Resnick/Walker.C. Wiley India Edition 2007

Introduction of Lasers – Avadhanulu, S.Chand& Co.

Fundamentals of Optics, H.R. Gulati and D.R. Khanna, 1991, R. Chand Publication

Principles of Optics- BK Mathur, Gopala Printing Press, 1995

**B.Sc. Physical Science**
**SEMESTER –II**
**SPH 122: Waves and Optics Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks
Credits: 2

**Preamble:** Determination and analyzing of optical constants with light

**Objective:** To find Physical constants and analyze for its accuracy

**List of Experiments**

Determination of radius of curvature of a given convex lens-Newton's rings.
Resolving power of grating.
Dispersive power of a prism.
Determination of wavelength of light using diffraction grating- minimum deviation method.
Wavelength of light using diffraction grating-normal incidence method.
Determination of thickness of a thin fiber by wedge method
Spectrometer- i-d curve.
Cauchys constants
Hallow prism

**Course Outcomes**:

Enable to determine optical constants, estimate and illustrate (L4 and L5)

**B.Sc. Physical Science**
**SEMESTER –II**
**SPH 102: Differential Equations**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

**Preamble:** Many physical laws and relations can be expressed mathematically in the form of differential equations. Thus it is natural that this course opens with the study of differential equations and their solutions. Indeed, many engineering problems appear as differential equations. The main objectives of this course are twofold: the study of ordinary differential equations and their most important methods for solving them and the study of modeling.

**Objective:**

To Identify the type of a given differential equation and apply the appropriate analytical technique for finding the solution of first order and higher degree ordinary differential equations.

To Solve second order and higher order linear differential equations. To Solve non-homogeneous differential equations

To Solve the Simultaneous differential equations and Total differential equations.

To formulate first order partial differential equations

To solve the non-linear first order Partial differential equation by Charpit's method

To classify second order partial differential equations into elliptic, parabolic and hyperbolic

To transform the second order partial differential equations to Normal forms

**UNIT-I**

First order exact differential equations. Integrating factors, rules to find an integratingfactor. First order higher degree equations solvable for x, y, p. Methods for solving higher-order differential equations.

**Learning Outcomes:**

Distinguish between linear, nonlinear, partial and ordinary differential equations.

Recognize and solve an exact differential equation.

Recognize and solve a non-exact differential equation by finding integrating factor.

Recognize and solve First order higher degree equations solvable for x, y, p

Evaluate basic application problems described by first order differential equations

**UNIT-II**

Basic theory of linear differential equations, Wronskian, and its properties.Solving a differential equation by reducing its order. Linear homogenous equations with constant coefficients, Linear non-homogenous equations, The method of variation of parameters, The Cauchy-Euler equation,Simultaneous differential equations, Total differential equations.

**Learning Outcomes:**

Use the existence theorem for boundary value problems to determine uniqueness of solutions.

Use the Wronskian condition to determine if a set of functions is linearly independent.

Determine the complete solution of a homogeneous differential equation with constant coefficients by examining the characteristic equation and its roots.

Evaluate the complete solution of a non-homogeneous differential equation as a linear combination of the complementary function and a particular solution.

Determine the complete solution of a non-homogeneous differential equation with constant coefficients by the method of undetermined coefficients.

Find the complete solution of a differential equation with constant coefficients by variation of parameters and also solve Cauchy-Euler Equation

Evaluate Simultaneous differential equations and total differential equation

Evaluate basic application problems described by second order linear differential equations with constant coefficients.

**UNIT-III**

Order and degree of partial differential equations, Concept of linear and non-linear partial differential equations, Formation of first order partial differential equations

**Learning Outcomes:**

Recognize the concept of linear and non-linear partial differential equations.

Recognize the concept of order and degree of partial differential equations

Construct a first order partial equation by elimination of arbitrary constants

Construct a first order partial equation by elimination of arbitrary functions of specific functions

Construct a first order partial equation by Elimination of Arbitrary Functions

Construct a physical or biological model to a first order partial differential equations

**UNIT-IV**

Linear partial differential equation of first order, Lagrange's method, Charpit's method.

**Learning Outcomes:**

Distinguish between general solution and complete solution Recognize and solve Lagrange's equation

Find Lagrange's multipliers

Recognize and solve first order non linear partial differential equation by Charpit's method.

Recognize and reduce the first order partial different equation to different forms

**UNIT-V**

Classification of second order partial differential equations into elliptic, parabolic and hyperbolic through illustrations only.

**Learning Outcomes:**

. Recognize the second order partial differential equations into elliptic, parabolic and hyperbolic

Construct the different example for elliptic, parabolic and hyperbolic

Transform the second order partial differential equations into normal form

Solve basic application problems like one dimensional wave equation and heat equation

**Text Books:**


A Text Book of B.Sc. Mathematics Volume-I, V.Venkateswara Rao , N Krishna Murthy, B.V.S.S. Sarma and S. Anjaneya Sastry, S.Chand& Company Ltd., New Delhi.

Differential Equation , Shepley L. Ross3rd Edition, John Wiley and Sons, 1984

Elements of Partial Differential Equations,Ian N Sneddon, International Edition, 1967, Dover Publications.


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**B.Sc. Physical Science**
**SEMESTER –II**
**SPH 120 Differential Equations Tutorial**

Hours per week: 2 Continuous Evaluation: 100 Marks
Credits: 2

- Solving first order and first degree differential equations
- Solving first order and higher degree differential equations
- Solving linear differential equations with constant coefficients
- Solving differential equations with variation of parameters
- Solving Cauchy-Euler equation
- Solving Simultaneous differential equations
- Soving total differential equations
- Formation of first order partial differential equations
- Problems using Lagrange's method
- Problems using Charpit's method
- Classification of second order partial differential equations

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

Evaluate first order and first degree differential equations
Solve problems on first order and higher degree differential equations
Explain linear differential equations with constant coefficients
Explain the methods to solve partial differential equations
Classify second order partial differential equations

**B.Sc. Physical Science**
**SEMESTER –II**
**SPH 108: Electronic Devices &Circuits**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

Preamble: Understanding of Basics of Electronic Circuits and mathematical and graphical solutions to Electrical Circuits.

Objective: To explain the basics of Electronic devices and applications

**UNIT -I**

**Junction Diodes**

PN junction diode - P-N junction theory-depletion region, barrier potential, working in forward& reverse bias condition, Junction capacitance, Diode current equation (no derivation),Effect of temperature on reverse saturation current, V-I Characteristics, Zener and Avalanche Break down, Zener diode - V-I characteristics, regulated power supply using Zener diode, Varactor Diode, Tunnel Diode - Principle, Working& Applications.

**Learning Outcomes:**

Understanding of Basic Semiconductor physics, doping and formation of PN Junction

Understand the V-I characteristics of different types of Junction diodes and Applications

**UNIT - II**

**Bipolar Junction Transistors (BJT)**

PNP and NPN transistors, current components in BJT, BJT static characteristics (Input and Output), Early effect, CB,CE,CC Configurations (Cut-off, Active and saturation regions) Determination of h-parameters from the characteristics, Concept of amplification-voltage and currentamplifier.The C.E amplifier-analysis and parameters, Transistor as a switch.

**Learning Outcomes:**

Understand the Basic Construction and working principle of BJT

Able to Connect the BJTs in different configurations and their analysis as amplifier.

**UNIT - III**

**Field Effect Transistors & UJT:**

FET - Construction - Working – Drain &Transfer characteristics -Parameters of FET - FET as an amplifier -MOSFET-Enhancement MOSFET-Depletion MOSFET-Construction& Working-Drain characteristics of MOSFET -Comparison of FET&BJT and JFET &MOSFET. UJT Construction-working, V-I Characteristics.

**Learning Outcomes:**

Understand the Basic working, V-I characteristics of FETs and their applications and also able to differentiate the BJT, FET and MOSFET.

Understanding the working principle and applications of UJT

**UNIT - IV**

**Photo Electric Devices**

Structure and operation, characteristics, spectral response and applications of LDR, Photo Voltaic cell, Photo diode, Photo transistor, LED and LCD.

**Learning Outcomes:**

Understand the applications of Semiconductor devices as Photo devices

Understand the V-I characteristics of Different photo electric devices.

**UNIT - V**

**Power Supplies**

Rectifiers - Half wave, full wave and bridge rectifiers - Efficiency - Ripple factor – Regulation.Types of filter- Choke input ( Inductor) filter –Shunt capacitor filter -L-Section and $\pi$ section filters - Three terminal fixed voltage I.C regulators (78XX and 79XX) - Principle and working of switch mode power supplies ( SMPS).

**Learning Outcomes:**

Basic Understanding of AC to DC conversion and different methods of conversion
Designing of IC regulated power supply and analysis

**Course Outcomes:**

Understanding basics of basic semiconductor physics **Recall** previous knowledge, understand **how** the depletion layer forms and **explanation** capability on the working of different diodes characteristics (L1 and L2)

Understanding the basic construction of semi conductor devices like BJT and FET, **classification** of Devices and **compare** the VI characteristics of BJT and FET in different configurations (L2).

Understand the basic optical devices operation and **how** they work, and how to **make use of** photo electronic devices as sensors and **apply** the knowledge in real time applications (L1, L3).

Understand the **classification** of Rectifiers; identify the merits and demerits of different filters. **Apply** the basic rectifier, **Analyze** and compare the working of SMPS (L2 L4).

**Text Books:**


Electronic Devices and Circuits David A.Bell, Fifth edition. Oxford university press
A.P Malvino, "Principles of Electronics", TMH, 7th edition
T.F. Bogart, Beasley, "Electronic Devices and circuits", Pearson Education, 6th Edition
N.N. Bhargava, D.C Kulshreshta, and S.C Gupta ,"Basic Electronics and Linear Circuits" TMH
T.L.Floyd, "Electronic Devices and circuits", PHI, fifth edition
V.K. Metha, "Principle of Electronics", S CHAND Co. New edition
Godse A.P., Bakshi U.A (1st edition), Electronics Devices, Technical Publications rune.


**References:**


I. Sedha R.S., A TextBook of Applied Electronics, S. Chand & Company Ltd.
Jacob Millman and Christos C. Halkias (2008) Integrated Electronics, Tara Mcgraw-Hill
Robert L. Boylestad, Louis Nashelsky (10th edition). Electron Devices and Circuit Theory, Dorling Kindersley (India Pvt. Ltd.)
Unified Electronics (Circuit analysis and electronic devices) by Agarwal-Arora.

**B.Sc. Physical Science**
**SEMESTER –II**
**SPH 126: Electronic Devices &Circuits Lab**

Hours per week: 6 Continuous Evaluation: 100 Marks
Credits: 2

| | |
|---|---|
| Preamble: | Understand and realize the working of Semiconductor Devices and graphical representation of V-I Characteristics and also results analysis. |
| Objective: | To design and obtain the V-I characteristics of Semiconductor devices |

**List of Experiments**

V-I Characteristics of Junction Diode.

V-I Characteristics of Zener Diode.

Regulated Power Supply using Zener Diode.

IC Regulated Power Supply

BJT input and output Characteristics (CE Configuration) and determination of h-parameters.

Characteristics of UJT.

Characteristics of JFET

LDR characteristics

Characteristics of L and π section filters using full wave rectifier.

**Course Outcomes:**

Understand the characteristics of Basic semiconductor devices and **Analyze** the results (L4)

**Make use of** IC regulators to **construct** the Regulated power supply (L3 and L4)

Able to **identify** the different kind of semiconductor devices, and can be able to distinguish the input and out characteristics and **analyze** the data to get the h-parapets (L3 and L4)

**B.Sc. Physical Science**
**SEMESTER –II**
**SPH 106: Chemical Energetics, Equilibria &Functional Organic Chemistry**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

**Preamble:** The students of undergraduate program in science need to be conversant with the various aspects of energetic and chemical equilibria. Functional group chemistry forms the foundation for training a undergraduate students as organic chemist.

**Objective:** To introduce the concept of chemical reaction equiribrium and reaction energetics in general and physical chemistry to the undergraduate students.

The students will learn the essential functional groups in organic chemistry, their reactions, and properties.

**UNIT-I**

**Section A: Physical Chemistry-1**

**Chemical Energetics:** Review of thermodynamics and the Laws of Thermodynamics. Important principles and definitions of thermochemistry.Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution.Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data. Variation of enthalpy of a reaction with temperature – Kirchhoff's equation.Statement of Third Law of thermodynamics .

**Chemical Equilibrium:**

Free energy change in a chemical reaction.Thermodynamic derivation of the law of chemical equilibrium.Le Chatelier's principle. Relationship between Kp, and Kc

**Learning Outcomes**

The student will learn about the essential concepts of thermo-chemistry and chemical thermodynamics The student will learn the calculation of bond energy, bond dissociation energy and resonance energy from thermo-chemical data.

The students will learn Le Chatelier's principle and applications.

**UNIT-II**

**Ionic Equilibria:**

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect.Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts.Buffer solutions. Solubility and solubility product of sparingly soluble salts

**Learning Outcomes**

The students will learn the elementary concepts of ionic chemical equilibrium with respect to acid – base, salt hydrolysis and solubility of ionic substances.

**Section B: Organic Chemistry-2**

**UNIT-III**

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure.

**Aromatic hydrocarbons**

Preparation (Case benzene): from phenol, by decarboxylation, from acetylene, from benzenesulphonic acid.

Reactions: (Case benzene): Electrophilic substitution: nitration, halogenation andsulphonation. Friedel-Craft's reaction (alkylation and acylation) (upto 4 carbons on benzene).Side chain oxidation of alkyl benzenes (upto 4 carbons on benzene).

**Alkyl Halides**

Preparation: from alkenes and alcohols.

Reactions: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation.

Williamson'sether synthesis: Elimination vs substitution. **Learning Outcomes**

The students will learn the concept of Functional group approach for aromatic hydrocarbon and alkyl halide.

**UNIT-IV**

**Aryl Halides** Preparation : (Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer& Gattermann reactions.

Reactions (Chlorobenzene): Aromatic nucleophilic substitution (replacement by –OH group)and effect of nitro substituent. Benzyne Mechanism: KNH2/NH3 (or NaNH2/NH3).

**Alcohols:** Preparation:Preparation of $1^{o}$, $2^{o}$and $3^{o}$alcohols: using Grignard reagent, Esterhydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters.

**Reactions:** With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk. KMnO4,acidic dichromate, conc. HNO3). Oppeneauer oxidation Diols: (Upto 6 Carbons) oxidation of diols. Pinacol-Pinacolone rearrangement.

**Learning Outcomes**

The student shall learn the elementary reactions and properties , mechanism of aryl halides and alcohol . The students will learn differentiation between, primary, secondary and tertiary alcohol.

**UNIT-V**

**Phenols:** (Phenol case)Preparation:Cumene hydroperoxide method, from diazonium salts.Reactions: Electrophilic substitution: Nitration, halogenation and sulphonation. Reimer-Tiemann Reaction, Gattermann-Koch Reaction, Houben–Hoesch Condensation, Schotten – Baumann Reaction.

**Ethers (aliphatic and aromatic):** Cleavage of ethers with HI.

**Aldehydes and ketones (aliphatic and aromatic):** (Formaldehye, acetaldehyde, acetone andbenzaldehyde)

Preparation: from acid chlorides and from nitriles.

Reactions – Reaction with HCN, ROH, NaHSO3, NH2-G derivatives. Iodoform test.AldolCondensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation.Clemensen reduction and Wolff Kishner reduction.Meerwein-Pondorff Verley reduction.

**Learning Outcomes**

The students will learn about reactions and properties of aromatic alcohols, ethers, aldehydes and ketones

**Reference Books:**


Graham Solomon, T.W., Fryhle, C.B. & Dnyder, S.A. Organic Chemistry, John Wiley & Sons (2014).

McMurry, J.E. Fundamentals of Organic Chemistry, $7^{th}$ Ed. Cengage Learning India Edition, 2013.

Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).

Finar, I.L. Organic Chemistry (Vol. I & II), E.L.B.S.

Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.

Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.

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

**B.Sc. Physical Science**
**SEMESTER –II**
**SPH 124: Chemical Energetics, Equilibria & Functional Organic Chemistry Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks
Credits: 2

**Preamble:** The students of undergraduate program in science in Chemistry need to be conversant with the various basic methodologies of chemistry. Therefore, one module each on in inorganic , physical and organic chemistry is introduced which helps the student familiarize with the techniques essential for developing the foundation of practical chemistry

**Objective**: student will be familiarized with the practical applications of thermo-chemistry and ionic equilibrium.

**Section A: Physical Chemistry**

**Thermochemistry**

Determination of heat capacity of calorimeter for different volumes.
Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
Determination of enthalpy of ionization of acetic acid.
Determination of integral enthalpy of solution of salts (KNO3, NH4Cl).
Determination of enthalpy of hydration of copper sulphate.
Study of the solubility of benzoic acid in water and determination of H.

**Ionic Equilibria** pH Measurements

Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter.
Preparation of buffer solutions:
(i) Sodium acetate-acetic acid (ii) Ammonium chloride-ammonium hydroxide
Measurement of the pH of buffer solutions and comparison of the values with theoretical values.

**Learning Outcomes**

The student will learn determination of heat of neutralization and enthalpy. The students will also lear to apply concept of ionic equilibrium for determination of pH. The students will also learn to prepare the solution of buffer and determination of its pH.

**Section B: Organic Chemistry**

Purification of organic compounds by crystallization (from water and alcohol) and distillation.
Criteria of Purity: Determination of melting and boiling points.
Preparations: Mechanism of various reactions involved to be discussed.
Recrystallisation, determination of melting point and calculation of quantitative yields to be done.
(a) Bromination of Phenol/Aniline (b) Benzoylation of amines/phenols
Oxime and 2,4-dinitrophenylhydrazone of aldehyde/ketone

**Learning Outcomes**

The students will familiarize the concept of measurement of melting point, boiling point and re-crystallization essential for organic synthetic chemistry

**Reference Books:**

Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbookof Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.
Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).

**B.Sc. Physical Science**
**SEMESTER –II**
**SPH 110: Data Structures and File Processing**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

**Preamble:** In the field of Computer Science, data structures provides an efficient way to handle data efficiently. With a single variable it is an unfeasible task to store huge amount of data. Storing data in a file provides a flexible approach where data is stored in a disk.

**Objective:**

Enable the student to learn about linear and non linear data structures.
Understand searching and sorting algorithms.
Learn to store data in a sequential file and access the data.
Use direct file access and Indexed sequential file organization.

**UNIT-I**

**Fundamental Concepts:** Introduction to Data Structures, Types of Data Structures.

**Linear Data Structure Using Sequential Organization:** Arrays, Arrays as an Abstract Data Type, Memory Representation and Address Calculation, Class Array, Pros and Cons of Arrays.

**Searching and Sorting:** Sequential Search, Binary Search, Types of Sorting, General Sort Concepts, Bubble Sort, Insertion Sort, Selection Sort.

**Learning Outcomes:**

By the end of this Unit, the student will be able to
Infer Linear and Nonlinear data structures. (L2)
Apply sequential search and Binary search on data sets.
(L2) Infer the general sorting methods. (L4)

**Stacks:** Concept of Stacks and Queues, Stacks, Stack Abstract Data Type, Representation of Stacks Using Arrays.

**Queues:** Concept of Queues, Queue Abstract Data Type, Realization of Queues Using Arrays, Circular Queue, Dequeue, Priority Queue.

By the end of this Unit, the student will be able to
develop stack using arrays. (L3)
interpret application of stack. (L2)
build queue using array. (L3)
make use of circular queue, deque, priority queue. (L3)

**UNIT-III**

**Linked Lists:** Introduction, Linked List, Realization of Linked Lists, Dynamic Memory Management, Linked list Abstract Data Type, Doubly Linked List, Circular Linked List.

**Trees:** Introduction, Types of Trees, Binary Tree, Binary Tree Abstract Data Type, Realization of a Binary Tree, Binary Tree Traversal.

**Learning Outcomes:**

By the end of this Unit, the student will be able to

utilize the concept of dynamic memory allocation.(L3)

develop doubly linked list, circular linked list. (L3)

Inspect Binary tree traversal algorithms. (L4)

**Hashing:** Introduction, Hash Functions, Collision Resolution Strategies, Extendible Hashing, Dictionary.

**Indexing and Multiway Trees:** Introduction, Indexing, Types of Search Trees- Multiway Search Tree, B-Tree, B+ Tree.

By the end of this Unit, the student will be able to

outline Hash Functions. (L2)

develop B tree and B+ Trees. (L3)

**UNIT-V**

**Files:** Introduction, External Storage Devices, File Organization, Files Using C++, Sequential File Organization, Direct Access File Organization, Indexed Sequential File Organization. (10)

**Learning Outcomes:**

By the end of this Unit, the student will be able to

experiment with sequential file organization and random file organization.

(L3) demonstrate indexed sequential file organization. (L2)

To illustrate array data structure and perform searching and sorting. (L2)

To write programs to create, insert, delete and display the elements of stack, queue, linked list. (L2)

To develop tree and perform traversals. (L3)

To utilize sequential and direct access files. (L3)

**Text Books:**

Data Structures Using C++ by Varsha H. Patil, Oxford University Press,2012.

**Reference Books:**

Data Structures and Algorithms in C++, Adam Drozdek, Cengage Learning,3rd Edition, 2006.

Data Structures and Algorithms in C++, Brijendra Kumar Joshi, Tata McGraw Hill,2010.

**B.Sc. Physical Science**
**SEMESTER –II**
**SPH 128 : Data Structures and File Processing Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks
Credits: 2

Write a C++ program to convert a sentence from lower case to to upper case , count number of vowels and delete blank spaces.

Write a C++ program to implement Stack operations.

Write a C++ program to implement queue operations..

Write a C++ program to implement the operations in Linked list

Write a C++ program to concatenate two files and copy the contents of one file to another file.

Write a C++ program program for direct access of records in a file.

Write a C++ program to implement field organization using length indicator.

Write a C++ program for fixed length field organization.

Write a C++ program for index access of records in a file.

Write a C++ program for accessing records in a file using index(record organization).

Write a C++ program to print a line if it contains more than 80 characters.

Write a C++ program for reading and writing contents to a file from console.

Write a C++ program to reverse the contents of the given file.

Write a C++ program to search for a given record using sequential search

Write a C++ program to search for a given record using simple Hashing.

Write a C++ program to sort records in a file.

**Text Books:**

Data Structures Using C++ ,
Varsha H. Patil, Oxford University Press,2012.

**Reference Books:**

Data Structures and Algorithms in C++ ,

Adam Drozdek, Cengage Learning,3rd Edition,2006.

**B.Sc. Physical Science**
**SEMESTER –III**
**SPH 203: Thermal Physics and Statistical Mechanics**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

**Preamble:** The course provides an introduction to the basic concepts in thermodynamics, various thermodynamic transport phenomena, general thermodynamic property relations and different law for energy spectrum emitted by black body. It develops the problem solving skills in problems in basic thermodynamics.

**Objective:** To understand the basic laws of thermodynamics and their application to the non-flow and flow processes, thermodynamic properties of ideal and real gases and thermodynamic probability in gaseous medium

**UNIT I**

**Kinetic theory of gases**

Introduction –Deduction of Maxwell's law of distribution of molecular speeds, experimental verification. Toothed wheel experiment. Transport phenomena-Viscosity of gases-thermal conductivity-diffusion of gases.

**Learning Outcomes**

Understanding molecular speed distribution in gases. (L2)
Understanding transport phenomena of gases.(L2)

**UNIT II**

**Thermodynamics**

Introduction- Isothermal and adiabatic process- Reversible and irreversible processes-Carnnot's engine and its efficiency-Carnot's theorem-Second law of thermodynamics. Kelvin's and Claussius statements-Thermodynamic scale of temperature-Entropy, physical significance –Change in entropy in reversible and irreversible processes-Entropy and disorder-Entropy of Universe-Temperature-Entropy (T-S) diagram-Change of entropy of a perfect gas- change of entropy when ice changes into steam.

**Learning Outcomes**

Understanding basic concepts in thermodynamic and Carnnot's heat ideal heat engine.(L2)
Develop the problem solving skill in basic thermodynamics.(L3)

**UNIT III**

**Thermodynamic potentials and Maxwell's equations**

Thermodynamic potentials-Derivation of Maxwell's thermodynamic relations-Clausius-Clayperon's equation-Derivation for ratio of specific heats-Derivation for difference of two specific heats for perfect gas.Joule Kelvin effect-expression for Joule Kelvin coefficient for perfect and Van der waal's gas.

**Learning Outcomes**

Understanding and applying Maxwell thermodynamic relations.( L2 and L3)
Examine temperature change by using Joule – Kelvin effect(L4)

**UNIT IV**

**Black body radiation**

Blackbody-Ferry's black body-distribution of energy in the spectrum of black body-Wein's displacement law,Wein's law and stefans law Rayleigh-Jean's law-Quantum theory of radiation-Planck's law-Measurement of radiation.

**Learning Outcomes**

Understanding different law for energy spectrum emitted by black body.(L2)

Determine measurement of radiation by different techniques. (L5)

**UNIT V**

**Introduction to Statistical Mechanics**

Phase space, Macrostate and Microstate Statistical basis, Probability, Principle of equal apriori probability, Maxwell-Boltzmann statistics, Bose-Einstein statistics, Fermi-Dirac statistics (qualitative treatment), Entropy and Thermodynamic probability.

**Learning Outcomes**

1. Understanding basic concepts of statistical thermodynamics.(L2)
2. Analyzing the average distribution of non-interacting material particles over various energy states in thermal equilibrium by using different laws.(L4)

**Course Outcomes:**

Understanding molecular speed distribution and transport in gases. (L2)

Understanding basic concepts in thermodynamics and solve basic equations (L2 and L3)

Understanding and applying Maxwell thermodynamic relations and examine temperature change by using Joule – Kelvin effect( L2 and L4)

Understanding and measure energy spectrum emitted by black body.(L2 and L5)

Understanding basic concepts of statistical thermodynamics and analyzing the average distribution of non-interacting material particles (L2 and L4)

**Text Books:**


BSc Physics, Vol.2, Telugu Akademy, Hyderabad

Thermodynamics, R.C. Srivastava, Subit K. Saha &Abhay K. Jain Eastern Economy Edition.

Unified Physics Vol.2, Optics & Thermodynamics, Jai Prakash Nath&Co.Ltd., Meerut

Heat ,Thermodynamics and Statistical Physics, Brij lal, Dr.N Subrahmanyam, P.S. Hemne, S Chand & Co

A text Book of Heat J.B.Rajam

Fundamentals of Physics. Halliday/Resnick/Walker.C. Wiley India Edition 2007

Heat, Thermodynamics and Statistical Physics-N Brij Lal, N Subrahmanyam, PS Hemne, S.Chand& Co.,2012

Heat and Thermodynamics- MS Yadav, Anmol Publications Pvt. Ltd, 2000

University Physics, HD Young, MW Zemansky,FW Sears, Narosa Publishers, New Delhi

Text Book of +3 Physics – Samal, Mishra &Mohanty, National Library, Min.of Culture, Govt of India.

Modern Engineering Physics, A.S. Vasudeva, S.Chand& Co.,

**B.Sc. Physical Science**
**SEMESTER –III**
**SPH 223: Thermal Physics and Statistical Mechanics Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks
Credits: 2

**Preamble:** Determination and analyzing of thermo dynamical parameters.

**Objective:** To find thermo dynamical constants and analyze for its accuracy.

**List of Experiments**

Specific heat of a liquid –Joule's calorimeter –Barton's radiation correction
Thermal conductivity of bad conductor-Lee's method
Measurement of Stefan's constant.
Specific heat of a liquid by applying Newton's law of cooling correction.
Heating efficiency of electrical kettle with varying voltages.
Thermoemf- thermo couple potentiometer
Coefficient of thermal conductivity of copper- Searle's apparatus.
Thermal behavior of an electric bulb (filament/torch light bulb)
Temperature variation of resistance- thermistor.

**Course Outcomes**:

Enable to determine thermo dynamical constants, analyze and illustrate (L4 and L5)

**B.Sc. Physical Science**
**SEMESTER –III**
**SPH 201: Real Analysis**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

**Preamble:** Real Analysis studies the behaviour of real numbers, functions, sequences, series and sets on the real line. The focus of the course is to study the properties of fields of real numbers, convergence/divergence of sequences, series of numbers and functions.

**Objective:**

To introduce

basic properties of fields of real numbers

sequences and discuss about their convergence

infinite series and the tests of convergence

Alternating series, absolute and conditional convergence of infinite series

Point wise and uniform convergence of sequence and series of functions

**UNIT-I**

Finite and infinite sets, examples of countable and uncountable sets. Real line, bounded sets, suprema and infima, completeness property of R, Archimedean property of R, intervals. Concept of cluster points and statement of Bolzano-Weierstrass theorem.

**Learning Outcomes:**

The student will be able to:

Define and recognize the basic properties of field of real numbers
Find suprema and infima of sets
Discuss the cluster points of sets

**UNIT-II**

Real Sequence, Bounded sequence, Cauchy convergence criterion for sequences. Cauchy's theorem on limits, order preservation and squeeze theorem, monotone sequences and their convergence (monotone convergence theorem without proof).

**Learning Outcomes:**

The student will be able to:

Define sequences and its properties
Verify the convergence of sequence
Prove fundamental theorems on convergence

**UNIT-III**

Infinite series. Cauchy convergence criterion for series, positive term series, geometric series, comparison test, convergence of p-series.

**Learning Outcomes:**

The student will be able to:

Define Infinite series and its properties
Discuss the convergence of Geometric series
Verify the convergence of series

**UNIT-IV**

Root test, Ratio test, alternating series, Leibnitz's test (Tests of Convergence without proof). Definition and examples of absolute and conditional convergence.

**Learning Outcomes:**

The student will be able to:

- Define alternating series
- Explain the absolute and conditional convergence of the series
- Explain the Root, Ratio and Leibnitz's test

**UNIT-V**

Sequences and series of functions, Pointwise and uniform convergence. M -test,Statements of the results about uniform convergence and integrability anddifferentiability of functions, Power series and radius of convergence.

**Learning Outcomes:**

The student will be able to:

- Define sequence and series of functions
- Understand the difference between point wise and uniform convergence
- Apply M-test

**Course Learning Outcomes:**

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

- Write precise proofs
- Recognize convergent, divergent, bounded, Cauchy and monotone sequences and their properties
- Calculate the infima, suprema and limit points of a set
- Recognize alternating, conditionally and absolutely convergent series
- Apply the ratio, root, Leibnitz's test
- Test the pointwise and uniform convergence of sequences and series of functions

**Text Books:**


Calculus Vol.I : One Variable Calculus, with an Introduction to Linear Algebra, Tom. M. Apostol, published by John Wiley and Sons (Asia) P. Ltd., 2002.

Introduction to Real Analysis" by Robert.G. Bartle and Donald. R Sherbert, John Wiley and Sons(Asia) Ltd., 2000.

Intermediate Real Analysis, Emanuel Fischer ,Springer Verlag, 1983.

Elementary Analysis: The Theory of Calculus, Kenneth A. Ross, Springer Verlag, 2003.

**B.Sc. Physical Science**
**SEMESTER –III**
**SPH 221: Real Analysis Tutorial**

Hours Per Week :2 Continuous Evaluation:100 Marks Credits :2

Finding supremum and infimum of a set

Finding limit points of a set

Problems on sequences

Problems on Cauchy convergence

Problems on monotonic sequence

Problems on infinite series

Convergence or divergence of Geometric series

Convergence or divergence using comparison test

Convergence or divergence of p-series

Problems on root test

Problems on Ratio test

Problems on alternating series

**Course Learning Outcomes:**

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

Calculate the infima, suprema and limit points of a set.
Apply tests to verify the convergence or divergence of sequences.
Verify the convergence, divergence, absolute convergence , conditional convergence of infinite series.

**B.Sc. Physical Science**
**SEMESTER –III**
**SPH-207: Digital Electronics**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

Preamble: This course was introduced to explain the concepts of Digital Electronics

Objective: To explain the basics of Digital circuits

**UNIT- I**

**Number Systems and Codes**

Decimal, Binary, Octal, Hexa Decimal numbers, conversion from one to another-codes, BCD, excess 3, gray codes conversion from one to another - Error detection codes**.**

**Learning Outcomes:**

To analyze the number systems
Solve the different number conversions

**UNIT - II**

**Boolean Algebra And Theorems**

Basic & Universal logic gates - Boolean Identities - Boolean theorems De Morgan's Theorem sum of products, products of sums expressions, simplification by Karnaugh Map method, simplification based on basic Boolean theorems - don't care conditions.

**Learning Outcomes:**

Analyzing of Universal gates
Simplification of Karnaugh maps

**UNIT – III**

**Combinational Digital Circuits**

Arithmetic Building blocks, Half & Full Adders and Half & Full Subtractions, BCD adders - multiplexers, De-multiplexers, encoders, decoders - Characteristics for Digital ICs -RTL, DTL, TTL, ECL CMOS (NAND & NOR Gates).

**Learning Outcomes:**

To design combinational circuits
Explains the logic families

**UNIT- IV**

**Sequential Digital Circuits**

Flip-flops, RS, Clocked SR, JK, D, T, Master-Slave Flip flop -Conversion of Flip flops – shift registers - ripple counters - synchronous counters and asynchronous counters (4-bit counter).

**Learning Outcomes:**

Analyze the various sequential circuits
To design the synchronous and asynchronous counters

**UNIT- V**

**Memory Devices**

ROM Organization - PROM Organization – PLA (Programmable Logic Array) - PAL (Programmable Array Logic) - Realization of functions using PROM

**Learning Outcomes:**

To construct the memory devices

To explain the programmable logic devices

**Course Outcomes:**

Learn the number systems in digital systems (L2)

Acquire the knowledge on simplification gates (L5)

Learn about the designing of combinational circuits (L4)

Learn about the designing of sequential circuits (L4)

Learn the basics of organization of memory devices (L3)

**Textbooks:**


R.P. Jain, "Modem digital Electronics", 3rd Edition, TMH, 2003.

Puri, V.K., Digital Electronics, Tata McGraw Hill,2nd Edition,2011

Marris mano M., Computer System Architecture, 2nd Edition, Prentice Hall, 1998

Malvino and Leach, Digital Principles and applications, McGraw Hill, 1996, 4th Edition


**Reference Books:**


Millman 1. Micro Electronics, McGraw Hill International Book Company, New Delhi.

Morris Mano M., "Digital Logic and Computer Design" PHI, 2005.

Godse A.P., Digital Electronics, Technical Publications.

Unified Electronics (Digital Electronics and Microprocessors) by Agarwal- Agarwal

**B.Sc. Physical Science**
**SEMESTER –III**
**SPH 227: Digital Electronics Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks
Credits: 2

Preamble: This course was designed to construct and verify Digital
Objective: circuits The student analyze and design the Digital circuits

**List of Experiments**

Verification of I C (basic) logic Gates

Universality of NAND & NOR Gates.

Verification of Boolean laws using NAND Gates (Associative, Commutative & Distributive Laws)

Study of RS, D, T and JK Flip-Flops with IC's

Half and Full Adders using Simple & NAND Gates.

6.4-bit binary parallel adder and Subtractor IC 7483 using PSPICE simulation

Study of7490 BCD Counter - MOD Counters using PSPICE simulation.

BCD to Seven segment decoder 7447/7448 using PSPICE simulation.

**Course Outcomes:**

After the completion of this course, the student will be able to design the electronic circuits (L3 and L4)

**B.Sc. Physical Science**
**SEMESTER –III**
**SPH 205: Solutions, Phase Equilibrium, Conductance, Electrochemistry & Functional Group Organic Chemistry-II**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

**Preamble**: The students of undergraduate program in science need to be conversant with the various aspects of solution chemistry, phase equilibrium, electrochemistry and Functional group chemistry forms the foundation for training a undergraduate students as analytical and synthetic chemist.

**Objective:** To introduce the concept of solution phase chemistry in physical chemistry and functional group chemistry in organic chemistry to the undergraduate students.

The students will learn the essential functional groups in organic chemistry, their reactions, and properties.

**UNIT-I**

**Section A: Physical Chemistry-2**

**Solutions**

Thermodynamics of ideal solutions: Ideal solutions and Raoult's law, deviations from Raoult's law – non-ideal solutions. Vapour pressure-composition and temperature-composition curves of ideal and non-ideal solutions. Distillation of solutions.Lever rule.Azeotropes.

**Phase Equilibrium**

Phases, components and degrees of freedom of a system, criteria of phase equilibrium.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 two component systems involving eutectics, congruent and incongruent melting points (lead-silver only).

**Learning Outcomes**

The student will learn about the essential concepts impotent principle and terms of phase rule. The students will be apple to apply phase rule to one component and two component systems

**UNIT-II**

**Conductance**

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 (only acid-base).

**Electrochemistry**

Reversible and irreversible cells.Concept of EMF of a cell.Measurement of EMF of a cell.Nernst equation and its importance.Types of electrodes.Standard electrode potential.Electrochemical series. Thermodynamics of a reversible cell, calculation of thermodynamic properties: G, H and S from EMF data.

Calculation of equilibrium constant from EMF data. Concentration cells with transference and without transference. Liquid junction potential and salt bridge.

**Learning Outcomes**

The students will learn the elementary concepts of conductance and electrochemistry. The students will learn the applications of kolhlrausch law. They will be able to calculate thermodynamic properties: G, H and S from EMF data.

**UNIT-III**

**Section B: Organic Chemistry-3**

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure.

**Carboxylic acids and their derivatives** 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 theirinterconversion.

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, Hofmann Bromamidereaction.

Reactions: Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, with HNO2,Schotten – Baumann Reaction. Electrophilic substitution (case aniline): nitration, bromination, sulphonation.

**Diazonium salts**:Preparation:from aromatic amines

Reactions: conversion to benzene, phenol, dyes.

**Learning Outcomes**

The students will learn the concept of synthesis nd reactions carboxyl Functional group and derivatives.

**UNIT-IV**

**Amino Acids, Peptides and Proteins:**

Preparation of Amino Acids: Strecker synthesis using Gabriel's phthalimide synthesis.Zwitterion, Isoelectric point and Electrophoresis.

Reactions of Amino acids: ester of –COOH group, acetylation of –NH2group, complexationwith $Cu^{2+}$ ions, ninhydrin test.

Overview of Primary, Secondary, Tertiary and Quaternary Structure of proteins.

Determination of Primary structure of Peptides by degradation Edmann degradation (N-terminal) and C–terminal (thiohydantoin and with carboxypeptidase enzyme).Synthesis of simple peptides (upto dipeptides) by N-protection (t-butyloxycarbonyl and phthaloyl) & C-activating groups and Merrifield solid-phase synthesis.

**Learning Outcomes**

The student shall learn

the elementary reactions and properties , mechanism of amines and diazonium salts . The students will learn the concept of applications of diazonium salts in synthetic organic chemistry.

The students will also familiarize with synthetic approaches to simple amono acids and concept of proteins.

**UNIT-V**

**Carbohydrates**: Classification, and General Properties, Glucose and Fructose (open chainand 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.

**Learning Outcomes**

The students will learn about the classification of carbohydrates. The students will familiarize the reactions and properties of mono, di and polysaccharides

**Reference Books:**


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

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

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

Finar, I. L. Organic Chemistry (Volume 2),
Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

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

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

**B.Sc. Physical Science**
**SEMESTER –III**
**SPH 225: Solutions, Phase Equilibrium, Conductance, Electrochemistry & Functional Organic Chemistry-II Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks
Credits: 2

**Preamble:** The students of undergraduate program in science in Chemistry need to be conversant with the various basic methodologies of chemistry. Therefore, one module each on in inorganic , physical and organic chemistry is introduced which helps the student familiarize with the techniques essential for developing the foundation of practical chemistry

**Objective:** To make student learn the practical application of solution, phase and electrochemistry for quantitative analysis

He students also learn to differentiate between reducing and non-reducing sugars by qualitative analysis.

**Section A: Physical Chemistry**

**Distribution**

Study of the equilibrium of one of the following reactions by the distribution method:

$I_2(aq) + I^-(aq) \rightleftharpoons I_3^-(aq)$

$Cu^{2+}(aq) + xNH_2(aq) \rightleftharpoons [Cu(NH_3)_x]^{2+}$

**Phase equilibria**

Construction of the phase diagram of a binary system (simple eutectic) using cooling curves.

Determination of the critical solution temperature and composition of the phenol water system and study of the effect of impurities on it.

Study of the variation of mutual solubility temperature with concentration for the phenol water system and determination of the critical solubility temperature.

**Conductance**

Determination of cell constant

Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.

Perform the following conductometric titrations:

Strong acid vs. strong base

Weak acid vs. strong base

**Potentiometry**

Perform the following potentiometric titrations:

Strong acid vs. strong base

Weak acid vs. strong base

Potassium dichromate vs. Mohr's salt

**Learning Outcomes**

The student will learn determination of conductance, cell constant. The students will learn to apply the concepts of electrochemistry for redox titrations by instrumental methods of analysis

**Section B: Organic Chemistry**

**I** Systematic Qualitative Organic Analysis of Organic Compounds possessingmonofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.

**II**

Separation of amino acids by paper chromatography
Determination of the concentration of glycine solution by formylation method.
Titration curve of glycine
Action of salivary amylase on starch
Effect of temperature on the action of salivary amylase on starch.
Differentiation between a reducing and a nonreducing sugar.

**Reference Books:**

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

**B.Sc. Physical Science**
**SEMESTER –III**
**SPH 209: Design and Analysis of Algorithms**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

Preamble: Design and Analysis of Algorithm is very important for designing algorithm to solve different types of problems in the branch of computer science and information technology. This course deals the fundamental concepts of Designing Strategies, Complexity analysis of Algorithms, followed by problems on Graph Theory and Sorting methods.

Objectives:

To rephrase algorithms. (L2)

To demonstrate sorting techniques.(L2)

To emphasize graph traversals. (L3)

To illustrate challenges in numeric algorithms. (L2)

**UNIT –I**

**Introduction:** Algorithm Specification, Performance Analysis, Randomized Algorithms- Las Vegas, Monte Carlo Algorithm Definition, RQuick Sort.

**Sorting Techniques:** Selection Sort, Bubble Sort, Insertion Sort, Heap Sort, Shell Sort, Linear Search.

**Learning Outcomes:**

By the end of this Unit, the student will be able to

Specify algorithms and analyze performance of algorithm.

(L2) To develop sorting techniques. (L5)

**UNIT - II**

**Divide and Conquer:** General Method, Binary Search, Finding maximum and minimum, Merge Sort, Quick Sort, Strassen's Matrix Multiplication.

**Basic Graph Traversal Techniques**- Breadth First Search, Depth-First Search.

**Learning Outcomes:**

By the end of this Unit, the student will be able to

examine divide and conquer method. ( L4)

adopt BFS and DFS algorithms. (L3)

**UNIT- III**

**Greedy Method:** General Method, Knapsack Problem, Minimum Cost Spanning Trees- Kruskal's , Prim Algorithms, Single Source Shortest Paths.

**Learning Outcomes:**

By the end of this Unit, the student will be able to

make use of minimum cost spanning trees. (L4)

explain Krushkl's, Prims and single source shortest path algorithm. (L2)

**UNIT – IV**

**Dynamic Programming:** General Method, All pairs Shortest Paths, Travelling Salesperson Problem.

**Transform and Conquer:** Multiplication of Large Integers, Horners Rule and Binary Exponentiation, Computing the least common multiple, counting paths in a graph, Reduction of Optimization Problem. ( Anany Levitin chapter -6)

**Learning Outcomes:**

By the end of this Unit, the student will be able to

elaborate Travelling salesman problem. (L4)

solve Horners rulw and binary exponentiation, computer LCM. (L3)

**UNIT – V**

**Input Enhancement in String Matching:** Horspools Algorithm, Boyer- Moore Algorithm.

**Limitations of Algorithm Power :** Lower-Bound Arguments, Trivial Lower Bounds, Information-Theoretic Arguments, Adversary Arguments, Problem Reduction

**Decision Trees**: Decision Trees for Sorting, Decision Trees for Searching a sorted Array

**P, NP, and NP-Complete Problems :**Basic Concepts, P and NP Problems, NP-Complete Problems, Challenges in Numeric Algorithms ( Anany Levitin – $11^{th}$ chapter)

**Learning Outcomes:**

By the end of this Unit, the student will be able to

model Horspools Algorithm, Boyer- Moore Algorithm. (L4)

choose decision tree for sorting. (L3)

**Course Outcomes:**

Upon completion of the course, the student is able to

Learn to analyze performance of algorithm.(L2)

solve a given problem recursively dealing with sub-problems.(L3)

learn to solve notorious computational problems. (L4)

**Text Books:**

Fundamentals of Computer Algorithms – Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, Second Edition, 2008, University Press,

Introduction to the Design and Analysis of Algorithms, ,Anany Levitin, $3^{rd}$ Edition 2012, Pearson (Unit- IV,V)

**B.Sc. Physical Science**
**SEMESTER –III**
**SPH 229: Design and Analysis of Algorithms Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks
Credits: 2

**List of Experiments**

Write a C++ program to implement Bubble sort.

Write a C++ program to implement Insertion Sort.

Write a C++ program implement Selection Sort.

Write a C++ program to implement Quick Sort.

Write a C++ program to implement Merge Sort.

Write a C++ program to implement Shell Sort.

Write a C++ program to Find Maximum and Minimum using Divide and Conquer.

Write a C++ program to implement Strassen's Matrix Multiplication.

Write a C++ program to implement Breadth First Search, Depth First Search.

Write a C++ program on Knapsack Problem.

Write a C++ program to find Minimum Cost Spanning Tree.

Write a C++ program to find All pairs Shortest Path.

Write a C++ program to find Single Source Shortest Path.

Write a C++ program to evaluate an expression using Horner's Rule.

Write a C++ program to perform string matching – Horspools or Boyer- Moore algorithm.

**Text Books:**

Fundamentals of Computer Algorithms – Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, Second Edition, 2008, University Press,
Introduction to the Design and Analysis of Algorithms, ,Anany Levitin, 3rd Edition 2012, Pearson (Unit- IV,V)

**B.Sc. Physical Science**
**SEMESTER –III**
**SFC 203: English for Communication– II**

Hours per week: 3 End Examination: 60 Marks
Credits: 2 Sessionals: 40 Marks

**Preamble:** This course has been designed to help students acquire English language skills for professional development. The students will be exposed to aspects of English language through some very interesting texts. Each unit of the book carries a very extensive and relevant explanation on pronunciation, grammar, vocabulary, spelling, punctuation, spoken dialogues, writing and reading.

**Objective:**

To introduce students to Prosodic features for right speech
To enable students to use English in day-to-day communication
To build up their confidence in the usage of English
To expose them to Group Discussion sessions
To develop their written communicative competence To make them interview ready

**UNIT- I The Open Window : Saki (H.H.Munro)**

**Pronunciation:** Syllabification**, Grammar:** Non-infinite verbs, **Vocabulary:** Simile & Metaphor**, Spelling:** using 'ie' or 'ei', **Punctuation:** semi-colon, **Conversation:** Asking for advice/information,

**Learning outcomes:**

By the end of the course, the student will be able to:

Improve their speaking ability in English both in terms of fluency and comprehensibility.
Heighten their awareness of correct usage of English grammar in writing and speaking.
Attain and enhance competence in the four modes of literacy: LSRW.
Utilize phonetic dictionary symbols to continue to improve pronunciation.
Punctuate quoted statements, sentences and questions correctly.

**UNIT- II The Voice of Humanity – Rabindranath Tagore**

**Pronunciation:** Word Stress, **Grammar:** Adjectives, **Vocabulary:** Oxymoron & Hyperbole**, Spelling:** using 'able' and 'ible', **Punctuation:** Colon & dash, **Group Discussion Learning outcomes:**

By the end of the course, the student will be able to:

To use newly acquired vocabulary in classroom activities.
Develop independent learning strategies and study skills.
Have the ability to communicate effectively with others.
Understand the rules of word stress
Acquire the skills needed for a G.D and participate efficiently.

**UNIT –III If – Rudyard Kipling**

**Pronunciation:** Sentence Stress**, Grammar:** Articles, **Vocabulary:** Portmanteau and loan words**, Spelling:** using suffixes, **Punctuation:**Hyphen & dash, **Oral Presentation**

**Learning outcomes:**

By the end of the course, the student will be able to:

Demonstrate command of the conventions of Standard English punctuation, and spelling when writing.

Enable to discuss literary texts from various theoretical and critical perspectives.

Formulate ideas and connections between literary concepts and themes.

Establish a deeper appreciation of cultural diversity by introducing them to poetry. acquire effective presentation skills

**UNIT -IV Riders to the Sea – JM Synge**

**Pronunciation –** Intonation**, Grammar:** Adverbs, **Vocabulary:** Palindromes**, Spelling:** completing tables with nouns, verbs, adjectives, adverbs **Punctuation:** Inverted comma, **Conversation/Role play:** Appearing for a job interview/conducting a job interview

**Learning outcomes:**

By the end of the course, the student will be able to:

Collaborate with peers for role-playing, story analysis, and presentation planning.

Use comparative forms of high frequency adjectives and adverbs.

Apply sentence mechanics and master spelling of high frequency words.

Demonstrate increased understanding of English syntax and grammatical elements for effective writing.

Understand and use intonation in spoken language.

Develop the skills needed for attending an interview

**UNIT- V Academic Writing:** Letter Writing, Paragraph Writing, Essay Writing, Resume Preparation, Dialogue Writing, Precis

**Learning outcomes:**

By the end of the course, the student will be able to:

Develop outlines, clusters, lists, or other graphic organizers to organize ideas for writing

Format various types of writing such summaries, personal letters, formal letters and narrative, descriptive, and expository paragraphs on a variety of topics

Develop own creativity and enhance their writing skills Paraphrase text appropriately.

Write effective introductions and conclusions for paragraphs. Prepare a persuasive resume.

**Text Books**:

Part – 2 (English for Enhanced Competence (by Sumit Roy, A.Karunakar, A.Aruna Priya)

**Supplementary Reading**:

Communicative skills for Technical Students, M. Faratullah.
Orient longman
Rizvi,MAshraf. **Effective Technical Communication.** McGraw - Hill.

**B.Sc. Physical Science**
**SEMESTER –III**
**SSE 271: Physics Workshop Skill**

Credits: 2 Continuous Evaluation: 100 Marks

**Preamble:** To introduce various measuring methods of mechanical and electrical circuits.

**Objective:** To understand the need of these measuring methods.

**Introduction:** Measuring units. conversion to SI and CGS. Familiarization with meterscale, Vernier calliper, Screw gauge and their utility. Measure the dimension of a solidblock, volume of cylindrical beaker/glass, diameter of a thin wire, thickness of metalsheet, etc. Use of Sextant to measure height of buildings, mountains, etc.

**Mechanical Skill**: Concept of workshop practice. Overview of manufacturing methods:casting, foundry, machining, forming and welding. Types of welding joints and weldingdefects. Common materials used for manufacturing like steel, copper, iron, metal sheets,composites and alloy, wood. Concept of machine processing, introduction to commonmachine tools like lathe, shaper, drilling, milling and surface machines.Cutting tools,lubricating oils.Cutting of a metal sheet using blade.Smoothening of cutting edge ofsheet using file.Drilling of holes of different diameter in metal sheet and wooden block.Use of bench vice and tools for fitting. Make funnel using metal sheet.

**Electrical and Electronic Skill**: Use of Multimeter. Soldering of electrical circuitshaving discrete components (R, L, C, diode) and ICs on PCB. Operation of oscilloscope.Making regulated power supply. Timer circuit, Electronic switch using transistor andrelay.

**Introduction to prime movers**: Mechanism, gear system, wheel, Fixing of gears withmotor axel. Lever mechanism, Lifting of heavy weight using lever. braking systems,pulleys, working principle of power generation systems. Demonstration of pulleyexperiment.

**Reference Books:**

A text book in Electrical Technology - B L Theraja – S. Chand and Company.
Performance and design of AC machines – M.G. Say, ELBS Edn.

**Course Outcomes:** At the end of the course

Will demonstrate and compare various measuring methods with respective methods(L2)

**B.Sc. Physical Science**
**SEMESTER –III**
**SSE 273: Basic Analytical Chemistry**

Credits :2 Continuous Evaluation:100 Marks

**Introduction:** Introduction to Analytical Chemistry and its interdisciplinary nature. Conceptof 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.

**Analysis of soil**: Composition of soil, Concept of pH and pH measurement, Complexometrictitrations, Chelation, Chelating agents, use of indicators

Determination of pH of soil samples.
Estimation of Calcium and Magnesium ions as Calcium carbonate by complexometric titration.

**Analysis of water:** Definition of pure water, sources responsible for contaminating water,water sampling methods, water purification methods.

Determination of pH, acidity and alkalinity of a water sample.
Determination of dissolved oxygen (DO) of a water sample.

**Analysis of food products:** Nutritional value of foods, idea about food processing and foodpreservations and adulteration.

Identification of adulterants in some common food items like coffee powder, asafoetida, chilli powder, turmeric powder, coriander powder and pulses, etc.
Analysis of preservatives and colouring matter.

**Chromatography:** Definition, general introduction on principles of chromatography, paperchromatography, TLC etc.

Paper chromatographic separation of mixture of metal ion ($Fe^{3+}$ and $Al^{3+}$).
To compare paint samples by TLC method. **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).

**Analysis of cosmetics:** Major and minor constituents and their function
Analysis of deodorants and antiperspirants, Al, Zn, boric acid, chloride, sulphate.
Determination of constituents of talcum powder: Magnesium oxide, Calcium oxide, Zinc oxide and Calcium carbonate by complexometric titration.

To study the use of phenolphthalein in trap cases.
To analyze arson accelerants.
To carry out analysis of gasoline.

**B.Sc. Physical Science**
**SEMESTER –III**
**SSE 275: Logic and Sets**

Credits: 2 Continuous Evaluation: 100 Marks

Introduction, propositions, truth table, negation, conjunction and disjunction.Implications, biconditional propositions, converse, contra positive and inverse propositions and precedence of logical operators.

Propositional equivalence: Logical equivalences.

Predicates and quantifiers: Introduction, Quantifiers, Binding variables and Negations.

Sets, subsets, Set operations, the laws of set theory and Venn diagrams. Examples of finite and infinite sets.Finite sets and counting principle. Empty set, properties of empty set. Standard set operations. Classes of sets. Power set of a set.
Difference and Symmetric difference of two sets. Set identities, Generalized union and intersections.

Relation: Product set, Composition of relations, Types of relations,Partitions, Equivalence Relations with example of congruence modulo relation.

**Text Books:**

Discrete and Combinatorial Mathematic, Ralph P. Grimaldi and B.V. Ramana Pearson Education, 1998.
Naïve Set Theory,Paul R. Halmos , Springer, 1974.
Theory of Sets, E. Kamke ,Dover Publications, 1950.

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

Explain propositional calculus
Evaluate problems on predicate functions
Explain different types of sets and operations on sets
Define relation between two sets
Explain different types of relations

**B.Sc. Physical Science**
**SEMESTER –III**
**SSE 277: Computer Graphics**

Credits :2 Continuous Evaluation:100 Marks

**Preamble:** Computer graphics is regarded as a branch of computer science that deals with the theory and technology for computerized image synthesis. The task of composing image on a computer is essentially a matter of setting pixel values. The field of computer graphics is characterized by rapid changes in hoe the technology is used in everyday applications and by constant evolution of graphics systems.

**Course Objectives:**

To familiarize with Raster Scan and Random Scan Systems.
To know about line drawing algorithms.
To learn about polygon filling algorithm.
To understand ant aliasing techniques.

**UNIT- I**

Development of Computer Graphics, Raster Scan and Random Scan graphics storages, display processor and character generators, color display techniques.

**Learning Outcome:**

By the end of this Unit, the student will be able to

Show raster scan and random scan graphics storage.
(L1) Explain display processor. (L1)
Outline colour display techniques. (L3)

**UNIT- II**

Cathode Ray Tube (CRT)basics, Refresh Display, Direct View Storage Tube(DVST , Interactive input/output devices).

Outline CRT display.
(L2) Explain DVST. (L3)
Narrate interactive input output devices. (L2)

**UNIT-III**

Points, lines and curves, Scan conversion, Line-Drawing Algorithms, Circle and Ellipse Generation.

**Learning Outcome:**

By the end of this Unit, the student will be able to

Know about scan conversion algorithms.(L3)
Describe Line drawing Algorithms. (L2)
Explain Circle generation and Ellipse generation algorithms. (L2)

**UNIT- IV**

Conic-section generation, polygon filling, anti aliasing.

**Learning Outcomes:**

By the end of this Unit, the student will be able to

Understand Conic Section generation. (L2)

Learn polygon filling algorithms. (L2)

Choose anti aliasing techniques. (L3)

**UNIT - V**

Two-dimensional viewing, Coordinate systems, linear transformations, line and polygon clipping algorithms.

**Learning Outcomes:**

By the end of this Unit, the student will be able

to Learn two dimensional viewing. (L3)

Make use of Coordinate systems. (L4)

Select line and Polygon clipping algorithms. (L3)

Differentiate raster scan and random scan

systems. Identify the CRT and DVD display.

Know about line generation and Polygon filling algorithms.

**Text Book:**

1. Computer Graphics ,Amarendra N Sinha, Arun D Udai, Tata McGraw Hill, 2008.

**Reference Books :**

Computer Graphics, D. Hearn and M.P. Baker, Prentice–Hall of India, 2nd Ed., 2004.

Procedural Elements in Computer Graphics , D.F. Rogers, TMH, 2nd Ed., 2001.

**B.Sc. Physical Science**
**SEMESTER –IV**
**SPH 204: Electricity & Magnetism**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

**Preamble:** To introduce the concepts of electric charges, fields and to induce the magnetic field concepts and to understand the relation between electricity and magnetism via electromagnetic induction, waves etc.

**Objective:** To combine the understanding of fundamental concepts in Electricity and Magnetism more rigorously and their relation to understand the physical systems of dielectrics, magnetic materials etc…as needed for further studies in physics.

**UNIT I**

**Electric field and potential:**

Gauss's law statement and its proof- Electric field due to (1) Uniformly charged sphere (2) an infinite conducting sheet of charge and (3) Uniformly charged cylinder. Electrical potential – equipotential surfaces- potential due to i) a point charge, ii)charged spherical shell and uniformly charged circular disc. Electric field strength due to an electric dipole.

**Learning Outcomes**

Understands the concept of electric flux and apply Gauss's law to calculate electric flux(L2 and L3).

Understand electrostatic interactions of point charges physical parameters.(L2)

**UNIT II**

**Capacitance and dielectrics:**

Electric capacitance - Derivation of expression for capacity of (i) a parallel plate capacitor (ii) a spherical capacitor. Dielectrics- effect of dielectric on the capacity of a condenser, Energy stored in a capacitor. Electric dipole moment and molecular polarizability- Electric displacement D , electric polarization P – relation between D,E and P- Dielectric constant and susceptibility.

**Learning Outcomes**

Understand the working of capacitor and different types of capacitors and realize charge on a capacitor to the potential of a capacitor.(L2 and L4)

Construct about dielectrics, dielectric breakdown, and how dielectrics make capacitors more effective (L3)

**UNIT III**

**Moving charges in electric and magnetic field**

Hall effect, cyclotron, synchrocyclotron and synchrotron- Force on a current carrying conductor placed in a magnetic field, force and torque on a current loop, Biot-Savart's law, explanation and calculation of B due to long straight wire, a circular current loop and solenoid.

**Electromagnetic induction**

Faraday's law-Lenz's law-expression for induced emf-time varying magnetic field Betatron – Moving coil ballistic galvanometer-theory, working. Self and mutual inductance, coefficient of coupling.

**Learning Outcomes**

Construct cyclotron, synchrocyclotron and synchrotron and their working (L3).

Explain mutual relation between electric and magnetic fields (L2).

**UNIT IV**

**Varying and alternating currents**

Growth and decay of currents in LR,CR and LCR dc circuits-critical damping, Alternating current relation between current and voltage in pure R,C and L. LCR series and parallel resonant circuit, Q -factor.

**Learning Outcomes**

Interpret circuits with Capacitance (C) , inductor (L) and Resistor (R) during charging and discharging when connected or disconnected to a battery (L2).

Function of an LC circuit for the change in oscillations due to resistance (L4)

**UNIT V**

**Maxwell's equations and electromagnetic waves**

A review of basic laws of electricity and magnetism-displacement current. Maxwell's equations in differential form, Maxwell's wave equation, plane electromagnetic waves. Transverse nature of electromagnetic waves.Poynting theorem.

1. Outline Maxwell's equations of electromagnetic theory (L2)

Infer how Maxwell modified Ampere's law for wave equation for the transfer of electromagnetic energy (L4).

**Course Outcomes**

Understands the concept of electric flux, interactions of point charges and apply Gauss's law to calculate electric flux.(L2 and L3)

Understand capacitor its types and analyze to the potential of a capacitor.(L2 and L4) Construct dielectrics, capacitors with dielectrics and particle accelerators (L3)

Explain mutual relation between electric and magnetic fields (L2)

Interpret and examine RLC circuits with battery connected and battery disconnected(L2 and L4)

Extend Maxwell's equations of electromagnetic theory and examine electromagnetic wave equation for the transfer of electromagnetic energy.(L2 and L4)

**Textbooks:**

BSc Physics, Vol.3, Telugu Akademy, Hyderabad

Electricity and Magnetism, D.N. Vasudeva. S. Chand & Co.

Unified Physics Vol.3, Electricity, Magnetism and Electronics, S.L. Gupta and Sanjeev Gupta, Jai PrakasahNath& Co., Meerut.

**Reference Books:**

Fundamentals of Physics- Halliday/Resnick/Walker - Wiley India Edition2007.

Berkeley Physics Course – Vol. II - Electricity and Magnetism – Edward M Purcell –The McGraw-Hill Companies.

Electricity and Magnetism Brijlal and Subramanyam. RatanPrakashanMandir.

Electricity and Magnetism, C.J. Smith, Edward Arnold Ltd.

**B.Sc. Physical Science**
**SEMESTER –IV**
**SPH 222: Electricity & Magnetism Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks
Credits: 2

**Preamble:** Examine electrical circuits for relevant measurements

**Objective:** To analyze electrical circuits for determining electrical quantities

**List of Experiments:**

Internal resistance of a cell by potentiometer.
LCR circuit series/parallel resonance, Q factor.
Determination of ac-frequency –sonometer.
Conversion of galvanometer into ammeter
Conversion of galvanometer into voltmeter.
Verification of Kirchoff's laws and maximum power transfer theorem.
Field along the axis of a circular coil carrying current.
LCR circuits in series and parallel
Hall probes-Magnetic field measurement

**Course Outcomes:**

Enable to analyze, determine electrical quantities with illustration (L4 and L5)

**B.Sc. Physical Science**
**SEMESTER –IV**
**SPH 202: Algebra**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

**Preamble:** This course aims to provide basic concepts of Abstract algebra. The focus of the course is to study the fundamental properties of Groups and its kind.

**Course Objectives:**

To introduce groups, subgroups, permutation and cyclic groups with examples
To discuss the fundamental properties of Groups, sub groups etc
To study the structure preserving mappings, homomorphism and isomorphism, its properties.
To increase mathematical maturity, including writing their own proofs

**UNIT – I**

**Groups:** Binary Operation – Algebraic structure – semi group-monoid – Group definition and elementary properties Finite and Infinite groups – examples – order of a group. Composition tables with examples.

**Learning Outcomes:**

The student will be able to:
Explain algebraic structures
Verify group properties of a given algebraic structure
Define order of a group and order of an element

**UNIT – II**

**Subgroups:** Complex Definition – Multiplication of two complexes Inverse of a complex-Subgroup definition – examples-criterion for a complex to be a subgroups. Criterion for the product of two subgroups to be a subgroup-union and Intersection of subgroups.

**Co-sets and Lagrange's Theorem :**

Cosets Definition – properties of Cosets–Index of a subgroups of a finite groups–Lagrange's Theorem.

**Learning Outcomes:**

The student will be able to:
Define and explain the properties of complexes, subgroups and co-sets
Explain the index of a subgroups with examples
Prove Lagranges theorem

**UNIT –III**

**Normal Subgroups:** Definition of normal subgroup – proper and improper normal subgroup–Hamilton group – criterion for a subgroup to be a normal subgroup – intersection of two normal subgroups – Sub group of index 2 is a normal sub group – simple group – quotient group – criteria for the existence of a quotient group.

**Learning Outcomes:**

The student will be able to:
Explain normal subgroups and its properties
Define quotient groups and criteria for the existence of a quotient group.

**UNIT – IV**

**Homomorphism :** Definition of homomorphism – Image of homomorphism elementary properties of homomorphism – Isomorphism – aultomorphism definitions and elementary properties–kernel of a homomorphism – fundamental theorem on Homomorphism and applications.

**Learning Outcomes:**

The student will be able to:

- Discuss the structure preserving mappings
- Prove the properties of Homomorphism and Isomporphism
- Define Kernal of Isomorphism and its properties

**UNIT –V**

**Permutations and Cyclic Groups:** Definition of permutation – permutation multiplication – Inverse of a permutation – cyclic permutations – transposition – even and odd permutations – Cayley's theorem.

**Cyclic Groups :**

Definition of cyclic group – elementary properties – classification of cyclic groups.

**Learning Outcomes:**

The student will be able to:

- Define and give examples of permutation and cyclic groups
- Perform permutation multiplication
- Find generators of cyclic group
- Prove fundamental properties of permutation and cyclic groups

**Course Learning Outcomes:**

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

Write abstract mathematical proofs in logical manner

Verify group properties for the given algebraic

structure Prove fundamental theorems of group theory

Explain the use of order of an element and group in finding generators of the

group Discuss the structure preserving mappings and its importance

**Text Books:**


A Text Book of B.Sc. Mathematics Volume-I

V.Venkateswara Rao, N Krishna Murthy, B.V.S.S. Sarma and S. Anjaneya Sastry, S.Chand & Company Ltd., New Delhi.

A First Course in Abstract Algebra, John B. Fraleigh, Narosa Publishing house.

Modern Algebr, M.L. Khanna, Jai Prakash Nath.

A First Course in Abstract Algebra, John B. Fraleigh ,$7^{th}$ Edition, Pearson, 2002**.**

Algebra, Micheal Artin, $2^{nd}$ Edition, Pearson, 2011.

**B.Sc. Physical Science**
**SEMESTER –IV**
**SPH 220: Algebra Tutorial**

Hours per week: 2 Continuous Evaluation: 100 Marks
Credits: 2

Problems on Groups

Problems on subgroups

Problems on co-sets and Lagrange's theorem

Problems on normal subgroups

Problems on quotient group

Problems on homomorphism of groups

Problems on isomorphism of groups

Problems on permutation multiplication

Problems to find inverse of a permutation

Problems on cyclic permutation and transposition

Problems on cayley's theorem

Problems on cyclic groups

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

Verify group properties of given algebraic structure
demonstrate the subgroups, normal subgroups, quotient groups with examples
Recognize the structure preserving mappings
Find the generators of a group
Discuss about permutations and their product

**B.Sc. Physical Science**
**SEMESTER –IV**
**SPH 208: Analog & Digital IC Applications**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

Preamble: This course was introduced to understand the analog and digital applications

Objective: To Know the internal operations of analog and digital circuits

**UNIT- I**
**Operational Amplifiers**

Basic differential amplifier-Op-Amp supply voltages - IC identification - Internal blocks of Op- Amp, Op-Amp parameters-offset voltages and currents-CMRR-Slew rate, Virtual ground, Op- Amp as a voltage amplifier - Inverting amplifier - non-inverting amplifier - Voltage follower

**Learning Outcomes:**

To understand the Functional blocks of Op Amp
To demonstrate the working of Op Amp parameters

**UNIT - II**
**OP-AMP Circuits**

Summing amplifier - Differential amplifier - Op-amp frequency response - Comparator- Integrator- Differentiator - Triangular Wave generators - Square Wave generators - Active filter (Basics) – Low pass filter - High pass filter - Band pass filter, IC 555 applications - Astable, Mono stable and Schmitt trigger

**Learning Outcomes:**

To illustrate the Op Amp applications
To analyze the filters and timer applications

**UNIT – III**
**Combinational &Sequential Circuits**

Design of code converter: BCD to 7 segments, Binary/ BCD to Gray, Gray to Binary / BCD, Design of counters using state machine: asynchronous and synchronous counters, Modulo-n counter, presettable binary up/down counter, Design of Universal shift register

**Learning Outcomes:**

To design and analyze the combinational circuits
To design the sequential counters

**UNIT- IV**
**Data Converters**

Key Features, Advantages and applications of Digital to Analog Converters: Weighted resistive network and R-2R ladder type. Key Features, Advantages and Applications Specific selection of Analog to Digital Converters: Staircase, Ramp Type, Single Slope and dual slope, Successive approximation and Flash type.

**Learning Outcomes:**

To illustrate the functioning of data converters
To understand different types of data converters

**UNIT- V**

**Digital System Interfacing And Applications**

Digital system interfacing of LEDs and Multi digit Seven segment LED display Driver. Interface considerations for ADC / DAC with digital systems.Applications of counters: Digital clock, Auto-parking system, Applications of shift registers: Time delay generator, parallel to serial converter, serial to parallel converter, UART and serial Key board encoder.

**Learning Outcomes:**

To understand the functional block diagram of Digital Systems
To discuss the applications of Digital systems

**Course Outcomes:**

Learn the basics of Op Amps (L3)

Understands the applications of Op Amps (L2)

Analyze the combinational and sequential circuits (L6)

Learn about the types and operation of data converters ((L4)

Understand the interfacing concepts of digital systems (L2)

**Text Books:**

G.K.Kharate - Digital electronics-Oxford university press

Floyd Thomas L Digital FundamenZtals Pearson Education

Microelectronic circuits by Sedra&Smith-6$^{th}$'edition-Oxford

Electronic Devices and Circuits David A.Bell, Fifth edition, Oxford university press

**Reference Books:**

Allen Mottershead, Electronic Devices and Circuits-an Introduction - Prentice Hall.

Mithal G.K., Electronic Devices and Circuits, Khanna Publishers.

Donald L.Schillling, Charles Belove, Discrete and Integrated Electronic Circuits, McGraw Hill.

**B.Sc. Physical Science**
**SEMESTER –IV**
**SPH 226: Analog & Digital IC Applications Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks
Credits: 2

| | |
|---|---|
| Preamble: | This course was designed to perform analog and digital circuits |
| Objective: | The student will be able to understand the designing of analog and digital circuits |

**List of Experiments**

OP-AMP -Inverting and Non-inverting amplifiers.

OP-AMP - Sine Wave Generator (weinbridge oscillator)

Binary to Grey and Grey to binary code converter

Design of 4-bit priority encoder

OP-AMP - Square wave generator using PSPICE simulation

Schmitt Trigger using IC 555 timer using PSPICE simulation

Study of presettable binary up/down counter using PSPICE simulation.

Design and verification of 4-bit ripple counter. Using PSPICE simulation.

OP-AMP integrator and differentiator.

AstableMultivibrator –determination of frequency (using IC-555)

**Course Outcomes:**

After the completion of this course, the student will be able to design the circuits in operational amplifiers (L4 and L2)

**B.Sc. Physical Science**
**SEMESTER –IV**
**SPH 206: Coordination Chemistry, States of Matter & Chemical Kinetics**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals:40 Marks

**Preamble:** The students of undergraduate program in science need to be conversant with the various aspects of coordination chemistry, chemical kinetics and states of matter for training a undergraduate students as synthetic chemist.

O**bjective:** To introduce the concept of coordination chemistry and the essentials of inorganic chemistry.

Students will also learn reactions kinetics, and chemical concepts of states of matter.

**UNIT-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.

Lanthanoids and actinoids: Electronic configurations, oxidation states, colour, magnetic properties, lanthanide contraction, separation of lanthanides (ion exchange method only).

**Learning Outcomes**

The students will learn the properties of transition elements , Lanthanides and Actinides.

**UNIT-II**

**Coordination Chemistry**

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**

Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE),
Crystal field effects for weak and strong fields. Tetrahedral symmetry.

**Learning Outcomes**

The students will know about Inner and outer orbital complexes Structural
and stereoisomerism in complexes and Crystal Field Theory.

**UNIT-III**

**Section B: Physical Chemistry-3**

**Kinetic Theory of Gases**

Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation.

Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation. van der Waals equation of state for real gases. Boyle temperature (derivation not required). Critical phenomena, critical constants and their calculation from van der Waals equation.

Maxwell Boltzmann distribution laws of molecular velocities and molecular energies (graphic representation – derivation not required) and their importance.

Temperature dependence of these distributions.Most probable, average and root mean square velocities (no derivation). Collision cross section, collision number, collision frequency, collision diameter and mean free path of molecules. Viscosity of gases and effect of temperature and pressure on coefficient of viscosity (qualitative treatment only).

**Learning Outcomes**

The student will learn about ideal gases , deviation from ideal behavior. van der Waals equation of state for real gases. The student ill learn to calculate critical constants from Vander Waals equation.

**UNIT-IV**

**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 (qualitative treatment only).

**Solids**

Forms of solids. Symmetry elements, unit cells, crystal systems, Bravais lattice types .Miller indices.X–Ray diffraction by crystals, Bragg's law.Structures of NaCl, KCl and CsCl (qualitative treatment only).Defects in crystals.

**Learning Outcomes**

The student will learn about Surface tension & viscosity and their determination. The students will also be familiar with effect of temperature on viscosity.

The student will learn the essentials of solid-state chemistry like symmetry elements, unit cells, crystal systems, Bragg's equation. The student will learn to determine Miller indices. The student will also be familiar with crystal defects.

**UNIT-V**

**Chemical Kinetics**

The concept of reaction rates.Effect of temperature, pressure, catalyst and other factors on reaction rates.Order and molecularity of a reaction.Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants).Half–life of a reaction.General methods for determination of order of a reaction.Concept of activation energy and its calculation from Arrhenius equation.

Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions.

**Learning Outcomes**

The student will learn concept of reaction rates, factors affecting reaction rates. Order and molecularity of a reaction.

The student will also learn derivation of integrated rate equations for zero, first and second order reactions and theories of reaction rates.

**Reference Books:**


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

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

Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning India Pvt. Ltd., New Delhi (2009).

Mahan, B.H. University Chemistry 3rd Ed. Narosa (1998).

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

Cotton, F.A. & Wilkinson, G. Basic Inorganic Chemistry, Wiley.

Shriver, D.F. & Atkins, P.W. Inorganic Chemistry, Oxford University Press.

Wulfsberg, G. Inorganic Chemistry, Viva Books Pvt. Ltd.

Rodgers, G.E. Inorganic & Solid State Chemistry, Cengage Learning India Ltd., 2008.

**B.Sc. Physical Science**
**SEMESTER –IV**
**SPH 224: Coordination Chemistry, States of Matter & Chemical Kinetics Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks
Credits: 2

**Preamble:** The students of undergraduate program in science in Chemistry need to be conversant with the various basic methodologies of chemistry. Therefore, one module each on in inorganic , physical and organic chemistry is introduced which helps the student familiarize with the techniques essential for developing the foundation of practical chemistry
**Objective**: To make student learn the practical application of Coordination Chemistry, States of Matter & Chemical Kinetics for quantitative analysis

**List of Experiments:**
**Section A: Inorganic Chemistry**
Semi-micro qualitative analysis using H2S of mixtures - not more than four ionic species (two anions and two cations and excluding insoluble salts) out of the following:

Cations : $NH4^{+}$, $Pb^{2+}$, $Ag^{+}$, $Bi^{3+}$, $Cu^{2+}$, $Cd^{2+}$, $Sn^{2+}$, $Fe^{3+}$, $Al^{3+}$, $Co^{2+}$, $Cr^{3+}$, $Ni^{2+}$, $Mn^{2+}$, $Zn^{2+}$, $Ba^{2+}$, $Sr^{2+}$, $Ca^{2+}$, $K^{+}$
Anions : $CO3^{2-}$ , $S^{2-}$, $SO^{2-}$, $S2O3^{2-}$, $NO3^{-}$, $CH3COO^{-}$, $Cl^{-}$, $Br^{-}$, $I^{-}$, $NO3^{-}$,$SO4^{2-}$, $PO4^{3-}$, $BO3^{3-}$,$C2O4^{2-}$, $F^{-}$
(Spot tests should be carried out wherever feasible)

- Estimate the amount of nickel present in a given solution as bis(dimethylglyoximato) nickel(II) or aluminium as oximate in a given solution gravimetrically.
- Draw calibration curve (absorbance at λmax vs. concentration) for various concentrations of a given coloured compound (KMnO4/ CuSO4) and estimate the concentration of the same in a given solution.
- Determine the composition of the $Fe^{3+}$-salicylic acid complex solution by Job's method.
- Estimation of (i) $Mg^{2+}$ or (ii) $Zn^{2+}$ by complexometric titrations using EDTA.
- Estimation of total hardness of a given sample of water by complexometric titration.

**Learning Outcomes**
The student will learn semi-micro analysis
The students will learn to apply the concepts of coordination chemistry Job's method by instrumental methods of analysis
The student will also learn the concept of complexometric titration

**Section B: Physical Chemistry**

(I) Surface tension measurement (use of organic solvents excluded).

Determination of the surface tension of a liquid or a dilute solution using a stalagmometer.

(II) Viscosity measurement (use of organic solvents excluded).

Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer.

(III) Chemical Kinetics

Study the kinetics of the following reactions.

Integrated rate method:

Acid hydrolysis of methyl acetate with hydrochloric acid.

Compare the strengths of HCl and $H_2SO_4$ by studying kinetics of hydrolysis of methyl acetate

**Learning Outcomes**

The students will learn to apply the principles of chemical kinetics for ester hydrolysis.

**Reference Books:**

Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.

Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.

Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).

**B.Sc. Physical Science**
**SEMESTER –IV**
**SPH 210: Operating Systems**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

**Preamble:** operating systems is an essential part of any computer science education. This field is undergoing rapid change, as computers are now prevalent in virtually every arena of day-to-day life—from embedded devices in automobiles through the most sophisticated planning tools for governments and multinational firms.

To cover both traditional PC and server operating systems, as well as operating systems for mobile devices.

To enlighten the concepts of distributed operating system, system calls and system programs.

To explain process scheduling algorithms.

To introduce memory management techniques.

To give an over view of mass storage structure.

**UNIT-I**

**Introduction**

What Operating Systems do. Computer-System Architecture, Operating-System Structure, Operating-System Operations, Distributed Systems, Special-purpose Systems, Computing Environments.

System Structures: Operating-System Services, User Operating-System Interface, System Calls, Types of System Calls, System Programs. Operating-System Structure.

define what the operating system is.((L2)

what is the role of operating system in the computational environment. ( L1)

what is the structure of operating system. (L1)

**UNIT-II**

**Process Management**

Process Concept, Process Scheduling, Operations on Processes.

Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling algorithms.

**Learning Outcomes:**

By the end of this Unit, the student will be able to

understand process scheduling. (L2)

explain process scheduling algorithms.(L2)

**UNIT-III**

**Process Coordination**

Synchronization: Background, The Critical-Section Problem.

Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention.

**Learning Outcomes:**

By the end of this Unit, the student will be able to

Summarize the methods to handle dead locks.(L3)

Learn how to avoid dead lock condition. (L1)

**UNIT-IV**

**Memory Management**

Memory-Strategies: Background, Swapping, Contiguous memory Allocation, Paging, Segmentation.

Virtual-Memory Management: Background, Demand Paging, Copy-on-write, page Replacement.

**Learning Outcomes:**

By the end of this Unit, the student will be able

to explain contiguous memory.(L3)

elaborate concept of paging.(L3)

summarize virtual memory management, demand paging. (L3)

**UNIT-V**

**File Management**

File Systems: File Concept, Access Methods, Directory and Disk Structure. Secondary-Storage Structure: Overview of Mass-Storage Structure, Disk Structure, Disk Scheduling.

**Learning Outcomes:**

By the end of this Unit, the student will be able to

spell the concept of file system, access methods.(L1)

make use of mass storage structure. (L3)

**Course Outcomes:**

Upon completion of the course, the student is able to

understand the concepts of distributed operating system, system calls and system programs.(L3)

explain process scheduling algorithms.(L3)

relate memory management techniques.(L3)

understand mass storage structure. (L2)

**Text Book:**

Operating System Concepts

Abraham Silberschatz,Peter B. Galvin, Greg Gagne, 8th Edition ,2011

**Reference Books:**

A.S. Tanenbaum, Modern Operating Systems, 3rd Ed., Prentice-Hall of India, 2008

Operating Systems: Internals And Design Principles William Stallings, Prentice Hall Of India, 5th Edition, 2006.

Operating Systems: A Modern Approach Gary Nutt, Addison Wesley, 3rd Edition,2004.

Operating Systems: A Concept Based Approach D.M.Dhamdhere, Tata Mcgraw-Hill, 2nd Edition, 2007.

**B.Sc. Physical Science**
**SEMESTER –IV**
**SPH 228: Operating Systems Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks
Credits: 2

**List of Experiments:**

Usage of following commands: ls, pwd, tty, cat, who, who am I, rm, mkdir, rmdir, touch, cd.

Usage of following commands: cal, cat(append), cat(concatenate), mv, cp, man, date.

Usage of following commands: chmod, grep, tput (clear, highlight), bc.

Write a shell script to check if the number entered at the command line is prime or not.

Write a shell script to modify "cal" command to display calendars of the specified months.

Write a shell script to accept a login name. If not a valid login name display message –"Entered login name is invalid".

Write a shell script to display date in the mm/dd/yy format.

Write a shell script to display on the screen sorted output of "who" command along with the total number of users .

Write a shell script to display the multiplication table of any number.

Write a shell script to find the sum of digits of a given number.

Write a shell script to find the factorial of a given number.

Write a shell script to check whether the number is Armstrong or not.

**Text Books:**


Unix Shell Programming
Stephan G Kochan, Patrick Wood, Sams,3rd Edition,2003.

Introduction to Unix and Shell Programming
M.G. Venkateshmurthy, Pearson, 1st Edition, 2005.

3. Unix Concepts and Applications, Sumitabha Das, 4th Edition, TMH,2006.

**B.Sc. Physical Science**
**SEMESTER –IV**
**SSE 272: Radiation Safety**

Credits: 2 Continuous Evaluation: 100 Marks

**Preamble:** To explain the origin of radiation, its interaction and monitoring

**Objective:** To summarize radiation, its methods and safety measures.

**UNIT-I**

**Basics of Atomic and Nuclear Physics**

Basic concept of atomic structure; X rays characteristic and production; concept of bremsstrahlung and auger electron, The composition of nucleus and its properties, mass number, isotopes of element, spin, binding energy, stable and unstable isotopes, law of radioactive decay, Mean life and half life, basic concept of alpha, beta and gamma decay, concept of cross section and kinematics of nuclear reactions, types of nuclear reaction, Fusion, fission.

**UNIT-II**

**Interaction of Radiation with matter**

Types of Radiation: Alpha, Beta, Gamma and Neutron and their sources, sealed and unsealed sources, Interaction of Photons – Photoelectric effect, Compton Scattering, Pair Production, Linear and Mass Attenuation Coefficients, Interaction of Charged Particles: Heavy charged particles - Beth-Bloch Formula, Scaling laws, Mass Stopping Power, Range, Straggling, Channeling and Cherenkov radiation. Beta Particles- Collision and Radiation loss (Bremsstrahlung), Interaction of Neutrons- Collision, slowing down and Moderation.

**UNIT-III**

**Radiation detection and monitoring devices**

Radiation Quantities and Units: Basic idea of different units of activity, KERMA, exposure, absorbed dose, equivalent dose, effective dose, collective equivalent dose, Annual Limit of Intake (ALI) and derived Air Concentration (DAC). Radiation detection: Basic concept and working principle of gas detectors (Ionization Chambers, Proportional Counter, Multi-Wire Proportional Counters (MWPC) and Gieger Muller Counter), Scintillation Detectors (Inorganic and Organic Scintillators), Solid States Detectors and Neutron Detectors, Thermo luminescent Dosimetry.

**UNIT-IV**

**Radiation safety management**

Biological effects of ionizing radiation, Operational limits and basics of radiation hazards evaluation and control: radiation protection standards, International Commission on Radiological Protection (ICRP) principles, justification, optimization, limitation, introduction of safety and risk management of radiation. Nuclear waste and disposal management.Brief idea about Accelerator driven Sub-critical system (ADS) for waste management.

**UNIT-V**

**Application of nuclear techniques**

Application in medical science (e.g., MRI, PET, Projection Imaging Gamma Camera, radiation therapy), Archaeology, Art, Crime detection, Mining and oil. Industrial Uses: Tracing, Gauging, Material Modification, Sterization, Food preservation.

**Course Outcomes:**

Enables to compare various radiation, its methods for detection and safety (L2)

**B.Sc. Physical Science**
**SEMESTER –IV**
**SSE 274: Chemical Technology & Society**

Credits :2 Continuous Evaluation:100 Marks

**Chemical Technology**

Basic principles of distillation, solvent extraction, solid-liquid leaching and liquid-liquid extraction, separation by absorption and adsorption. An introduction into the scope of different types of equipment needed in chemical technology, including reactors, distillation columns, extruders, pumps, mills, emulgators. Scaling up operations in chemical industry.Introduction to clean technology.

**Society**

Exploration of societal and technological issues from a chemical perspective. Chemical and scientific literacy as a means to better understand topics like air and water (and the trace materials found in them that are referred to as pollutants); energy from natural sources (i.e. solar and renewable forms), from fossil fuels and from nuclear fission; materials like plastics and polymers and their natural analogues, proteins and nucleic acids, and molecular reactivity and interconversions from simple examples like combustion to complex instances like genetic engineering and the manufacture of drugs.

**Reference Book:**

John W. Hill, Terry W. McCreary & Doris K. Kolb, Chemistry for changing times 13$^{th}$ Ed

**B.Sc. Physical Science**
**SEMESTER –IV**
**SSE 276: Vector Calculus**

Credits: 2 Continuous Evaluation: 100 Marks

**Limits of vector point functions**
Scalar valued and vector valued point functions, limits, Directional derivatives along co-ordinate axis, along any line.

**Vector differentiation**
Vector Differentiation, Ordinary derivatives of vectors, Differentiability, Tangent vector of a curve, Unit tangent vector, Principle normal, curvature, Binormal, Torsion, Frenet -Serret formulae and applications

**Vector identities**
Gradient, Divergence, Cur, their geometrical interpretations and Successive operations

**Line , surface and Volume integrals**
Line Integral, Surface Integral, Volume Integral

Stokes theorem, Gauss divergence theorem and applications, Greens Theorem and applications.

**Text Books:**


A Text Book of Vector Calculus, Shanti Narayan, S. Chand & Company Pvt. Ltd., New Delhi.
Vector Calculus, R. Gupta, Laxmi Publications.
Calculus and Analytic Geometry George B. Thomas, Jr. and Ross L. Finney, Pearson Education, 2007, 9th edition.
Calculus Single Variable Howard Anton, Irl Bivens and Stephen Davis, John Wiley and Sons, Inc., 2002.
Vector Calculus, Paul C. Matthews, Springer Verlag London Limited, 1998.


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

Define limit of vector function
demonstrate the vector differentiation with examples
define gradient of a scalar function, divergence and curl of a vector function
explain line, surface and volume integrals
evaluate applications on Stokes theorem, Gauss divergence theorem, and Greens theorem

**B.Sc. Physical Science**
**SEMESTER –IV**
**SSE 278: Number Theory**

Credits :2 Continuous Evaluation:100 Marks

Division algorithm, Lame's theorem, linear Diophantine equation, fundamental theorem of arithmetic.

Prime counting function, statement of prime number theorem.

Goldbach conjecture, binary and decimal representation of integers, linear congruences, complete set of residues.

Number theoretic functions, sum and number of divisors, totally multiplicativefunctions, definition and properties of the Dirichlet product.

The Möbius inversion formula, the greatest integer function, Euler's phi-function.

**Text Books:**


Elementary Number Theory, David M.Burton, Tata McGraw-Hill,2007 6th edition.

Applications of Abstract Algebra with MAPLE, Richard E. Klima, Neil Sigmon and Ernest Stitzinger, CRC Press, Boca Raton, 2000.

Beginning Number Theory Neville Robbins, Jones and Bartlett publications, 2nd edition.


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

Define division algorithm

Demonstrate the fundamental theorem of arithmetic

Explain prime number theorem

Explain complete set of residues

Evaluate problems using Möbius inversion formula

Define Euler's phi-function

**B.Sc. Physical Science**
**SEMESTER –IV**
**SSE 280 : E-Commerce**

Credits :2 Continuous Evaluation:100 Marks

**Introduction to E-Commerce-** E-Commerce Business models and Concepts-Technology Infrastructure for E-commerce, The Internet and World Wide Web, E-Commerce Infrastructure, Building an E-Commerce website, Security and Payment .

Business Concepts and Social Issues-E-Commerce marketing Concepts, E-Commerce Marketing Communications, Ethical ,Social and Political Issues in E-commerce.

E-Commerce in Action – Online Retailing and Services, Online Content and Media, Social Networks, Auctions and Portals.

**Text Books:**


Kenneth C.Laudon, Carol GuercioTravere, E-Commerce:Business, Technology, Society, 4th Edition, Pearson ,2008

P.T. Joseph, E-Commerce: An Indian Perspective, Prentice-Hall of India, 2007.

E.M. Awad, Electronic Commerce from Vision to Fulfillment, 3rd Ed., PrenticeHall of India, 2006

Scott Bonneau, Tammy Kohl, Jeni Tennison, Jon Duckett and Kevin Williams, XML Design Handbook, Wrox Press Ltd., 2003.

Michael Cheshar, Ricky Kaura, and Peter Linton, Electronic Business and Commerce, Springer, 2003.

W.J. Pardi, XML in Action: Learn to Quickly Create Dynamic, Data-driven Sites with the Web's Hottest New Technology, Prentice Hall of India, 1999.

P. Weill and M.R. Vitale, Place to Space: Migrating to eBusiness Models, Harvard Business School Press, 2001.

D. Whiteley, E-commerce: Strategy, Technologies and Applications, Tata McGraw-Hill Edition, 2001.

M. Fitzgerald, Building B2B Applications with XML: A Resource Guide, John Wiley and Sons, Inc., 2001.

**B.Sc. Physical Science**
**SEMESTER – V**
**SPH 351: Elements of Modern Physics**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

**Preamble:** This course imparts the knowledge on Modern Physics topics such as atomic models, atoms in fields, matter waves, Uncertainty principle and wave mechanics.

**Objective:** The students will understand the concepts of Modern Physics which will help as a bridge to understand the advanced physics courses such as atomic and molecular physics, quantum mechanics.

**UNIT I**

**Atomic physics**

Introduction –Drawbacks of Bohr's atomic model-Sommerfeld's elliptical orbits-relativistic correction (no derivation).Vector atom model and quantum numbers associated with it. L-S and j-j coupling schemes. Selection rules, intensity rules- Pauli's Exclusion Principle, Larmor precision frequency. Fine structure of Sodium D lines. Stern and Gerlach experiment.

**Learning Outcomes**

To develop the atomic models (L3)
Pauli's Exclusion Principle, Larmor precision are understood (L2)

**UNIT II**

**Atoms in Electrical and Magnetic Fields**

Zeeman Effect, Normal Zeeman Effect, Experimental arrangement, Explanation of NormalZeeman Effect by Vector Atom Model. Anomalous Zeeman Effect. Paschen- Back Effect, Stark Effect Explanations (Elementary ideas only).

**Vibrational Spectroscopy**

Raman Effect-Stokes and Anti Stokes lines, Classical theory of Raman Effect, Quantum theory of Raman Effect, Experimental arrangement for Raman Effect, Applications of Raman Effect.

**Learning Outcomes**

Analyze influence of electric and magnetic effects on atomic models (L4)
Understanding Raman Effect (L2)

**UNIT III**

**Matter waves and Uncertainty Principle**

Matter waves, de Broglie's hypothesis-wavelength of matter waves and their properties, Wave or Phase and group velocities- Davisson and Germer experiment-G.P.Thomson Experiment, de Broglie Standing waves of electron in Bohr orbits.

Heisenberg's uncertainty principle for position and momentum (x and p), &energy and time (E and t).Gamma ray microscope. Diffraction by a single slit, position of electron in Bohr orbit, Complementary principle of Bohr.

**Learning Outcomes**

Interpret the concept of wave and particle nature (L2).
Experimental studies on de Broglie's hypothesis and Heisenberg uncertainity principle. (L3)

**UNIT IV**

**Wave mechanics**

Basic postulates of quantum mechanics-Schrodinger time independent wave equation-derivation. Physical interpretation of wave function and its significance. Solution of Schrodinger Equations. Eigen functions, Eigen values. Application of Schrodinger wave equation to particle in one dimensional infinite box.

**Learning Outcomes**

Interpretation of quantum mechanics for probability (L2)

Explain equation of motion in quantum mechanics (L2)

**UNIT V**

**Lasers and Fiber optics**

Lasers: introduction, spontaneous emission, stimulated emission, Population Inversion, Types of lasers-He-Ne laser, Ruby laser, Applications of lasers.

Introduction- different types of fibers, rays and modes in an optical fiber, fiber material, advantages of fiber optic communication.

**Learning Outcomes**

Compare the process in LASERS (L2)

Outline optical fibers for Application in communication (L2 and L3)

**Course Outcomes**

To develop the atomic models and understand underlying principles in it (L3 and L2)

Analyze influence of electric and magnetic effects on atomic models and extend to scattering (L4 and L2)

Interpret the concept of wave and particle nature and related experimental studies (L2 and L3).

Interpretation of quantum mechanics for probability and its equation of motion (L2)

Compare the process in LASERS and outline optical fibers for application (L2 and L3)

**Text Books:**

B.Sc. Physics, Vol.4, Telugu Akademy, Hyderabad

Modern Physics by R. Murugeshan and Kiruthiga Siva Prasath. S. Chand & Co.

Unified Physics Vol.4, S.L. Gupta and Sanjeev Gupta, Jai PrakasahNath& Co., Meerut.

Optics –Brijlal & Subrahmanyam, S Chand and Co

**B.Sc. Physical Science**
**SEMESTER – V**
**SPH 355: Electronic Devices and Circuits**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

**Preamble:** To explain various semiconductor devices with its schematic diagram and illustrate its characteristics

**Objective:** The student will understand role of various electronic devices and analyze it for present day technology.

**UNIT- I**

**Junction Diodes**

PN junction diode - P-N junction theory-depletion region, barrier potential, working in forward& reverse bias condition, Junction capacitance, Diode current equation (no derivation), Effect of temperature on reverse saturation current, V-I Characteristics, Zener and Avalanche Break down, Zener diode - V-I characteristics, regulated power supply using Zener diode, Varactor Diode, Tunnel Diode - Principle, Working& Applications

**Learning Outcomes**

To interpret the characteristics of junction diode and examine its limitations (L2 and L4)

**UNIT- II**

**Bipolar Junction Transistors**

PNP and NPN transistors, current components in BJT, BJT static characteristics (Input and Output), Early effect, CB,CE,CC Configurations (Cut-off, Active and saturation regions) Determination of h-parameters from the characteristics, Concept of amplification-voltage and current amplifier. The C.E amplifier-analysis and parameters, Transistor as a switch.

**Learning Outcomes**

To interpret the characteristics of junction transistor (L2)
Compare the three configurations with limitations (L4)

**UNIT - III**

**Field Effect Transistors & UJT**

FET - Construction - Working – Drain &Transfer characteristics -Parameters of FET - FET as an amplifier -MOSFET-Enhancement MOSFET-Depletion MOSFET-Construction& Working.

**Learning Outcomes**

To demonstrate the characteristics of FET and UJT (L2)
To categorize the configurations of FET (L4)

**UNIT - IV**

**Photo Electric Devices**

Photo diode, Photo transistor, solar cell,LED and LCD Structure and operation, characteristics, spectral response and applications

**Learning Outcomes**

To explain the characteristics of photo devices (L2)
To compare characteristics of photo devices.(L4)

**UNIT - V**

**Power Supplies**

Rectifiers - Half wave, full wave and bridge rectifiers - Efficiency - Ripple factor – Regulation. Types of filter- Choke input ( Inductor) filter –Shunt capacitor filter -L-Section and π section filters - Three terminal fixed voltage I.C regulators (78XX and 79XX) - Principle and working of switch mode power supplies ( SMPS).

**Learning Outcomes**

To outline various rectifiers and power supplies (L2)

To compare these rectifiers and explain power supplies (L4 and L2)

**Course Outcomes**

To interpret the characteristics of junction diode with its limitations (L2 and L4)

To interpret the characteristics of junction transistor and compare these configurations (L2 and L4)

To demonstrate and categorize the FET and UJT (L2 and L4)

To explain and compare the characteristics of photo devices (L2 and L4)

To outline rectifiers compare them and understand power supplies (L4 and L2)

**Text Books:**


Electronic Devices and Circuits David A.Bell, Fifth edition. Oxford university press

A.P Malvino, "Principles of Electronics", TMH, $7^{th}$ edition

T.F. Bogart, Beasley, "Electronic Devices and circuits", Pearson Education, 6th Edition

N.N. Bhargava, D.C Kulshreshta, and S.C Gupta ,"

Basic Electronics and Linear Circuits" TMH

T.L.Floyd, "Electronic Devices and circuits", PHI, fifth edition

V.K. Metha, "Principle of Electronics", S CHAND Co. New edition

Godse A.P., Bakshi U.A (1st edition), Electronics Devices, Technical Publications Pune.


**Reference Books:**


Sedha R.S., A TextBook of Applied Electronics, S. Chand & Company Ltd.

Jacob Millman and Christos C. Halkias (2008) Integrated Electronics, Tara Mcgraw-Hill

Robert L. Boylestad, Louis Nashelsky (10th edition). Electron Devices and Circuit Theory, Dorling Kindersley (India Pvt. Ltd.)

Unified Electronics (Circuit analysis and electronic devices) by Agarwal-Arora.

**B.Sc. Physical Science**
**SEMESTER – V**
**SPH 357: Materials Science**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

**Preamble:** Aims in understanding the different phenomena of materials used in technology.

**Objective:** To impart knowledge in understanding crystals structures in terms of lattice parameters classification of magnetic materials, dielectric materials for synthesis and phase transitions in different types of materials.

**Unit I**
**Crystal Structure**
Solids:Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis–Central and Non-Central Elements. UnitCell.
Miller Indices.Reciprocal Lattice.Types of Lattices.BrillouinZones.Diffraction of X-rays and neutrons by Crystals. Bragg's Law. Atomic and Geometrical f actors, periodicity of wave functions.
**Learning outcomes**
To illustrate crystalline structures (L2)
Experimental studies of crystals (L3)

**Unit II**
**Elementary Lattice Dynamics**
Lattice Vibrations and Phonons,LinearMonoatomic and Diatomic Chains.Acoustical and Optical Phonons.Qualitative Description of the Phonon Spectrum in Solids. Dulong and Petit'sLaw,Einstein and Debye theories of specificheat of solids.$T^3$ law.
**Learning Outcomes**
Explain various lattices and develop theories related to lattice (L2 and L3)

**Unit III**
**Magnetic Properties of Matter and Superconductivity**
Dia-, Para-, Ferri- and Ferromagnetic Materials. Classical Langev in Theory of dia–and Paramagnetic Domains. Quantum Mechanical Treatmentof Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis and Energy Loss. **Basics of Superconductivity** Critical Temperature.
Critical magnetic field.Meissner effect. TypeI and typeII Superconductors and applications of super conductors.
**Learning Outcomes**
Classification of magnetic materials and explain related theories (L2 and L3)
Outline superconductors (L2)

**Unit IV**
**Dielectric Properties of Materials**
Polarization Local Electric Field at an Atom. Depolarization Field, Electric Susceptibility. Polarizability Clausius Mosotti Equation. Langevin Theory of Electric Polarizability. Complex Dielectric Constant. Optical Phenomena related to dielectrics.
**Learning Outcomes**
Develop dielectrics for polarizabilities (L3)

**Unit V**

**Elementary band theory**

Bloch theorem and Kronig Pennymodel. Band Gaps. Conductors, Semiconductors and insulators. P and N type Semiconductors. Conductivity of Semiconductors, mobility, HallEffect, Hallcoefficient.

**Learning Outcomes**

Construct model for band theory of solids (L3)
Classify various semiconductors (L2)

**Course Outcomes**

To illustrate crystalline structures and related experimental studies (L2 and L3)
Explain various lattices and develop theories related to lattice (L2 and L3)
Classification of magnetic materials and explain related theories (L2 and L3) Outline superconductors (L2)
Develop dielectrics for polarizabilities (L3)
Construct model for band theory of solids (L3)
Classify various semiconductors (L2)

**Text Books:**


Introduction to Solid State Physics, CharlesKittel,8th Ed.,2004,Wiley India Pvt.Ltd.
Elements of Solid State Physics, J.P.Srivastava, 2nd Ed.,2006, PHI
Introduction to Solids, Leonid V.Azaroff, 2004, TataMc-Graw Hill
Solid StatePhysics, Neil W. Ashcroft andN. David Mermin, 1976, Cengage Learning
Elementary *Solid State Physics*: Principles and Applications Addison-Wesley Series 1993

**B.Sc. Physical Science**
**SEMESTER – V**
**SPH 321: Modern Physics Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks
Credits: 2

**Preamble:** To perform experimental studies related to photons/particle and optical fibers
**Objective:** Enable to develop and explain properties related to solids

**List of Experiments:**

e/m of an electron by Thomson method.
Determination of Planck's Constant (photocell)
Franck and Hertz Experiment
Laws of Photoelectric effect –
Numerical aperture of optical fiber
Characteristics of optical fibers
Bending losses in Optical Fiber
Diffraction due to single slit.
Diffraction due to circular aperture.
Wavelength of He-Ne laser-Diffraction grating.

**Course Outcomes:**

To illustrate and examine properties of solids and optical fibers (L2 and L3)

**B.Sc. Physical Science**
**SEMESTER – V**
**SPH 325: Electronic Devices & Circuits Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks
Credits: 2

**Preamble:** To verify characteristics of various semiconducting devices

**Objective:** To examine semiconductor device characteristics and their limitations

**List of Experiments:**

V-I Characteristics of Junction Diode.
V-I Characteristics of Zener Diode.
Regulated Power Supply using Zener Diode.
IC Regulated Power Supply
BJT input and output Characteristics (CE Configuration)
Characteristics of UJT.
Characteristics of JFET
LDR characteristics
Characteristics of L and π section filters using full wave rectifier.

**Course Outcomes**

To explain various electronic devices with its characteristics and measure its threshold voltages(L2 and L5)

**B.Sc. Physical Science**
**SEMESTER – V**
**SPH 347: Materials Science Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks
Credits: 2

**Preamble:** To perform experimental studies related to different materials

**Objective:** Enable to develop and explain properties related to materials

**List of Experiments:**

Susceptibility of paramagnetic solution (Quinck`sTubeMethod)

Magnetic susceptibility of Solids by four probe method.

Coupling Coefficient of a Piezoelectric crystal.

Dielectric Constant of a dielectric Materials with frequency using LCR

Hysteresis loop of a Ferroelectric Crystal.

B-H curve

The resistivity of a semiconductor(Ge) crystal with temperature by four-probemethod(fromroomtemperatureto150$^{O}$C)andtodetermineitsbandgap.

Hall coefficient of a semiconductor.

**Course outcomes:**

To illustrate and examine properties of different materials (L2 and L3)

**B.Sc. Physical Science**
**SEMESTER – V**
**SPH 361: Matrices**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

**Preamble :** Matrix mathematics applies to several branches of science, as well as different mathematical disciplines. This course aims to provide basic concepts of vector spaces, matrix form of basic geometric transformations. The focus of the course is to study the fundamental properties of matrices and applications of matrices in geometry, physics, chemistry, combinatorics and statistics.

To introduce vector spaces and subspaces

To discuss the fundamental properties of matrices , eigen values and eigen vectors

To study the rank of a matrix and its applications

To know the applications of matrices in geometry, physics, chemistry, combinatorics and statistics

**UNIT I**

R, $R^2$, $R^3$ as vector spaces over R. Standard basis for each of them. Concept of Linear Independence and examples of different bases.Subspaces of $R^2$, $R^3$.

**Learning Outcomes:**

The student will be able to:

Define vector spaces over a field and subspaces
Learn the concept of linear independence of vectors and linear dependence of vectors
Define different bases of vector spaces

**UNIT II**

Translation, Dilation, Rotation, Reflection in a point, line and plane. Matrix form of basic geometric transformations. Interpretation of eigen values and eigen vectors for such transformations and eigen spaces as invariant subspaces.

**Learning Outcomes:**

The student will be able to:

Define translation, dilation, rotation, reflection
Evaluate eigen values and eigen vectors of a matix
Explain eigen spaces as invariant subspaces

**UNIT III**

Types of matrices. Rank of a matrix. Invariance of rank under elementary transformations. Reduction to normal form, Solutions of linear homogeneous andnon-homogeneous equations with number of equations and unknowns upto four.

**Learning Outcomes:**

The student will be able to:

Explain different types of matrices
Evaluate rank of matrix using various methods
Explain solutions of linear and non-homogeneous equations

**UNIT IV**

Matrices in diagonal form.Reduction to diagonal form upto matrices of order 3. Computation of matrix inverses using elementary row operations. Rank of matrix.

**Learning Outcomes:**

The student will be able to:

- Explain reduction of matrices to diagonal form
- Evaluate inverse of a matrix using elementary row operations
- Explain rank of a matrix using different methods

**UNIT V**

Solutions of a system of linear equations using matrices.Illustrative examples of above concepts from Geometry, Physics, Chemistry, Combinatorics and Statistics.

**Learning Outcomes:**

The student will be able to:

- Explain solutions of a system of linear equations using matrices
- Evaluate system of linear equations
- Explain the applications of matrices in Geometry, Physics, Chemistry, combinatorics and statistics

**Text Books:**


Introduction to Algebra, A.I. Kostrikin, Springer Verlag, 1984.

Linear Algebra, Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Prentice Hall ofIndia Pvt. Ltd., New Delhi, 2004.

Schaum's Outline of Matrix Operations: Theory and Problems of Matrix Operations Richard Bronson, Tata McGraw Hill,1989.

**B.Sc. Physical Science**
**SEMESTER – V**
**SPH 333: Matrices Tutorial**

Hours per week: 2 Continuous Evaluation: 100Marks
Credits: 2

Problems on vector spaces

Problems on linear independence and dependence of vectors

Problems on eigen values and eigen vectors

Find rank of a matrix

Reduction to normal form

Solutions of linear and nonlinear homogeneous equations

Reduction to diagonal form

Computation of matrix inversion using elementary row operations

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

Define vector space

Differentiate linear independent and linear dependent of vectors

Evaluate eigen values and eigen vectors of a matrix

Find rank of a matrix using different methods

Solve linear and nonlinear homogenous equations

**B.Sc. Physical Science**
**SEMESTER – V**
**SPH 365: Linear Algebra**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

**Preamble :** Linear algebra applies to several branches of science, as well as different mathematical disciplines. This course aims to provide basic concepts of matrices, rank of a matrix and consistency of matrices. The focus of the course is to study the fundamental properties of matrices, applications of matrices ,vector spaces and inner product spaces.

To define rank of a matrix and its applications
To evaluate eigen values and eigen vectors of a matrix
To study vector spaces, subspaces, basis of a vector spaces and dimension of a vector space
To know the linear transformations of a vector space, product of linear transformations
To define inner product space

**UNIT I**
**Matrices I**
Rank of a matrix, Elementary transformations, normal form ,Echelon form , Rank of product of matrices ,System of homogeneous equations,Linear equations, Null space and nullity of matrices

**Learning Outcomes:**
The student will be able to:
Define rank of a matrix
Evaluate rank of a matrix using normal form and echelonform
Define rank of product of matrices
Explain the method to solve system of homogeneous equations

**UNIT II**
**Matrices II**
Condition for consistency, Crammers' rule,Characteristic values and characteristic vectors, Cayley- Hamilton theorem ,Inverse of a matrix using Cayley- Hamilton theorem, Minimal polynomial of a matrix.

**Learning Outcomes:**
The student will be able to:
Explain consistency of matrices
Evaluate Crammer's rule
Explain characteristic values and characteristic vectors of a matrix
Evaluate minimal polynomial of a matrix

**UNIT III**

**Linear Algebra -I**

Vector spaces, General properties of vector spaces, Vector subspaces, Algebra of subspaces, linear combination of vectors. Linear span, linear sum of two subspaces, Linear independence and dependence of vectors, Basis of vector space, Finite dimensional vector spaces, Dimension of a vector space, Dimension of a subspace.

**Learning Outcomes:**

The student will be able to:

- Define vector spaces and vector subspaces with examples
- Explain linear combination of vectors
- Explain basis of vector space
- Explain dimension of a vector space

**UNIT IV**

**Linear Algebra - II**

Linear transformations, linear operators, Range and null space of linear transformation, Rank and nullity of linear transformations, Linear transformations as vectors, Product of linear transformations, Invertible linear transformation.

**Learning Outcomes:**

The student will be able to:

- Explain the concepts of linear transformations and linear operators
- Evaluate range and null space of linear transformation
- Explain rank and nullity of linear trasformations

**UNIT V**

**Inner product spaces**

Inner product spaces, Euclidean and unitary spaces, Norm or length of a vector, Schwartz inequality, Orthogonality, Orthonormal set, complete orthonormal set, Gram - Schmidt orthogonalisation process.

**Learning Outcomes:**

The student will be able to:

- Define inner product spaces, Euclidean and unitary spaces
- Explain orthogonality, orthonormality of sets
- Explain Gram-Schmidt orthogonalisation process

**Text Books:**


- A Text Book of B.Sc. Mathematics Volume-III, V.Venkateswara Rao , N Krishna Murthy, B.V.S.S. Sarma and S. Anjaneya Sastry, S.Chand & Co.
- Linear Algebra, A.R. Vasishtha and J.N. Sharma, Krishna Prakashan Media (P) Ltd.
- Linear Algebra Kenneth Hoffman and Ray Alden Kunze, Pearson Education (low priced edition), New Delhi.
- Linear Algebra, Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Prentice Hall of India Pvt. Ltd., $4^{th}$ edition New Delhi, 2007.
- Rings and Linear Algebra, Pundir, Pundir, PragathiPrakashan

**B.Sc. Physical Science**
**SEMESTER – V**
**SPH 337: Linear Algebra Tutorial**

Hours per week: 2 Continuous Evaluation: 100Marks
Credits: 2

Find rank of a matrix

Reduction to normal form and Echelon form

Problems on eigen values and eigen vectors

Problems on Cayley-Hamilton theorem

Find inverse of a matrix using Cayley-Hamilton theorem

Problems on Vector spaces

Problems on subspaces

Problems on Linear independence and dependence of vectors

Problems on Basis of vector space

Problems on dimension of a vector space

Problems on linear transformations

Problems on inner product spaces

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

Define vector space

Differentiate linear independent and linear dependent of vectors

Evaluate eigen values and eigen vectors of a matrix

Find rank of a matrix using different methods

Solve problems on subspaces and dimension of a vector

space Define inner product space

**B.Sc. Physical Science**
**SEMESTER – V**
**SSE 375: Theory of Equations**

Credits :2 Continuous Evaluation:100 Marks

General properties of polynomials, Graphical representation of a polynomials, maximum and minimum values of a polynomials

Quadratic Equations, General properties of equations, Descarte's rule of signs positive and negative rule,

Relation between the roots and the coefficients of equations. Symmetric functions, Applications symmetric function of the roots.

Transformation of equations.Solutions of reciprocal and binomial equations.

Algebraic solutions of the cubic and biquadratic.Properties of the derived functions.

**Text Books:**

W.S. Burnside and A.W. Panton, The Theory of Equations, Dublin University Press, 1954.
C. C. MacDuffee, Theory of Equations, John Wiley & Sons Inc., 1954.

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

Explain properties of polynomials and graphical representation Explain quadratic equations
Differentiate between roots and the coefficients of equations Explain tansformation of equations
Solve cubic and biquadratic equations.

**SEMESTER – V**
**SSE 377: Probability and Statistics**

Credits :2 Continuous Evaluation:100 Marks

Meaning and Scope of the Statistics Introduction, Frequency distribution, Graphic representation of a frequency distribution, measures of central tendency , measures of dispersion, coefficients ofdispersion, moments, skewness, kurtosis

Introduction, meaning of correlation, Karl Pearson s coefficient of correlation, rank correlation.Linear regression, Curve fitting, fitting of straight line, fitting of second degree parabola.

Probability **:** Introduction, definition, axiomatic approach to probability, probability-mathematical notation, probability function, law of addition of probabilities, multiplication law of probability and conditional law of probability, independent events, Baye s theorem.

Random variables and distribution functions: One and two dimensional random variables (discrete and continuous).

Probability distribution: Discrete distributions Binomial, Poisson distributions and their properties and applications.

**Text Books:**


Fundamentals of Mathematical Statistics S.C. Gupta and V.K. Kapoor, Sultan Chand & Sons

Statistical Methods Combined Edition (Volumes I & II) N G Das, McGraw Hill, 2008,1st edition.

Statistical Methods: Concepts, Application and Computation, Y.P. Aggarwal, Sterling Publishers, 1998.

Introduction to Mathematical Statistics, Robert V. Hogg, Joseph W. Mckean, Allen Thornton Craig, Pearson Education, Asia, 2007.

Mathematical Statistics with Applications, Irwin Miller and Marylees Miller, Pearson Education, Asia, 2006,7th edition.

Introduction to Probability Models, Sheldon M. Ross, Academic Press, IndianReprint, 2007, 9th edition.


**Course Learning Outcomes:**

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

Explain measures of central tendency

Explain measures of dispersion

Differentiate between correlation coefficient and regression Define probability

Differentiate discrete probability distribution and continuous probability distribution

**SEMESTER –V**

**SPH 371: Microprocessors (Intel 8085)**

Hours per week: 4 End Examination: 60 Marks

Credits: 4 Sessionals: 40 Marks

Preamble: This course was introduced to understand the basics of Microprocessors (Intel 8085)

Objective: To understand the architecture and then programme it.

**UNIT- I**

**Architecture of 8085 Microprocessor**

Functional block diagram of Intel 8085-Register structure-multiplexing & De-multiplexing of address / data bus - Control Signal Generation and status signals - 8085 pin-out diagram & functions - Interrupts - Priority Concept

**Instruction Set of 8085** -Instruction set classification - addressing modes

**Learning Outcomes:**

To understand the Functional block diagram of Intel 8085

To know the 8085 pin-out diagram

**UNIT - II**

**Memory**

Instruction cycle - machine cycle - T-state -Timing diagrams for Opcode FetchCycle Memory Read, Memory Write, I/O Read, I/O Write, - Functional explanation for RAM, ROM, EPROM, EEPROM

**Learning Outcomes:**

Must know different types of memory

Must draw the timing diagrams

**UNIT – III**

**Programming 8085**

Addition & subtraction(16-bit), multiplication, division, largest, smallest, block data transfer (all 8-bit data), Binary to BCD, BCD to Binary, Binary to ASCII, ASCII to Binary, BCD to ASCII, ASCII to BCD (all 8-bit data) - Stack & Subroutines Concept - time delay using single and double register & calculations – Debugging program

**Learning Outcomes:**

1.Able to write arithmetic and logical programmes

To apply Stack & Subroutines Concepts in writing the programmes

**UNIT- IV**

**INTERFACING MEMORY**

2K X 8, 4K X 8 ROM, RAM to 8085, interfacing an I/O portion Memory Mapped I/O and I/O Mapped I/O - Difference between I/O mapped and Memory Mapped I/O.

**Learning Outcomes:**

Able to understand, how to interface the memory

Lists the Differences between I/O mapped and Memory Mapped I/O

**UNIT- V**

**Microprocessor Applications**

Programmable peripheral devices (8255, 8253)- Pin functions, Different Modes & Block Diagram - Keyboard and Display Interface 8279 (Architecture) - Simple temperature controller- Simple traffic light controller-stepper motor control interface.

**Learning Outcomes:**

To understand the Programmable peripheral devices

To apply the written programs to control external interfacing devices

**Course Outcomes:**

Learn the architecture of 8085, its pin diagram **(L2)**.

Learn about the microprocessors and the organization of microprocessor based systems **(L1)**.

Acquire knowledge of microprocessor and their role in I/O port programming and their interface with peripherals **(L5)**.

Learn about analog to digital and digital to analog convertors **(L4)**.

Learn basics of programming and other microprocessors **(L3).**

**Text Books**


Ramesh S. Gaonakar, Microprocessor Architecture, Programming andApplication with the 8085-PenramLnternational Publishing,Mumbai.

Ram, Fundamentals of microprocessors and microcomputers - Dhanpat Rai Publications, NewDelhi

MicroprocessorsMicrocontrollersbyN.Senthilkumar,M.Saravanan&S.Jeevananthan, 1st edition, Oxford press (Helpful for interfacing applications)

4. Microprocessors & Microcontrollers by B.P.Singh, Galgotia publicationsPvt.Ltd.


**References**


Mathur A.P., Introduction to Microprocessors. (3rd edn., Tata McGraw, New Delhi,

Leventhal L.A., Microprocessor Organisation and Architecture, Prentice Hall India.

Microprocessor lab premier by K.A.Krishnamurthy

**SEMESTER –V**

**SPH 375: Consumer Electronics**

Hours per week: 4 End Examination: 60 Marks

Credits: 4 Sessionals: 40 Marks

Preamble: This course was designed to understand the need of electronics in consumer electronics.

Objective: Application area of electronics: consumer electronics.

**Unit-I**

**Microwave Ovens -** Microwaves (Range used in Microwave Ovens) - microwave oven block diagram -LCD timer with alarm - Single-Chip Controllers - Types of Microwave oven - Wiring and Safety instructions -Care and Cleaning.

**Learning Outcomes**

To describe the operation of microwave ovens

To know the safety instructions of ovens

**Unit-II**

**Washing Machines** - Electronic controller for washing machines - Washing machine hardware and software- Types of washing machines - Fuzzy logic washing machines Features of washing machines.

**Learning Outcomes**

To understand the operation of washing machines

To know the types of washing machines

**Unit-III**

**Air Conditioners and Refrigerators -** Air Conditioning - Components of air conditioning systems - All water air conditioning systems - All air conditioning systems - Unitary and central air conditioning systems -Split airconditioners

**Learning Outcomes**

To know the mechanism of air conditioner

To discuss the types of air conditioners

**Unit-IV**

**Home/Office Digital Devices -** Facsimile machine - Xerographic copier - Calculators- Structure of a calculator - Internal Organization of a calculator - Servicing electronic calculators - Digital clocks - Block diagram of a digitalclock.

**Learning Outcomes**

To know the operation of different digital devices

To understand the block diagram of digital clocks

**Unit-V**

**Digital Access Devices -** Digital computer -Internet access - Online ticket reservation - Functions and networks - Barcode Scanner and decoder - Electronic Fund Transfer - Automated Teller Machines (ATMs) - Set-Top boxes - Digital cable TV - Video on demand.

**Learning Outcomes**

To know the types of digital accesss devices

To understand the operation of ATMs

**Course Outcomes**

To describe the operation of microwave ovens (L3)
To know the types and workingof washing machines (L2)
Understand the mechanism of air conditioners (L2)
Able to know the block diagram of digital clocks
(L3) To understand the operation of ATMs (L2)

**Text Books:**

S.P. Bali, Consumer Electronics - Pearson Education, New Delhi,2005.
R. G. Gupta Audio and Video systems Tata McGraw Hill(2004)

**SEMESTER –V**

**SPH 327: Microprocessors Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks

Credits: 2

Preamble: This course was designed to perform arithmetic, logical and interfacing programs

Objective: The student will be able to understand then applies the written programs.

**List of Experiments**

Addition & Subtraction (8 &16-bits)

Multiplication & Division (8 -bit)

Largest & Smallest number in the given array.

Ascending & Descending order.

Binary to ASCII & ASCII to Binary, BCD to ASCII & ASCII toBCD.

Block Transfer ofData.

Waveform generation using DAC interface.

Stepper motor interface.

**Course Outcomes:**

After the completion of this course, the student will be able to write the programs to control basic devices **(L2 and L3)**

**SEMESTER – V**

**SPH 331: Consumer Electronics Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks

Credits: 2

| | |
|---|---|
| Preamble: | This course was designed for setup of electronics systems. |
| Objective: | The student will be able to assemble and disassemble of electronic systems. |

**List of Experiments**

Study of PA systems for various situations - Public gathering, closed theatre/Auditorium, Conference room, Prepare Bill of Material (Costing)

Installation of Audio /Video systems - site preparation, electrical requirements, cables and connectors

Market Survey of Products ( at least one from each module)

Identification of block and tracing the system. Assembly and Disassembly of system using Toolkit

Assembly and Disassembly of system& printer

**NOTE:** One activity as directed in practical course is equivalent to 4 experiments

**Course Outcomes:**

After the completion of this course, the student will be able to assemble and disassemble of electronic systems **(L2 and L3)**

**B.Sc. Physical Science**
**SEMESTER – V**
**SPH 381: Analytical Methods in Chemistry**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

**Preamble:** The students of undergraduate program in science need to be conversant with the various instrumental and analytical techniques in analytical chemistry for training a undergraduate students as analytical chemist.

**Objective:** The concept of qualitative and quantitative methods in analytical chemistry will be introduced to undergraduate students.

Students will also learn the fundamental concepts of various instrumental methods for quantitative analysis, separation methods and solvent extraction.

**UNIT -I**

**Qualitative and quantitative aspects of analysis**

Evaluation of analytical data, errors, accuracy and precision, methods of their expression,, statistical test of data; F, Q and t test, rejection of data, and confidence intervals.

**Optical methods of analysis**

Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law.

**Learning Outcomes**

The students will learn evaluation of analytical data and fundamental laws of spectroscopy.

**UNIT -II**

UV-Visible Spectrometry: Basic principles of instrumentation (choice of source,monochromator and detector) for single and double beam instrument;

Infrared Spectrometry: Basic principles of instrumentation (choice of source, monochromator& detector) for single and double beam instrument.

**Learning Outcomes**

The students will learn the concept and applications of UV Visible& Infra red spectrometry for quantitative analysis.

**UNIT-III**

Flame Atomic Absorption and Emission Spectrometry: Basic principles of instrumentation(choice of source, monochromator, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; sources of chemical interferences. Techniques for the quantitative estimation of trace level of metal ions from water samples.

**Learning Outcomes**

The student will learn the concept of atomic spectrometry for quantitative analysis

**UNIT-IV**

**Thermal methods of analysis**

Theory of thermogravimetry (TG), basic principle of instrumentation.

**Electroanalytical methods**

Classification of electroanalytical methods, basic principle of pH metric, potentiometric and conductometric titrations.

**Learning Outcomes**

To familiarize with basic thermo and electro-analytical methods for chemical analysis.

**UNIT-V**

**Separation techniques**

Solvent extraction: Classification, principle and efficiency of the technique.Mechanism of extraction: extraction by solvation and chelation.Technique of extraction: batch, continuous and counter current extractions.

Chromatography: Classification, principle and efficiency of the technique.Mechanism of separation: adsorption, partition & ion exchange. Development of chromatograms: frontal, elution and displacement methods.

**Learning Outcomes**

The student will learn concept of separation methods in chemical analysis.

**Reference Books:**


Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6$^{th}$Ed., Pearson, 2009.

Willard, H.H. et al.: Instrumental Methods of Analysis, 7$^{th}$ Ed. Wardsworth Publishing Company, Belmont, California, USA, 1988.

Christian, G.D. Analytical Chemistry, 6$^{th}$ Ed. John Wiley & Sons, New York, 2004.

Harris, D.C.: Exploring Chemical Analysis, 9$^{th}$ Ed. New York, W.H. Freeman, 2016.

Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age International Publisher, 2009.

Skoog, D.A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed.

Mikes, O. Laboratory Hand Book of Chromatographic & Allied Methods, Elles Harwood Series on Analytical Chemistry, John Wiley & Sons, 1979.

Ditts, R.V. Analytical Chemistry; Methods of separation, van Nostrand, 1974

**B.Sc. Physical Science**
**SEMESTER – V**
**SPH 339: Analytical Methods in Chemistry Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks
Credits: 2

**Preamble:** The students of undergraduate program in science in Chemistry need to be conversant with the various basic methodologies of chemistry. Therefore, one module each on in inorganic , physical and organic chemistry is introduced which helps the student familiarize with the techniques essential for developing the foundation of practical chemistry

**Objective**: To make student learn the practical application of analytical techniques and Instrumental methods for quantitative analysis.

**List of Experiments:**

**I. Separation Techniques**

1. Chromatography:

(a) Separation of mixtures

2. Paper chromatographic separation of $Fe^{3+}$, $Al^{3+}$, and $Cr^{3+}$.

Ä¹Ā□Ā□ Separation and identification of the monosaccharides present in the given mixture (glucose & fructose) by paper chromatography. Reporting the Rf values.

Ä¹Ā□Ā□ Separate a mixture of Sudan yellow and Sudan Red by TLC technique and identify them on the basis of their Rf values.

ĀÄ¹ĀÈĀÄChromatographic separation of the active ingredients of plants, flowers and juices by
TLC

**Solvent Extractions:**

To separate a mixture of $Ni^{2+}$& $Fe^{2+}$ by complexation with DMG and extracting the $Ni^{2+}$-DMG complex in chloroform, and determine its concentration by spectrophotometry.

Solvent extraction of zisconium with amberliti LA-1, separation from a mixture of irons and gallium.

Determine the pH of the given aerated drinks fruit juices, shampoos and soaps.

Determination of Na, Ca, Li in cola drinks and fruit juices using fame photometric techniques.

Analysis of soil:
Determination of pH of soil.
Total soluble salt
Estimation of calcium, magnesium, phosphate, nitrate

Ion exchange:

Determination of exchange capacity of cation exchange resins and anion exchange resins.
Separation of metal ions from their binary mixture.
Separation of amino acids from organic acids by ion exchange chromatography.

**III Spectrophotometr**y

Determination of pKa values of indicator using spectrophotometry.
Structural characterization of compounds by infrared spectroscopy.
Determination of dissolved oxygen in water.
Determination of chemical oxygen demand (COD).
Determination of Biological oxygen demand (BOD).
Determine the composition of the Ferric-salicylate/ ferric-thiocyanate complex by Job's method.

**Reference Books:**


Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6$^{th}$Ed., Pearson, 2009.
Willard, H.H. et al.: Instrumental Methods of Analysis, 7$^{th}$ Ed. Wardsworth Publishing Company, Belmont, California, USA, 1988.
Christian, G.D. Analytical Chemistry, 6$^{th}$ Ed. John Wiley & Sons, New York, 2004.
Harris, D.C. Exploring Chemical Analysis, 9$^{th}$ Ed. New York, W.H. Freeman, 2016.
Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age International Publisher, 2009.
Skoog, D.A. Holler F.J. and Nieman, T.A. Principles of Instrumental Analysis Cengage Learning India Edition.

**B.Sc. Physical Science**
**SEMESTER – V**
**SPH 383: Green Chemistry**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

**Preamble:** The students of undergraduate program in science need to be conversant with the various green techniques in synthetic and analytical chemistry. This course will lay the foundation for the student to be able to appreciate eco-friendly methods in chemistry and develop as a responsible chemist forth benefit of the society and environment.
**Objective:** The concept of green chemistry encompassing green chemistry strategies, concepts and practices will be introduced to the undergraduate students.
Students will also learn the fundamental concepts of various green synthetic methods and techniques for quantitative analysis.
The student will also Green separation and extraction for sample preparation

**UNIT I**

**Introduction to Green Chemistry**

Green chemistry - Introduction - need for green chemistry - goals of green chemistry - Anastas' twelve principles of green chemistry - Designing a green synthesis (tools) - choice of starting materials, solvents, catalysts, reagents, processes with suitable examples.

**Learning Outcomes**

The students will learn the goals and principles of green chemistry

**UNIT II**

**Ionic liquids**

Synthesis, physical properties of ionic liquids - applications in alkylation, epoxidation, Friedal-Crafts reaction - Diels-Alder reactions – Knoevengal condensations and Wittig reactions.

Phase Transfer Catalyst (PTC) - Definition - advantages, types of PTC reactions - synthesis of PTC, applications of PTC in organic synthesis - Michael reaction - alkylation of aldehydes and ketones. Wittig, generation of dihalocarbene, elimination reaction

**Learning Outcomes**

The students will learn the properties of ionic liquids and synthesis of molecules using the green solvents- ionic liquids.

**UNIT III**

**Supercritical $CO_2$**

phase diagram - uses in extracting natural products, dry cleaning, bromination, Kolbe-Schmidt synthesis - Friedel-crafts reaction. Dimethyl carbonate as a methylating agent in green synthesis

**Learning Outcomes**

The student will learn the concept of atomic spectrometry for quantitative analysis.

**UNIT IV**

**Microwave and Ultrasound Assisted Reactions**

Microwave activation - advantages of microwave exposure - Microwave assisted reactions, condensation reactions - oxidation, reduction reactions, multicomponent reactions. **Sonochemistry** - use of ultrasound in organic synthesis (alternate source of energy) - saponification - substitution, addition, oxidation reactions, reductions.

**Learning Outcomes**

The student will familiarize with basic thermo and electro-analytical methods for chemical analysis.

**UNIT V**

**Green Analytical Techniques**

Micelle mediated extraction- Cloud point extraction and adsorptive miceller flocculation methods. Solid Phase Micro Extraction (SPME)

**Learning Outcomes**

The student will learn concept of separation methods in chemical analysis.

**Text books:**


Paul T. Anastas and John C. Warner, "Green Chemistry", Oxford University Press, Indian Edition, 2008.

V. K. Ahluwalia and M. Kidwai, "New Trends in Chemistry", Anamaya Publishers, 2nd Edition, 2007.

V. Kumar, "An Introduction to Green Chemistry", Vishal Publishers, 1st Edition, 2007.

V. K. Ahluwalia and R. S. Varma, "Green Solvents", Narosa Publishing, 1st Edition, 2009.

V.K.Ahluwalia and Renu Aggarwal, "Organic Synthetic Special Techniques", Narosa, 2nd Edition, 2009.

V. K. Ahluwalia, "Green Chemistry - Environmentally Benign Reactions", Ane books,
India, 2006.

Matlack, A.S. Introduction to Green Chemistry, Marcel Dekker (2001).

**SEMESTER – V**
**SPH 341: Green Chemistry Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks
Credits: 2

**Preamble:** The students of undergraduate program in science in Chemistry need to be conversant with the various basic methodologies of green chemistry. Therefore, green chemistry is introduced which helps the student familiarize with the techniques essential for green chemistry.

**Objective:** To make student learn the practical application of green analytical and synthetic techniques for waste utilization a

**List of Experiments:**

**1. Safer starting materials**

Preparation and characterization of nanoparticles of gold using tea leaves.

**2. Using renewable resources**

Preparation of biodiesel from vegetable waste cooking oil.

**3. Avoiding waste**

Principle of atom economy.

Use of molecular model kit to stimulate the reaction to investigate how the atom economy can illustrate Green Chemistry.

Preparation of propene by two methods can be studied

Triethylamine ion + $OH^-$ → propene + trimethylpropene + water

1-propanol $\xrightarrow{H_2SO_4/\Delta}$ propene + water

Other types of reactions, like addition, elimination, substitution and rearrangement should also be studied for the calculation of atom economy.

**4. Use of enzymes as catalysts**

Benzoin condensation using Thiamine Hydrochloride as a catalyst instead of cyanide.

**5. Alternative Green solvents**

Extraction of D-limonene from orange peel using liquid CO2 prepared form dry ice. Mechanochemical solvent free synthesis of azomethines

**Alternative sources of energy**

Solvent free, microwave assisted one pot synthesis of phthalocyanine complex of copper (II).

Photoreduction of benzophenone to benzopinacol in the presence of sunlight.

**Learning Outcomes:**

The students will learn synthesis of nano material, biodiesel and simple organic molecules

**Reference Books:**

Anastas, P.T & Warner, J.C. Green Chemistry: Theory and Practice, Oxford University Press (1998).
Kirchoff, M. & Ryan, M.A. Greener approaches to undergraduate chemistryexperiment. American Chemical Society, Washington DC (2002).
Ryan, M.A. Introduction to Green Chemistry, Tinnesand; (Ed), American Chemical Society, Washington DC (2002).
Sharma, R.K.; Sidhwani, I.T. & Chaudhari, M.K. I.K. Green Chemistry Experiment:A monograph International Publishing House Pvt Ltd. New Delhi. Bangalore CISBN978-93-81141-55-7 (2013).
Cann, M.C. & Connelly, M. E. Real world cases in Green Chemistry, American Chemical Society (2008).

**B.Sc. Physical Science**
**SEMESTER –V**
**SPH 391: Data Mining**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

**Preamble:** Data mining techniques addresses the major latest techniques of discovering knowledge from a data warehouse. They contain algorithms for discovering association rules, decision trees, clustering neural networks, genetic algorithms.

To make the student to understand the major tasks performed in data mining. To infer the statistical perspective of data mining.

To identify the clustering algorithms.

**UNIT I**

**Introduction**

Basic Data Mining Tasks, Classification, Regression, Time Series Analysis, Prediction, Clustering, Summarization, Association Rules, Data Mining Versus Knowledge Discovery in Databases.

**Learning Outcomes:**

By the end of this Unit, the student will be able to

Outline the data mining tasks. (L2)

Make use of prediction, Clustering, Summarization. (L3)

**UNIT II**

**The Development of Data Mining**

Data Mining Issues, Social Implication of Data Mining, Data Mining from a Database, Perspective Data Mining Techniques, Statistical Perspectives of Data Mining, Similarity Measures, Decision Trees.

**Learning Outcomes:**

By the end of this Unit, the student will be able to

Outline Perspective data mining techniques. (L2)

Apply similarity measure in clustering. (L3)

Develop Decision tree. (L3)

**UNIT III**

**Classification**

Issues in Classification, Statistical Based Algorithms, Distance Based Algorithms, Decision Tree Based Algorithms.

**Learning Outcomes:**

By the end of this Unit, the student will be able to

Illustrate Statistical Based Algorithms. ( L3)

Make use of distance based algorithms. (L3)

Examine Decision tree based algorithms. (L4)

**UNIT IV**

**Clustering**

Introduction, Similarity and Distance Measures, Outliers, Hierarchical Algorithms, Partitional Algorithms, Minimum Spanning Tree, Squared Error Clustering Algorithm, K-Means Clustering, Nearest Neighboring Algorithm.

**Learning Outcomes:**

By the end of this Unit, the student will be able to

Choose Hierarchical Algorithms.(L1)

Summarize Partitional Algorithms. (L2)

Organize clusters using K-Means Algorithm. (L3)

**UNIT V**

**Association Rule:**Introduction, Large Item Sets, Basic Algorithms, Apriori Algorithm, Sampling Algorithm, Partitioning, Parallel & distributed algorithms, Data parallelism, Task parallelism.

**Learning Outcomes:**

By the end of this Unit, the student will be able

to Explain Apriori Algorithm. (L2)

Identify Parallel and Distributed algorithms. (L3)

**Course Outcomes:**

Upon completion of the course, the student is able to

relate the steps in knowledge discovery process. (L2)

identify perspective data mining techniques. (L4)

examine the data mining techniques. (L3)

Data Mining- Introductory and Advanced topics, Margaret H.Dunham, Pearson Education, sixth impression, 2009.

Data mining Techniques, Arun K. Pujari, University Press, 2001.

Introduction to Data mining with Case Studies, G.K.Gupta, PHI India, 2006.

**B.Sc. Physical Science**
**SEMESTER –V**
**SPH 393: Cryptography**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

**Preamble**: Cryptography is the cornerstone of computer and communications security. Its foundation is based on various concepts of mathematics such as number theory, computational-complexity theory. The course explains how programmers and network professionals can use cryptography to maintain the privacy of computer data.

To brief the security goals, security services and mechanisms. To outline different Ciphers.
To explain different data encryption techniques.
To brief public Key encryption algorithms.
To outline message authentication and Hash functions.

**UNIT I**

**Introduction**

Security Goals- Confidentiality, Integrity, Availability, Attacks- Attacks Threatening Confidentiality, Attacks Threatening Integrity, Attacks Threatening Availability, Passive Versus Active Attacks, Services And Mechanism - Security Services, Security Mechanisms, Relation Between Services And Mechanisms, Techniques- Cryptography, Steganography .

**Learning Outcomes:**

By the end of this Unit, the student will be able to

Spell security Goals.(L1)
Differentiate between Passive attacks and Active attacks.(L1)
Identify the relationship between Services and Mechanisms. (L2)

**UNIT II**

**Traditional Symmetric Key Ciphers**

Introduction- Kerckhoff's Principle, Cryptanalysis, Categories Of Traditional Ciphers, Substitution Ciphers- Mono Alphabetic Ciphers, Poly Alphabetic Ciphers, Transposition Ciphers- Keyless Transposition Ciphers, Keyed Transposition Ciphers, Combining Two Approaches.

**Learning Outcomes:**

By the end of this Unit, the student will be able to

Discover Traditional Ciphers. (L3)
Able to perform Crypta analysis. (L3)

**UNIT III**

**Data Encryption Techniques**

Algorithms For Block And Stream Ciphers, Symmetric Key Encryption, Data Encryption Standard (DES), Advanced Encryption Standard.

**Learning Outcomes:**

By the end of this Unit, the student will be able to

Understand Block and Stream Ciphers. (L3)
Summarize Data Encryption Standards. ( L2)

**UNIT IV**

**Algorithms for Public Key Encryption**

RSA, DH Key Exchange, Digital Signatures.

**Learning Outcomes:**

By the end of this Unit, the student will be able to

Explain RSA Encryption Algorithm. (L3)

Infer Digital Signature. (L3)

**UNIT V**

**Message Authentication and Hash Functions**

SHA, WHIRLPOOL .

**Learning Outcomes:**

By the end of this Unit, the student will be able to

Analyze message Authentication. (L3)

Appraise SHA, WHIRLPOOL. (L5)

**Text Books:**

Cryptography and Network Security, Behrouz A. Forouzan, TMH, Special Indian Edition, 2007 ( Unit I and Unit II )

Cryptography and Network Security Principles and Practices, William Stallings, PHI, 4th Edition, 2006.( Unit III, Unit IV and Unit V )

**Reference Books:**

Cryptography and Network Security, William Stallings, Pearson Education, 4th Edition, 2006

Cryptography and Network Security, Atul Kahate, Tata McGraw-Hill, New Delhi, 2003

**Course Outcomes:**

By the end of the course the student is able to

Know the importance of security goals, security services and mechanisms. Distinguish between plain text and Cipher text.

Know RSA public Key encryption algorithm.

Explain message authentication and Hash functions

**B.Sc. Physical Science**
**SEMESTER – V**
**SPH343: Data Mining Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks
Credits: 2

**List of Experiments:**

Introduction to the Weka machine learning toolkit

Performing data preprocessing for data mining in Weka

Classification using the Weka toolkit

Performing clustering in Weka

Association rule analysis in Weka

Data mining Case Study

**B.Sc. Physical Science**
**SEMESTER – V**
**SPH 345: Cryptography Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks
Credits: 2

**List of Experiements:**

Study of various cryptographic techniques.

Problems on Substitution techniques.

Problems on Transposition techniques.

Introduction to Unix, Vi Editor.

Usage of the following commands in unix: ls, pwd, tty, cat, who, who am I, rm, mkdir, rmdir, cd.

Usage of following commands in unix : cal, cat(append), cat(concatenate), mv, cp, man, date.

Implement Substitution technique

Implement Transposition technique.

Study of Open SSL.

Implement Symmetric key Algorithm – DES using open SSL.

Implement Asymmetric key Algorithm – RSA using open SSL.

Implement Hash Algorithm – SHA using open SSL.

**Text Books:**

1.Cryptography and Network Security by Behrouz A. Forouzan, TMH, Special Indian Ed. 2007.
2.Unix Concepts and Applications ,Sumitabha Das, 4th Edition, TMH,2006.

**Reference Books:**

Introduction to Unix and Shell Programming M.G. Venkateshmurthy, Pearson, 1st Edition, 2005.

**B.Sc. Physical Science**
**SEMESTER – V**
**SSE 371: Applied Optics**

Credits: 2 Continuous Evaluation: 100 Marks

**Preamble:** To outline modern optics.

**Objective:** To interpret laser radiation and its role in modern optics.

Theory includes only qualitative explanation. Minimum five experiments should be performed covering minimum three sections.

**(i) Sources and Detectors**

Lasers, Spontaneous and stimulated emissions, Theory of laser action, Einstein's coefficients, Light amplification, Characterization of laser beam, He-Ne laser, Semiconductor lasers.

**Experiments on Lasers:**

a. Determination of the grating radial spacing of the Compact Disc (CD) by reflection using He-Ne or solid state laser.

b. To find the width of the wire or width of the slit using diffraction pattern obtained by a He-Ne or solid state laser.

c. To find the polarization angle of laser light using polarizer and analyzer d. Thermal expansion of quartz using laser

**Experiments on Semiconductor Sources and Detectors:**

V-I characteristics of LED
Study the characteristics of solid state laser
Study the characteristics of LDR
Photovoltaic Cell
Characteristics of IR sensor

**(ii) Fourier Optics**

Concept of Spatial frequency filtering, Fourier transforming property of a thin lens

**Experiments on Fourier Optics:**

**a. Fourier optic and image processing**

Optical image addition/subtraction
Optical image differentiation
Fourier optical filtering
Construction of an optical 4f system

**b. Fourier Transform Spectroscopy**

Fourier Transform Spectroscopy (FTS) is a powerful method for measuringemission and absorption spectra, with wide application in atmospheric remotesensing, NMR spectrometry and forensic science.

**Experiment:**

To study the interference pattern from a Michelson interferometer as afunction of mirror separation in the interferometer. The resulting interferogramis the Fourier transform of the power spectrum of the source. Analysis ofexperimental interferograms allows one to determine the transmissioncharacteristics of several interference filters. Computer simulation can also bedone.

**(iii) Holography**

Basic principle and theory: coherence, resolution, Types of holograms, white light reflection hologram, application of holography in microscopy, interferometry, and character recognition

**Experiments on Holography and interferometry:**

Recording and reconstructing holograms
Constructing a Michelson interferometer or a Fabry Perot interferometer
Measuring the refractive index of air
Constructing a Sagnac interferometer
Constructing a Mach-Zehnder interferometer
White light Hologram

**(iv) Photonics: Fibre Optics**

Optical fibres and their properties, Principal of light propagation through a fibre, The numerical aperture, Attenuation in optical fibre and attenuation limit, Single mode and multimode fibres, Fibre optic sensors: Fibre Bragg Grating

**Experiments on Photonics: Fibre Optics**

a. To measure the numerical aperture of an optical fibre
b. To study the variation of the bending loss in a multimode fibre
c. To determine the mode field diameter (MFD) of fundamental mode in a single-mode fibre by measurements of its far field Gaussian pattern
d. To measure the near field intensity profile of a fibre and study its refractive index profile e. To determine the power loss at a splice between two multimode fibre

**Reference Books:**


Fundamental of optics, F. A. Jenkins & H. E. White, 1981, Tata McGraw hill.
LASERS: Fundamentals & applications, K.Thyagrajan & A.K.Ghatak, 2010, Tata McGraw Hill
Fibre optics through experiments,M.R.Shenoy, S.K.Khijwania, et.al. 2009, Viva Books
Nonlinear Optics, Robert W. Boyd, (Chapter-I), 2008, Elsevier.
Optics, Karl Dieter Moller
Learning by computing with model examples, 2007, Springer.
Optical Systems and Processes, Joseph Shamir, 2009, PHI Learning Pvt. Ltd.
Optoelectronic Devices and Systems, S.C. Gupta, 2005, PHI Learning Pvt. Ltd.
Optical Physics, A.Lipson, S.G.Lipson, H.Lipson, 4th Edn., 1996, Cambridge Univ. Press


**Course Outcomes:**

To explain LASER and its importance to emerging fields in holography, Fourier optics and photonics

**B.Sc. Physical Science**
**SEMESTER – V**
**SSE 373: Pharmaceutical Chemistry**

Credits :2 Continuous Evaluation:100 Marks

**Preamble:** The students of undergraduate program in Chemistry need to be conversant with the various basic methodologies of pharmaceutical chemistry. Pharmaceutical Chemistry is a multifaceted field that deals with the principles and applications of natural, synthetic, computational and analytical chemistry in the discovery of chemical moieties for the prevention and cure of life threatening diseases.

**Objective:** To make student learn the basic principles of pharmaceutical chemistry with respect to Drug discovery, design and development

The idea of basic retrosynthetic approach for the synthesis of representative drugs of the different classes.

**Drugs & Pharmaceuticals**

Drug discovery, design and development; Basic Retrosynthetic approach. Synthesis of the representative drugs of the following classes: analgesics agents, antipyretic agents, anti-inflammatory agents (Aspirin, paracetamol, lbuprofen); antibiotics (Chloramphenicol); antibacterial and antifungal agents (Sulphonamides; Sulphanethoxazol, Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir), Central Nervous System agents (Phenobarbital, Diazepam),Cardiovascular (Glyceryl trinitrate), antilaprosy (Dapsone), HIV-AIDS related drugs (AZT- Zidovudine).

**Fermentation**

Aerobic and anaerobic fermentation. Production of (i) Ethyl alcohol and citric acid, (ii) Antibiotics; Penicillin, Cephalosporin, Chloromycetin and Streptomycin, (iii) Lysine, Glutamic acid, Vitamin B2, Vitamin B12 and Vitamin C.

**Learning Outcome:**

The students will learn synthetic route via retrosynthesis and fermentation methods to representative drugs and vitamins.

**B.Sc. Physical Science**
**SEMESTER – V**
**SSE 375: Theory of Equations**

Credits :2 Continuous Evaluation:100 Marks

General properties of polynomials, Graphical representation of a polynomials, maximum and minimum values of a polynomials

Quadratic Equations, General properties of equations, Descarte's rule of signs positive and negative rule,

Relation between the roots and the coefficients of equations. Symmetric functions, Applications symmetric function of the roots.

Transformation of equations.Solutions of reciprocal and binomial equations.

Algebraic solutions of the cubic and biquadratic.Properties of the derived functions.

**Text Books:**

W.S. Burnside and A.W. Panton, The Theory of Equations,Dublin University Press, 1954.
C. C. MacDuffee, Theory of Equations, John Wiley & Sons Inc., 1954.

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

Explain properties of polynomials and graphical representation Explain quadratic equations
Differentiate between roots and the coefficients of equations Explain tansformation of equations
Solve cubic and biquadratic equations.

**B.Sc. Physical Science**
**SEMESTER – V**
**SSE 377: Probability and Statistics**

Credits :2 Continuous Evaluation:100 Marks

Meaning and Scope of the Statistics Introduction, Frequency distribution, Graphic representation of a frequency distribution, measures of central tendency , measures of dispersion, coefficients ofdispersion, moments, skewness, kurtosis

Introduction, meaning of correlation, Karl Pearson s coefficient of correlation, rank correlation.Linear regression, Curve fitting, fitting of straight line, fitting of second degree parabola.

Probability **:** Introduction, definition, axiomatic approach to probability, probability-mathematical notation, probability function, law of addition of probabilities, multiplication law of probability and conditional law of probability, independent events, Baye s theorem.

Random variables and distribution functions: One and two dimensional random variables (discrete and continuous).

Probability distribution: Discrete distributions Binomial, Poisson distributions and their properties and applications.

**Text Books:**


Fundamentals of Mathematical Statistics S.C. Gupta and V.K. Kapoor, Sultan Chand & Sons

Statistical Methods Combined Edition (Volumes I & II) N G Das, McGraw Hill, 2008,1st edition.

Statistical Methods: Concepts, Application and Computation, Y.P. Aggarwal, Sterling Publishers, 1998.

Introduction to Mathematical Statistics, Robert V. Hogg, Joseph W. Mckean, Allen Thornton Craig, Pearson Education, Asia, 2007.

Mathematical Statistics with Applications, Irwin Miller and Marylees Miller, Pearson Education, Asia, 2006,7th edition.

Introduction to Probability Models, Sheldon M. Ross, Academic Press, IndianReprint, 2007, 9th edition.


**Course Learning Outcomes:**

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

Explain measures of central tendency

Explain measures of dispersion

Differentiate between correlation coefficient and regression Define probability

Differentiate discrete probability distribution and continuous probability distribution

**B.Sc. Physical Science**
**SEMESTER – V**
**SSE 379: Combinatorial Optimization**

Credits :2 Continuous Evaluation:100 Marks

**Introduction**
Optimization problems, neighbourhoods, local and global optima, convex sets and functions, simplex method, degeneracy; duality and dual simplex algorithm, computational considerations for the simplex and dual simplex algorithms-Dantzig-Wolfe algorithms.

**Integer Linear Programming**
Cutting plane algorithms, branch and bound technique and approximation algorithms for travelling salesman problem.

**Text Books:**

Combinatorial Optimization: Algorithms and Complexity by C.H. Papadimitriou and K. Steiglitz, Prentice-Hall of India, 2006

Optimization by K. Lange, Springer, 2004.

Linear Programming and Network Flows by Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, John Wiley and Sons, 2004.

Operations Research: An Introduction by H.A. Taha, 8th Ed., Prentice Hall, 2006.

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

Explain formulation of mathematical problem for given business problem
Explain simplex method to solve linear programming problem
Differentiate between simplex and dual simplex
algorithms Explain integer linear programming

**B.Sc. Physical Science**
**SEMESTER – VI**
**SPH 352: Digital and Analog Electronics**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

**Preamble:** To explain various analog and digital devices with its schematic diagram

**Objective:** The student will understand role of analog and digital devices and analyze it for present day technology.

**UNIT I**
**Basic Electronics**
Intrinsic and Extrinsic semiconductors.Fermi level,continuity equation.PN juction diode, Zener diode characteristics, Zener breakdown and Avalanche breakdown.PNP and NPN transistors, Current components in transistors, CB,CE and CC configurations- transistor hybrid parameters, Determination of hybrid parameters from transistor (CE) characteristics. (No derivation) Current gains α and β- Relations between α and β.

**Learning Outcomes**
To interpret the characteristics of junction diode (L2)
Compare the three configurations with limitations (L4)

**UNIT II**
**Rectifiers and Amplifiers**
Half-wave Rectifier, Full-wave Rectifiers-Calculation of Ripple Factor and Rectification Efficiency, Basic idea about capacitor filter, L- type and π – type filters. Zener Diode as Voltage Regulator.Concept of feedback, feedback amplifiers-types of amplifiers-voltage series, current series ,voltage shunt and current shunt.

**Learning Outcomes**
To outline various rectifiers and power supplies (L2)
To compare these rectifiers and explain power supplies (L4 and L2)

**UNIT III**
**Operational Amplifiers**
Characteristics of an Ideal and Practical Op-Amp (IC 741), Open-loop& Closed-loop Gain.CMRR, concept of Virtual ground. Applications of Op-Amps: (1) Inverting and Non-inverting Amplifiers, (2) Adder, (3) Subtractor, (4) Differentiator, (5) Integrator,(6) Zero Crossing Detector.

**Learning Outcomes**

To demonstrate the characteristics of OPAMP (L2)
To categorize the configurations with applications of OPAMP (L4)

**UNIT IV**
**Digital principles**
Differences between analog and digital circuits-Binary number system, convertion of Binary to Decimal system and vice versa. Binary addition and substraction(1’s and 2’s complement methods).

**Learning Outcomes**
To explain the different number systems (L2)
To distinguish number systems for application.(L4)

**UNIT V**

**Logic Gates**

Logic gates: OR,AND,NOT gates, truth tables, realization of these gates using discrete components. NAND, NOR as universal gates, exclusive-OR gate, De Morgan's Laws-statement and proof, Half adder and Full adder, Parallel adder circuits.

**Learning Outcomes**

To explain the different logic gates (L2)

To evaluate these gates for application.(L4)

**Course Outcomes**

To interpret the characteristics of junction diode and compare these configurations (L2 and L4)

To outline rectifiers compare them and understand power supplies (L4 and L2)

To demonstrate and categorize the OPAMP for application (L2 and L4)

To explain and distinguish number systems for its application (L2 and L4)

To explain and evaluate logic gates for its application (L2 and L4)

**Text Books:**

BSc Physics, Vol.3, Telugu Akademy, Hyderabad

Unified Electronics, Vol.3, Electronic Circuits and Digital Electronics, Agarwal and Agarwal, A.S. Prakasahan, Meerut.

Principles of Electronics, V.K. Mehta, S.Chand& Co.,

Digital Principles and Applications, A.P.Malvino and D.P.Leach, Mc GrawHill Edition.

**Reference Books:**

Electronic Devices and Circuits, Millman and Halkias, Mc GrawHill

Electricity, Magnetism with Electronics, K.K.Tewari, R.Chand& Co.,

Digital and analog systems cicuits and Devices: An Introduction, Belov Schilling, Mc Graw Hill International Edition.

**B.Sc. Physical Science**
**SEMESTER – VI**
**SPH 356: Electronic Communications**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

**Preamble:** To explain role of signal parameters in communication.

**Objective:** The student will understand various techniques for propagation of information

**UNIT I**
**Basics of Communication Systems and Noise**
Block diagram of communication system. Types of Electronic Communication systems: Simplex, Duplex. Analog /Digital Signals. Basis in Noise - Thermal, Shot noise Bit rate, Baud rate, Bandwidth and signal to Noise Ratio. Frequency spectrum in communications
**Learning Outcomes:**
To introduce the nomenclature of signals and explain communication system (L2)
**UNIT II**
**Amplitude Modulation**
Need for modulation. Amplitude modulation, Modulation index, frequency spectrum, generation of AM (balanced modulator,), Amplitude Demodulation (diode detector), other forms of AM: Double side band suppressed carrier, DSBSC generation (Balanced modulator), Single side band suppressed carrier, SSBSC generation (Filter method, phase cancellation method, third method), SSB detection, Introduction to other forms of AM (Pilot carrier modulation, Vestigial side band modulation).
**Learning Outcomes:**
To illustrate generation and detection of AM systems (L2)
**UNIT III**
**Angle Modulation**
Frequency and phase modulation, modulation index and frequency spectrum, equivalence between FM and PM, Generation of FM (Direct and indirect methods), FM detector (Slope detector, balanced slope detector, PLL).Comparison between AM, FM and PM.
**Learning Outcomes:**
To outline generation and detection of Angle modulation systems (L2)
**UNIT IV**
**Transmitters & Receivers**
Transmitters: Communication channels for AM and FM broadcast, AM transmitter: Lowlevel and high level modulation, FM transmitter.
**Receivers:** Receiver parameters, sensitivity, selectivity and fidelity, Super Heterodynereceiver, AM receivers, FM receivers. Frequency division multiplexing.
**Learning Outcomes:**
To explain various modulation levels of transmitters and receivers (L2)
**UNIT V**
**Electromagnetic Interference and**
Sampling theorem, Pulse Amplitude Modulation (PAM), Time Division Multiplexing (TDM), Pulse Width Modulation (PWM) and Pulse Position Modulation(PPM), Pulse Code Modulation, Differential Pulse Code Modulation, Delta Modulation, Adaptive DeltaModulation.
**Learning Outcomes:**
To explain digital communication systems (L2)

**Course Outcomes**

To introduce the nomenclature of signals and explain communication system (L2)
To illustrate generation and detection of AM systems (L2)
To outline generation and detection of Angle modulation systems (L2)
To explain various modulation levels of transmitters and receivers (L2) To explain digital communication systems (L2)

**Text Books:**

1.H. Taub and D. Schilling, Principles of Communication Systems, TMH (1999)
2.W.Tomasi, Electronic Communication Systems,Pearson Education (2004)
3.L.E.Frenzel, Communication Electronics, Principle and Applications, TMH (2002)
4.L. W. Couch II, Digital and Analog Communication Systems, Pearson Education (2005)

**Reference Books:**

S.Haykin, Communication Systems, Wiley India (2006)
G. Kennedy and B. Davis, Electronic communication systems, TMH(1999)
R. P. Singh and S. D. Sapre, Communication Systems: Analog and Digital, TMH
L. E. Frenzel, Communication electronics: Principles and applications. TMH
T.G. Thomas and S. Chandra Sekhar, Communication theory, TMH (2006)

**B.Sc. Physical Science**
**SEMESTER – VI**
**SPH 358: Solid State and Nuclear Physics**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

**Preamble:** To Study the general properties of solids and nucleus

**Objective:** Understanding and examine the solids with properties of crystals, electron theory and different magnetic materials. Interpret the general properties of nuclei and its radioactive properties.

**UNIT I**

**Crystal Structure**

Amorphous and Crystalline Materials,Unit Cell, Miller Indices, Reciprocal Lattice, Types of Lattices, Diffraction of X-rays by Crystals, Bragg's Law, Experimental techniques, Laue's method and powder diffraction method.

**Learning Outcomes**

To illustrate crystalline structures (L2)
Experimental studies of crystals (L3)

**UNIT II**

**Introduction to Free electron and band theory**

Free electron theory and its demerits**,** Bloch theorem and Kronig Penny model, Energy Bands in solids, Energy gaps, Conductors, Semiconductors and insulators, P and N type Semiconductors, P-N Junction diode, Half wave and Full wave rectifiers (qualitative).

**Learning Outcomes**

Construct model for band theory of solids (L3)
Classify various semiconductors (L2)

**UNIT III**

**Magnetic Materials& Superconductivity**

Dia, Para, Ferromagnetic Materials, Classical Langevin Theory of Paramagnetism, Curie-Weiss's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains- Basic concepts of superconductivity Experimental Results, Critical Temperature, Critical magnetic field- Meissner effect. Type I and type II Superconductors- applications of super conductors

**Learning Outcomes**

Classification of magnetic materials and explain related theories (L2 and L3)
Outline superconductors (L2)

**Unit IV**

**General Properties of Nuclei**

Basic ideas of nucleus -size, mass, charge density (matter energy), binding energy, angular momentum, parity, magnetic moment, electric moments, semi-empirical mass formula.
Liquid drop model-Shell model- Collective model (qualitative), Magic numbers.

**Learning Outcomes**

To outline various properties of nuclei(L2)
To classify various Models of Nucleus(L4)

**UNIT V**

**Radioactivity decay**

Alpha decay: basics of α-decay processes, Gamow's theory of α-decay, Geiger Nuttal law, β-decay, Energy kinematics for β-decay, positron emission, electron capture, neutrino hypothesis. Detectors of nuclear Radiation -Ionization chamber, Proportional counter, GM Counter, scintillation counter.

**Learning Outcomes**

To outline various properties of and theories of radioactive radiation (L2)
Experimental studies of detectors of radiation (L3)

**Course Outcomes**

To illustrate crystalline structures and experimental studies of crystals (L2 and L3)
Construct model for band theory of solids (L3)
Classify various semiconductors (L2)
Classification of magnetic materials and explain related theories (L2 and L3) Outline superconductors (L2)
To outline properties of nuclei and related models (L2 and L4)
To outline properties, theories and experiments of radioactive radiation (L2 and L3)

**Text Books:**


Elements of Solid State Physics,J.P.Srivastava, Prentice Hall of India Pvt., Ltd.
Modern Physics, R.Murugeshan and Kiruthiga Siva Prasath, S.Chand& Co.
3. Unified Physics, Vol.4.,S.L.Gupta & Sanjeev Gupta, Jai Prakash Nath & Co. Meerut.
4. Nuclear Physics, D.C.Tayal, Himalaya Publishing House.


**Reference Books:**


Concepts of Modern Physics, Arthur Beiser Tata McGraw Hill Edition.
Nuclear Physics, Irving kaplan, Narosa publishing House.
Introduction to Solid State Physics,C.Kittel, John Wiley& Sons.
Solid State Physics, A.J.Dekker, McMillan India.
Physics of MagnetismSushinChikazumi, Stanley H. Charap, Krieger Pub Co (June 1978)

**B.Sc. Physical Science**
**SEMESTER – VI**
**SPH 320: Solid State and Nuclear Physics Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks
Credits: 2

**Preamble:** To perform experimental studies related to solids state and radioactive sources.

**Objective:** To develop and explain properties related to solids state and radioactive sources.

**List of Experiments**

Ultrasonic Interferometer
Rigidity modulus-Internal friction
B-H Curve- Determination of Curie temperature
Thermo EMF
Dielectric Constant
Plateau Characteristics
Intensity variation of radiation
Absorption Coefficient of material
Statistical Aspects of Radiation
Beta back scattering factor
Gamma ray Spectrometer Energy resolution characteristics

**Course Outcomes:**

To illustrate and examine properties of solid state and radioactive sources (L2 and L3)

**B.Sc. Physical Science**
**SEMESTER – VI**
**SPH 322: Digital and Analog Electronics Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks
Credits: 2

**Preamble:** To measure and compare analog and digital devices from its characteristics

**Objective:** The student will understand role of analog and digital devices and analyze it for application

**List of Experiments**

Energy gap of semiconductor using a junction diode.
PN Junction Diode Characteristics
Zener Diode Characteristics
Zener Diode as Voltage Regulator
Transistor CE Characteristics- Determination of Hybrid Parameters
Logic Gates- OR,AND,NOT and NAND gates. Verification of Truth Tables.
Verification of De Morgan's Theorems
RC Circuit –Frequency response.
LR circuit-frequency response.
Full Wave Rectifier- C- type, L- type and π- type filters
Field Effect Transistor (FET) Characteristics

**Course Outcomes**

To understand analog and digital devices and analyze it for application (L2 and L5)

**B.Sc. Physical Science**
**SEMESTER – VI**
**SPH 326: Electronic Communications Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks
Credits: 2

**Preamble:** To illustrate various modulation for generation and detection of signals

**Objective:** The student will realize importance of various communication systems

**List of Experiments**

Amplitude Modulation and Demodulation.
Frequency Modulation and Demodulation
Pulse Amplitude Modulation
Pulse Width Modulation
Pulse Position Modulation
6.Pulse Code Modulation
7.AM modulation and Demodulation
8.FM modulation and Demodulation
9.Calculation of EMI Components

**Course Outcomes**

To interpret various modulation methods for communication (L2 and L5)

**B.Sc. Physical Science**
**SEMESTER – VI**
**SPH 362: Numerical Methods**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

**Preamble:** Numerical analysis is the study of algorithms that use numerical approximation for the problems of mathematical analysis. Numerical analysis naturally finds application in all fields of engineering and the physical sciences. Numerical analysis can only be applied to real-world measurements by translation into digits; it gives approximate solutions within specified error bounds.

**Objective:** The course is framed to extend the student's knowledge about understanding numerical techniques to solve various categories of problems. It will also help in developing deep understanding of the approximation techniques and problem solving capabilities.

**UNIT-I**

**Errors in Numerical Computations:** Errors and their accuracy, Mathematical Preliminaries, Errors and their Analysis, Absolute, Relative and Percentage Errors, A general error formula, Error in a series approximation.

**Learning Outcomes:**

After studying this unit the student can

- Understand the different types of errors in numerical computation
- Know the rules to round off a given number
- Understand a general error formula and also error in a series approximation

**UNIT-II**

**Solution of Algebraic and Transcendental Equations**: The bisection method, The iteration method, The method of false position, Newton Raphson method, Generalized.

**Learning Outcomes**

After studying this unit the student can

- Understand the usage of intermediate value theorem in locating the roots of an equation
- Understand the techniques of bisection method, iteration method, method of false position and also Newton-Raphson method and generalized Newton-Raphson method to find a real root of the given equation.

**UNIT-III**

**System of Simultaneous Equations:** Direct methods, Gauss Elimination Method, LU decomposition; Iterative Methods**:** Gauss-Jacobi, Gauss-Siedel and SOR iterative methods.

**Learning Outcomes**

After studying this unit the student can

- Understand the direct methods such as Gauss elimination method and LU decomposition method to solve the given system of equations
- Understand the iterative techniques such as Gauss-Jacobi, Gauss-Siedel and SOR iterative methods to solve the given system of equations numerically

**UNIT-IV**

**Lagrange and Newton Divided difference interpolation**: linear and higher order,

**Finite difference Operators**: Newton forward and backward Interpolations, Central Difference Interpolation Formulae, Gauss's central difference formulae, Stirling's central difference formula, Bessel's Formula

**Learning Outcomes**

After studying this unit the student can

Understand the problem of interpolation

Know the interpolation techniques when the nodes are evenly spaced

Know the interpolation techniques when the nodes are unevenly spaced

**UNIT-V**

**Numerical differentiation**: forward difference, backward difference and central Differences.

**Numerical Integration**: Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule

**Learning Outcomes**

After studying this unit the student can

Understand the problem of numerical differentiation and numerical integration

Know the techniques for numerical differentiation with finite difference operators

Know the techniques of Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule

**Text Books:**

Introductory Methods of Numerical Analysis" by S.S.Sastry published by Prentice Hall of India Pvt. Ltd., New Delhi. (Latest Edition)

"Higher Engineering Mathematics" by B.S. Grewal published by Khanna Publishers

"Mathematical Methods" by G. Shanker Rao published by I.K. International Publishing House Pvt. Ltd.

"Finite Differences and Numerical Analysis" by H.C Saxena published by S. Chand and Company, Pvt. Ltd., New Delhi.

**Course Outcomes:**

Able to understand the numerical techniques for various category of problems Able to develop algorithms for approximation techniques

**B.Sc. Physical Science**
**SEMESTER – VI**
**SPH 364: Complex Analysis**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

**Preamble:** Complex analysis is the branch of mathematical analysis that investigates functions of complex numbers and it is known as the theory of functions of a complex variable. Complex analysis naturally finds application in all fields of engineering and the physical sciences. Complex analysis can be applied to real-world problems

**Objectives:** To introduce
Basic properties of complex numbers Cauchy-Riemann equations
Analytical functions
Contours and their properties
Expansion of the function using taylor's series

**UNIT-I**
Limits, Limits involving the point at infinity, continuity.Properties of complex numbers, regions in the complex plane, functions of complex variable, mappings.
Derivatives, differentiation formulas, Cauchy-Riemann equations, sufficient conditions for differentiability.

**Learning Outcomes:**
The student will be able to:
- Define limits and continuity
- Explain properties of complex numbers
- Evaluate problems using Cauchy Riemann equations
- Explain differentiation formulas and conditions for differentiability

**UNIT-II**
Analytic functions, examples of analytic functions, exponential function, Logarithmic function, trigonometric function, derivatives of functions.

**Learning Outcomes:**
The student will be able to:
- Define analytical function with examples
- Evaluate analytical functions for exponential, logarithmic, and trigonometric
- Explain derivatives of functions

**UNIT-III**
Definite integrals of functions.Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals.

**Learning Outcomes:**
The student will be able to:
- Explain definite integrals of functions
- Describe contours, contour integrals and its properties
- Evaluate problems on upper bounds for moduli of contour integrals

**UNIT-IV**
Cauchy-Goursat theorem, Cauchy integral formula,Liouville's theorem and the fundamental theorem of algebra.Convergence ofsequences and series, Taylor series and its examples.

**Learning Outcomes:**

The student will be able to:

- Explain Cauchy Goursat theorem and its applications
- Explain Cauchy integral formula with applications
- Evaluate problems on convergence of sequences and series
- Explain Taylor's series with examples

**UNIT-V**

Laurent series and its examples, absolute and uniform convergence of power series.

**Learning Outcomes:**

The student will be able to:

- Evaluate problems on Laurent series
- Explain absolute convergence of power series
- Explain uniform convergence of power series

**Text Books:**


Complex Analysis for Mathematics and Engineering,
John H. Mathews and Russell W. Howell ,Jones and Bartlett Publishers, $5^{th}$ edition.

Complex Variables and Applications James Ward Brown and Ruel Vance Churchill
Mc Graw-Hill Higher Education, $8^{th}$ edition.

Complex Analysis ,Joseph Bak and Donald J. Newman, Springer-
Verlag New York, Inc., New York, 1997,$2^{nd}$ edition.

**B.Sc. Physical Science**
**SEMESTER – VI**
**SPH 366: Linear Programming**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

**Preamble:** Linear programming is a mathematical technique for maximizing or minimizing a linear function of several variables, such as output. Linear programming is a part of operations research. Linear programming finds application in all fields of engineering, physical sciences and life sciences. Linear programming can be applied to solve real world problems.

**Course Objectives:**

To introduce formulation of linear programming model

To discuss the methods to solve linear programming problems

To study the optimality and unboundedness in a linear programming problem

To know the applications of sensitivity analysis

**Unit-I**

Linear Programming Problems, Graphical Approach for Solving some Linear Programs.Convex Sets, Supporting and Separating Hyperplanes.

**Learning Outcomes:**

The student will be able to:

Formulate linear programming model for a business problem
Explain graphical approach to solve linear programming problem
Evaluate problems on convex sets
Explain about hyperplanes

**Unit-II**

Theory of simplex method, optimality and unboundedness, the simplex algorithm, simplex method in tableau format

**Learning Outcomes:**

The student will be able to:

Explain simplex method to solve linear programming problem
Evaluate optimality and unboundedness in a linear programming problem
Evaluate problems using simplex algroithm

**Unit-III**

Introduction to artificial variables, two-phase method, Big-M method and their comparison.

**Learning Outcomes:**

The student will be able to:

Solve problems on two phase method
Explain problems on Big-M method
Compare two phase method and Big-M method

**Unit-IV**

Duality, formulation of the dual problem, primal- dual relationships, economic interpretation of the dual.

**Learning Outcomes:**

The student will be able to:

Explain duality and formulation of the dual problem
Differentiate primal- dual problems
Explain economic interpretation of the dual problem over primal problem

**Unit-V**

Sensitivity analysis.

**Learning Outcomes:**

The student will be able to:

Study the uncertainty in the output of a mathematical model which can be divided and allocated to different sources of uncertainty in its inputs

Provide examples using sensitivity analysis

Apply sensitivity analysis on various problems

**Text Books:**


Operations Research" by S.D. Sharma , Kedarnath and Ramnath Co.

Linear Programming and Network Flows, Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali , John Wiley and Sons, India, 2004, 2nd edition.

Introduction to Operations Research,Frederick S. Hiller and Gerald J. Lieberman TataMcGraw Hill, Singapore, 2004, 8th edition.

Operations Research: An Introduction, Hamdy A. Taha , Prentice-HallIndia, 2006, 8th edition.


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**B.Sc. Physical Science**
**SEMESTER – VI**
**SPH 334: Numerical Methods Tutorial**

Hours per week: 4 Continuous Evaluation: 100 Marks
Credits: 2

Problems on absolute , relative and percentage errors

Find a root of an equation using bisection method

Find a root of an equation using the iteration method

Find a root of an equation using the method of false position

Find a root of an equation using Newton Raphson method

Solving system of simultaneous equations using Gauss elimination method

Solving system of simultaneous equations using LU decompoostion method

Solving system of simultaneous equations using Gauss-Jacobi method

Solving system of simultaneous equations using Gauss-Siedel method

Problems using Newton's forward and backward interpolation formulae

Problems using divided difference and Lagrange's interpolation formulae

Problems using Stirling's and Bessel's formulae

Problems on Trapezoidal and simpson's rules for Numerical integration

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

Evaluate solution of algebraic and transcendental equations
Understand the numerical techniques for various category of problems Evaluate problems on system of simultaneous equations
Solve problems on interpolation to estimate the function and function value. Solve problems on Numerical integration

**B.Sc. Physical Science**
**SEMESTER – VI**
**SPH 333: Complex Analysis Tutorial**

Credits: 2 Continuous Evaluation: 100 Marks

Problems on Cauchy-Riemann equations

Problems on analytical functions

Problems on contour integration

Problems on Cauchy Goursat theorem

Problems on Cauchy integral formula

Problems on Taylor's series

Problems on Laurent series

Problems on absolute and uniform convergence of power series

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

Define analytic function

Evaluate problems on analytic functions

Understand contour integration

Evaluate problems on Cauchy Goursat theorem and Cauchy integral formula

Solve problems on Taylor's series

Solve problems on Laurent series

**B.Sc. Physical Science**
**SEMESTER – VI**
**SPH 338: Linear Programming Tutorial**

Credits :2 Continuous Evaluation:100 Marks

Formulation of Linear programming problem

Graphical approach to solve LP problem

Problems on convex sets

Simplex method to solve LPP

Two Phase method to solve LPP

Big-M method to solve LPP

Formulation of dual problem

Problems on primal –dual

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

Formulate Linear Programming Model

Evaluate Linear programming problems using graphical approach

Understand convex sets with examples

Evaluate LP problems using simplex method

Solve LP problems using two phase method and Big- M method

Solve problems on primal and dual

**B.Sc. Physical Science**
**SEMESTER –VI**
**SPH 372: Microcontrollers & Applications**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

Preamble: This course was introduced to understand the basics of Microcontroller and its applications
Objective: To understand the architecture and then programme it

**UNIT- I**
**8051Architecture**
Introduction to Microcontroller - Comparison of Microcontroller& Microprocessor-8051 Microcontroller - Block diagram - I/O pins, ports and circuits - External memory - Counter and Timers -Serial data I/O - Interrupts

**Learning Outcomes:**
To understand the Functional block diagram of 8051
To know the 8051's I/O pin-out diagram

**UNIT - II**
**8051 Instruction Set**
Classification of instruction set-Addressing Modes – Logical operation: Byte level - Bit level-Rotate and Swap operation.**ARITHMETIC OPERATIONS**- Instructions affecting flags - Incrementing and Decrementing - Addition -Subtraction - Multiplication and Division - Example Programs

**Learning Outcomes:**
1.To learn the classification of instruction set and addressing modes
2. Must understand the arithmetic operations

**UNIT – III**
**Jump and Call Instruction**
Introduction - The Jump and Call program Range- Jumps: Bit - Byte Unconditional: Calls and Subroutine -Interrupts and Returns – Example programs. Time delay generation and calculation, Timer/Counter programming, accessing a specified port terminal and generating a rectangular waveform.

**Learning Outcomes:**
Able to know the range of jumps
To understand the time delay generation and calculation for waveform generation

**UNIT- IV**
**Interfacing**
Keyboards - Displays - Stepper motor - ADC & DAC

**Learning Outcomes:**
Able to understand, how to interface external devices
Writing programs for interfacing devices

**UNIT- V**

**Introduction to Other Microcontrollers**

6509 - PIC controllers -6575 series - Introduction to Embedded Systems.

**Learning Outcomes:**

To understand the functional block diagram of 6509

To know, what is an embedded system and its applications

**Course Outcomes:**

Learn the architecture of 8051, its pin diagram**(L2)**.

Learn about the microcontrollers and the organization of microcontroller based **systems** (L1).

Acquire knowledge of microcontrollers and their role in I/O port programming and their interface with peripherals**(L5)**.

Learn about analog to digital and digital to analog convertors**(L4)**.

Learn basics of programming and other controllers**(L3)**

**Text Books:**


Kenneth 1. Ayala, "The 8051 Microcontroller, Architecture, Program and Application" Pen ram International.

Muhammed Ali Mazidi, Janice GillispieMazidi "The 8051 Microcontroller and Embedded Systems" -Low PriceEdition.

Microprocessors & Microcontrollers by N. SenthiIkumar, M. Saravanan & S. Jeevananthan,1edition. Oxford press (Helpful for interfacingapplications)

Microcontrollers: Theo & App by Ajay V. Deshmuk Tata McGraw-Hill Education, 2005.


**References:**


Programming and customizing the 8051 Microcontroller- byMykePredko-TMH

Design with Microcontrollers by-J.B.PeatmaTMH

Microcontroller Hand Book, INTEL,2008.

Microprocessor, Microcontroller & Applications by D.A Godse A.P Godse Technical Publications 2008.

**B.Sc. Physical Science**
**SEMESTER –VI**
**SPH 374: VLSI Design**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

Preamble: This course was designed to learn the basics of VLSI technology

Objective: To understand various technologies of VLSI design

**UNIT- I**
**CMOS Technology**

brief History-MOS transistor, Ideal I-V characteristics, C-V characteristics, Non ideal I-V effects, DC transfer characteristics - CMOS technologies, Layout design Rules, CMOS process enhancements, Technology related CAD issues, Manufacturing issues.

**Learning Outcomes:**

To understand the MOS technology
To know the technology related issues

**UNIT - II**
**Circuit Characterization and Simulation**

Delay estimation, Logical effect and Transistor sizing, Power dissipation, Interconnect, Design margin, Reliability, Scaling- SPICE tutorial, Device models, Device characterization, Circuit characterization, Interconnect simulation.

**Learning Outcomes:**

To studyvarious device models
Must understand the simulation

**UNIT – III**
**Combinational and Sequential Circuit Design**

Circuit families -Low power logic design - comparison of circuit families - Sequencing static circuits, circuit design of latches and flip flops, Static sequencing element methodology- sequencing dynamic circuits – synchronizers

**Learning Outcomes:**

Able to know the low power logic design
To understand the circuit design

**UNIT- IV**
**CMOS Testing**

Need for testing- Testers, Text fixtures and test programs- Logic verification- Silicon debug principles- Manufacturing test - Design for testability - Boundary scan.

**Learning Outcomes:**

Able to understand, how to test devices
To know how to handle the text fixtures

**UNIT- V**

**Specification Using Verilog HDL**

Basic concepts- identifiers- gate primitives, gate delays, operators, timing controls, procedural assignments conditional statements, Data flow and RTL, structural gate level switch level modeling, Design hierarchies, Behavioral and RTL modeling, Test Benches, Structural gate level description of decoder, equality detector, comparator, priority encoder, half adder, full adder, Ripple carry adder, D latch and D flip flop.

**Learning Outcomes:**

To understand the basic concepts of VHDL language

To develop the design skills by writing the VHDL programmes

**Course Outcomes:**

To understand the MOS technology**(L2)**

Must understand the simulation process **(L1**).

Able to know the low power logic design**(L5)**.

Learn the basics of programming**(L3)**

Learn by writing the VHDL programmes**(L4)**.

**Text Books:**

Weste and Harris: CMOS VLSI DESIGN (Third edition) Pearson Education.
2.Uyemura J.P: Introduction to VLSI circuits and systems, Wiley.

**References:**

D.A Pucknell& K. Eshraghian Basic VLSI Design, Third edition, PHI
Wayne Wolf, Modern VLSI design, Pearson Education
M.J.S. Smith: Application specific integrated circuits, Pearson Education
J.Bhasker: Verilog HDL primer, BS publication
Ciletti Advanced Digital Design with the Verilog HDL, Prentice Hall of India

**B.Sc. Physical Science**
**SEMESTER – VI**
**SPH 376: Mathematical Methods and Analysis Using MATLAB**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

**UNIT I**
**Introduction to MATLAB and Graphics**
Preliminary, workspace, variables, simple arithmetic problems, symbolic calculations. Matrices, Vectors operations, Operators .Introduction to graphics: 2-D and 3-D plots, types & features, overlays, scripts and functions, M-files, special function variable loops, branch, control, flow statements, structures and cells. File handling, input and output.

**UNIT II**
**Laplace Transforms**
Signals and systems: continuous time and discrete time signals.
Laplace Transform: definition, Laplace transform of simple function, properties of
L T (linearity, shifting, change of scale), Inverse LT, partial fraction technique to find Inv of L T transfer functions.

**UNIT III**
**Laplace Transforms Applications**.
Series RC circuit, RL circuit, RLC circuit,
Poles and Zeros stability criteria, Low pass and High pass filters.
**MATLAB Exercises**
3.CT and DT signals plotting
4.To find Laplace Transform and I LT of any given
function. RC / RL/RLC (series) circuit analysis for DC input
Transfer Function, Pole and Zero stability criteria and filters

**UNIT IV**
**Fourier series and Transform**
Fourier Series Definition, Evaluation of Fourier Co-efficient, Fourier series for
Square, Triangularwaves, Half Wave, Full wave rectifiers, Fourier Transform:
Definition and examples.
**MA TLAB Exercises:**
I. To evaluate Fourier Co-efficient for given waveform function.
2. To find Fourier Transform for given function.

**UNIT V**
**Mathematical Application**
Solution of differential equation using separation of variable method (Laplace, Poisson and Schrodinger equations in Cartesian co-ordinate system),
Curve fitting (Straight line, Exponential & Cubic Spy .line) and its application to
Diode characteristics
Ohm's Law
Filters, Phasors as per AC circuits
**MATLAB Exercises**
Real root of algebraic equation, curve fitting
Diode/BJT characteristics. Ohm's law filters performance.

**Text Books:**

RudraPratap Getting Started with MA TLAB ,7th Edition Oxford University Press N Delhi
MATLAB and Simulink for engineers, Agamkumartyagi-Oxford University press.
Amos Gilat MATLAB : An introduction with applications, Wiley India
Stephen 1. Chapman MATLAB Programming for Engineers. Thomas Learning.

**Reference Books:**

G K Mittal Network Analysis KhannaPubtishers, NewDelhi
Van Valkenberg Network Analysis, 3rd Edition DorlingKindersley(Jndia) PVl Ltd.,
Umesh Sinha etwork Analysis and Synthesis Satya Prakashan. Delhi.

**B.Sc. Physical Science**
**SEMESTER –VI**
**SPH 328: Microcontrollers & Applications Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks
Credits: 2

Preamble: This course was designed to perform arithmetic, logical and interfacing programs.
Objective: The student will be able to understand then applies the written programs.

**List of Experiments**

Multiplication of two numbers using MUL Command (later using counter method for repeated addition)

Division of two numbers using DIV command (later using counter method for repeated subtraction)

Pick Largest & smallest number among a given set of numbers

Interface a DAC & Generate a stair case wave form with step duration and no. of steps as variables.

Interface a stepper motor and rotate Clockwise or anti clockwise through given angle step.

Using Keil software, write a program to pick the smallest among a given set of numbers.

Using Keil software, write a program to pick the largest among a given set of numbers.

Using Keil software, write a program to generate a rectangular wave form at a specified port terminal.

**Course Outcomes:**

After the completion of this course, the student will be able to write the programs and also controls basic interfacing devices **(L2 and L3)**

**B.Sc. Physical Science**
**SEMESTER –V**
**SPH 330: VLSI Design Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks
Credits: 2

Preamble: This course was designed to perform simulation programmes in VHDL

Objective: The student will be able to understand then applies the written programs

**List of Experiments**

Study of Simulation using tools

Design Entry and Simulation of Combinational Logic Circuits

a) Basic logic gates b) Half adder and full adder

c) Half Subtractor and full sub tractor d) 8 bit adder

3. Design Entry and Simulation of Combinational Logic Circuits

a) 4 bit multiplier b) Encoder and Decoder c) Address Decoder d) Multiplexer

4. Design Entry and Simulation of Sequential Logic Circuits

a) Flip-Flops b) Counter

Study of Synthesis tools

Place and Route and Back annotation for FPGAs

Schematic Entry and SPICE Simulation

a) CMOS Inverter b) Universal Gate c) Differential Amplifier

8. Layout of a CMOS Inverter

**Course Outcomes:**

After the completion of this course, the student will be able to write the programs to simulate basic combinational and sequential circuits **(L2 and L3)**

**B.Sc. Physical Science**
**SEMESTER – VI**
**SPH 332: MATLAB**

Hours per week: 4 Continuous Evaluation: 100 Marks

Credits: 2

**List of Experiments**

CT and DT signals plotting
To find Laplace Transform and IL T of any given function.
RC / RL/RLC (series) circuit analysis for DC input
Transfer Function, Pole and Zero stability criteria and filters
To evaluate Fourier Co-efficient for given waveform Function.
To find Fourier Transform for given function.
Real root of algebraic equation, curve fitting
Diode/BJT characteristics. Ohm's law, filters performance

**B.Sc. Physical Science**
**SEMESTER – VI**
**SPH 382: Industrial Chemicals and Environment**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

**Preamble:** With industrial development in gigantic proportions, the onus of safeguarding the environment from the hazard of the chemicals synthesis, usage and disposal lies a great deal on every individual. It becomes imperative to inculcate the education related to safe use of handling of chemicals. An understanding of the potential hazards and precautions required in handling of chemicals is of utmost importance in preventing exposure to chemicals and mishaps.

**Objective:** Individual and material safety is of utmost importance in any organization. Many times accidents take place due to unsafe working in environment. Wide ranges of chemicals are used in universities, national laboratories and industries, each with its own inherent hazards.

The course is designed to impart basic knowledge of production, uses, storage and hazards in handling industrial gases and chemicals.

Essential knowledge of the components of the environment, sources of pollution and pollutants shall be imparted to the students

**Unit I**

**Industrial Gases and Inorganic Chemicals**

Industrial Gases: Large scale production, uses, storage and hazards in handling of thefollowing gases: oxygen, nitrogen, argon, neon, helium, hydrogen, acetylene, carbon monoxide, chlorine, fluorine, sulphur dioxide and phosgene.

Inorganic Chemicals: Manufacture, application, analysis and hazards in handling thefollowing chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda, common salt, borax, bleaching powder, sodium thiosulphate, hydrogen peroxide, potash alum, chrome alum, potassium dichromate and potassium permanganate.

**Learning Outcomes**

The students will learn about the production, uses, storage and hazards in handling industrial gases and chemicals.

**Unit II**

**Environment and its segments**

Ecosystems. Biogeochemical cycles of carbon, nitrogen and sulphur.

Air Pollution: Major regions of atmosphere.Chemical and photochemical reactions in atmosphere. Air pollutants: types, sources, particle size and chemical nature; Photochemical smog: its constituents and photochemistry. Environmental effects of ozone, Major sources of air pollution.

Pollution by $SO_2$ , $CO_2$, CO, NOx, $H_2S$. Methods of estimation of CO, NOx, SOx and control procedures.

**Learning Outcomes**

The students will learn about the biogeochemical cycles in environment and air pollution : sources and pollutants

**Unit III**

Greenhouse effect and Global warming, Ozone depletion by oxides of nitrogen, chlorofluorocarbons and Halogens, removal of sulphur from coal.Control of particulates.

Water Pollution : Hydrological cycle, water resources, aquatic ecosystems, Sources andnature of water pollutants, Techniques for measuring water pollution, Impacts of water pollution on hydrological and ecosystems.

**Learning Outcomes**

The student will learn the concept of global warming.
The students will also learn about water

**Unit IV**

Water purification methods. Effluent treatment plants (primary, secondary and tertiary treatment). Industrial effluents from the following industries and their treatment: textile, tannery, dairy, petroleum and petrochemicals.

Industrial waste management, incineration of waste. Water treatment and purification (reverse osmosis, electro dialysis, ion exchange). Water quality parameters for waste water, industrial water and domestic water.

**Learning Outcomes**

The student will familiarize with water quality parameters, water and wastewater treatment and industrial waste treatment.

**Unit V**

**Energy & Environment**

Sources of energy: Coal, petrol and natural gas. Nuclear Fusion / Fission, Solar energy, Hydrogen, geothermal, Tidal and Hydel, etc.

Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its management.

**Learning Outcomes**

The student will learn about sources of energy. The students will lso learn about nuclear pollution and waste management.

**Reference Books:**


E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK.

R.M. Felder, R.W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi.

J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.

S. S. Dara: A Textbook of Engineering Chemistry, S. Chand & Company Ltd. New Delhi.

K. De, Environmental Chemistry: New Age International Pvt., Ltd, New Delhi.

S. M. Khopkar, Environmental Pollution Analysis: Wiley Eastern Ltd, New Delhi.

S.E. Manahan, Environmental Chemistry, CRC Press (2005).

G.T. Miller, Environmental Science 11th edition. Brooks/ Cole (2006).

A. Mishra, Environmental Studies. Selective and Scientific Books, New Delhi (2005).


## B.Sc. Physical Science
## SEMESTER – VI
## SPH 384: Instrumental Methods of Analysis

Hours per week: 4 — End Examination: 60 Marks
Credits: 4 — Sessionals: 40 Marks

**Preamble:** The students of undergraduate program in science need to be conversant with the various instrumental and analytical techniques in analytical chemistry for training a undergraduate students as analytical chemist.

**Objective:** The concept of qualitative and quantitative methods in analytical chemistry will be introduced to undergraduate students.

Students will also learn the fundamental concepts of various instrumental methods for quantitative analysis, separation methods and solvent extraction.

**UNIT I**

**Thermal methods of analysis**

Thermo gravimetry - theory, in-strumentation, applications with special reference to $CuSO_4$. $5H_2O$, $CaC_2O_4.H_2O$ and $CaCO_3$. Basic idea of differential thermal analysis: principle and instrumentation. Difference between TGA and DTA. Differential scanning calorimetry: principle and instrumentation.

**Learning Outcome:** The students will learn the fundamentals of thermo analytical technique.

**UNIT II**

**Flame photometry**

Theory and instrumentation. Analyses of Na, K, Ca, and Mg.

Atomic Absorption Spectrometer: Theory, instrumentation, chemical and spectral interferences, Applications

Induced couple plasma spectroscopy: Theory, Instrumentation and applications of ICP-OES

**Learning Outcome:** The student will learn the concept of atomic spectrometry for quantitative analysis

**UNIT III**

**Principles of chromatography**

Classification of different chromatographic methods, adsorption and partition isotherms, column capacity, retardation factor, retention time and retention volume, gradient elution, height equivalent theoretical plate (HETP)

High performance liquid chromatography: Theory and instrumentation: pumps, column, detectors-UV detector, refractive index detector, Fluorescence detector, photo diode array detector and applications.

Gas liquid chromatography: Theory and instrumentation: columns (packed and capillary columns), detector: thermal conductivity detector, flame ionization detector, electron capture detector, nitrogen-phosphorus detector, photo ionization detector, and applications.

**Learning Outcome:**

The students will learn about the details of a gas chromatograph and applications of gas chromatography.

**UNIT IV**

**Voltametry**

Principle of polarography residual current, migration current, diffusion current, half-wave potential, Ilkovic equation. Instrumentation: Dropping mercury electrode (DME), advantages and disadvantages of DME, qualitative and quantitative analysis of inorganic ions - Cu, Pb Cd and Zn. Anode Stripping Voltametry: Principle and instrumentation. Hanging drop mercury electrode, application in the analysis of some selected metals.

**Learning Outcome:**

The student will familiarize electro-analytical methods for chemical analysis with reference to voltametry

**UNIT V**

**X-ray Spectroscopy:**X-ray spectrometers, energy dispersive and wavelength dispersive techniques, instrumentation, matrix effects and applications.

**Learning Outcome:**
The student will learn applications and details of the X-ray spectrometer in chemical analysis.

**Text books**:

Instrumental methods of analysis - H.H. Willard, Meritt Jr. and J.A. Dean CBSPublishers and distributors, 6th edition, 1986.
Principles of instrumental analysis – Douglas A. Skoog, F. James Holler and R. Crouch, Cengage Learning, 6th edition, 2006.
Vogel's textbook of Quantitative Inorganic Analysis - J. Basset, R.C. Denney, G.H.Jeffery and J. Mendham, Prentice Hall, 6th edition, 2000
Industrial methods of analysis - B.K.Sarma, Goel Publishing House, Meerut, 1997
Instrumental methods of Analysis – G.R. Chatwal and S. Anand, Himalaya publishing House, 13th reprint, 1999.
Analytical Chemistry – S.Usha Rani, Macmillan India Limited, 2001.

**Reference Books:**

Instrumental methods of Analysis – Galen S. Ewing, Mcgraw Hill Higher Education, $5^{th}$ edition, 1985
Handbook of Instrumental techniques for Analytical Chemistry, Frank Settle, Prentice Hall, 1997.

**B.Sc. Physical Science**
**SEMESTER – VI**
**SPH 340: Industrial Chemicals & Environment Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks
Credits: 2

**Preamble:** Application of basic chemistry and chemical calculations to measure chemical, parameters of water and wastewater. Laboratory methods and interpretation of results with regard to environmental analysis are important for studying the pollution trend .

**Objective:** To introduce students to how the common environmental experiments relating to water and wastewater quality are performed. This course will help students know which tests are appropriate for given environmental problems and apply the laboratorial results to problem identification, quantification and basic solutions.

**List of Experiments**

1.Determination of dissolved oxygen in water.
Determination of Chemical Oxygen Demand (COD)
Determination of Biological Oxygen Demand (BOD)
Percentage of available chlorine in bleaching powder.
Measurement of chloride, sulphate and salinity of water samples by simple titration method ($AgNO_3$ and potassium chromate).
Estimation of total alkalinity of water samples ($CO_3^{2-}$, $HCO_3^-$) using double titration method.
Measurement of dissolved $CO_2$.
Study of some of the common bio-indicators of pollution.
Estimation of SPM in air samples.
Preparation of borax/ boric acid.

**Learning Outcome:**

Students who successfully complete this course will be able to perform environmental experiments relating to water and wastewater quality, and know which tests are appropriate for given environmental problems.

**Reference Books:**


E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK.
R.M. Felder, R.W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi.
J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.
S. S. Dara: A Textbook of Engineering Chemistry, S. Chand & Company Ltd. New Delhi.
K. De, Environmental Chemistry: New Age International Pvt., Ltd, New Delhi.
S. M. Khopkar, Environmental Pollution Analysis: Wiley Eastern Ltd, New Delhi.


**B.Sc. Physical Science**
**SEMESTER – VI**
**SPH 342: Instrumental Methods of Analysis Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks
Credits: 2

**Preamble:** The students of undergraduate program in science in Chemistry need to be conversant with the various instrumental method of analysis in chemistry. Therefore, It helps the student familiarize with the techniques essential for developing the foundation of Instrumental methods in analytical chemistry.

**Objective:** To make student learn the practical application of Instrumental methods for quantitative analysis.

To make the students learn separation methods of analysis including planar, gas and liquid chromatography.

To make students learn quantitative analysis using atomic absorption spectroscopy

**List of Experiments**

Safety Practices in the Chemistry Laboratory

Titration curve of an amino acid.

Determination of a Mixture of Cobalt and Nickel (UV/Vis spec.)

IR Absorption Spectra (Study of Aldehydes and Ketones)

Determination of Calcium, Iron, and Copper in Food by Atomic Absorption

Quantitative Analysis of Mixtures by Gas Chromatography (i.e., chloroform and carbon tetrachloride)

Separation of Carbohydrates by HPLC

Potentiometric Titration of a Chloride-Iodide Mixture

Laboratory analysis to confirm anthrax or cocaine

Detection in the field and confirmation in the laboratory of flammable accelerants or explosives

Detection of illegal drugs or steroids in athletes

Detection of pollutants or illegal dumping

At least 8-10 experiments to be performed.

**Reference Books:**

Skoog, D.A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed.

Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. Instrumental Methods of Analysis, 7th Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.

**B.Sc. Physical Science**
**SEMESTER –VI**
**SPH 392: Information Security**

Hours per week: 4 End Examination: 60 Marks

Credits: 4 Sessionals: 40 Marks

**Preamble:**
Information security (IS) is designed to protect the confidentiality, integrity and availability of computer system data from those with malicious intentions. Confidentiality, integrity and availability are sometimes referred to as the CIA Triad of information security. This course gives an overview of security issues, cryptography and public key encryption methods.

**Objectives:**

To introduce critical characteristics of Information.
To emphasize the need for security.
To elaborate security threats.
To explain classical encryption techniques.

**UNIT I**
**Introduction to Information Security**
Introduction, The History of Information Security, What Is Security? Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing Components, Balancing Information Security and Access.
**Learning Outcomes:**
By the end of this Unit, the student will be able to

Familiarize with the history of information security.

Understand balance between information security and information acess.

**UNIT II**
**Approaches to Information Security Implementation**
The Systems Development Life Cycle, The Security Systems Development Life Cycle, Security Professionals And The Organization, Is It An Art Or A Science? Information Security Terminology. **The Need For Security**: Introduction, Business Needs First, Threats, Attacks.
**Learning Outcomes:**
By the end of this Unit, the student will be able to

Illustrate Security System Life Cycle. (L2)
Know the difference between a threat and an attack. (L2)

**UNIT III**
**Overview of Security**
Protection Versus Security, Aspects Of Security – Data Integrity, Data Availability, Privacy, Security Problems, User Authentication. **Security Threats:** Program Threats, Worms, Viruses, Trojan horse, Trap Door, Stack and Buffer Overflow. **System Threats:** Intruders, Communication Threats-Tapping and Piracy.

**Learning Outcomes:**
By the end of this Unit, the student will be able to

Distinguish Protection and Security. (L3)
Identify different security threats. (L2)
Explain the System Threats. (L2)

**UNIT IV**

**Cryptography:** Classical Encryption Techniques, Substitution and Transposition Techniques.

Symmetric Key Algorithms: Data Encryption Standard, Advanced Encryption Standards.

**Learning Outcomes:**

By the end of this Unit, the student will be able to

Take part of classic Encryption Techniques. (L4)
Construct Symmetric Key Algorithms. (L3)

**UNIT V**

**Public Key Encryption:** RSA, Diffie Hellman Key Exchange, ECC Cryptography, Digital Signatures.

**Message Authentication:** MAC, Hash Functions. Message Digests, SHA, WHIRLPOOL.

**Learning Outcomes:**

By the end of this Unit, the student will be able to

Demonstrate Public Key Encryption.
(L2) Label Message Authentication. (L1)

**Text Books:**

Principles of Information Security By Michael E. Whitman And Herbert J.Mattord, Thomas India Edition, 2011.

Cryptography And Network Security Principles and Practices By William Stallings Prentice-Hall Of India ,4th Ed, 2006.

**Reference Books:**

Computer Security: Art And Science, Mathew Bishop, Addison-Wesley, 2003.

Computer Security Principles And Practice By William Stallings, Lawrie Brown, 2/E, Pearson, 2012.

**Course Outcomes:**

By the end of the course the student is able to

Identify critical characteristics of Information. The necessity of security.

Name different security threats.

Know classical encryption techniques.

Perform Message Authentication

**B.Sc. Physical Science**
**SEMESTER –VI**
**SPH 394 : Database Applications**

Hours per week: 4 — End Examination: 60 Marks
Credits: 4 — Sessionals: 40 Marks

**Preamble**

Database management has evolved from a specialized computer application to a central component of a modern computing environment. The knowledge about database systems has become an essential part of an education in computer science.

**Objectives**

To explain the purpose of data base system.
To design data base.
To build ER model.
To write SQL queries.
To write application programs in JSP

**Introduction:** Database-Systems Applications, Purpose of Database Systems, View of Data, Database Languages, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture.

After completion of this unit, student will be able to
understand database, data storage and querying.(L3)
Know about transaction management.(L2)

**Database Design and E-R Model**: Overview, Entity-Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity Relationship Diagrams, Reduction to Relational Schemas, Entity-Relationship Design Issues, Extended E-R Features, Other Aspects of Data Design. **Introduction to Relational Model:** Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Operations.

After completion of this unit, student will be able to
learn entity, relationship.(l1)
write database schema.(L2)
perform relational operations. (L3)

**Unit -III**

**SQL:** Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub queries, Modification of the Database. **Intermediate SQL:** Join Expressions, Views, Transactions, Integrity Constraints, SQL Data Types and Schemas, Authorization.

**Learning Outcomes:**

After completion of this unit, student will be able
to to perform aggregate functions.(L4)
to execute schemas .(L4)

**Advanced SQL:** Functions and Procedures, Triggers, Advanced Aggregate Features. **Query Processing:** Steps In Query Processing, Measures Of Query Cost, Selection Operation – Basic Algorithm, Selection Using Indices, Selections Involving Comparisons, Implementation of Complex Selections, Sorting, Join Operation – Nested Loop Join, Block Nested Loop Join, Evaluation of Expressions.

After completion of this unit, student will be able to
to implement triggers.(L5)
to execute nested loops.(L5)

**Unit – V**

**Application Design and Development:** Application Programs and User Interfaces, Web Fundamentals, Servlets and JSP, Application Architecture, Rapid Application Development, Application Security, Encryption and its applications.

**Learning Outcomes:**

After completion of this unit, student will be able to

Develop application programs and user interface.(L4)

Understand encryption and its applications.(L3)

**Course Outcomes:**

Upon completion of the course, the student is able to

Know about data base and its architecture. (L2)

Learn transaction management.(L2)

Use SQL Queries in retrieving data from data base. (L4)

**Text Book:**

Database System Concepts, 6th Edition,Avi Silberschatz, Henry F. Korth ,S. Sudarshan Tata McGraw-Hill,2011.

**Reference Books:**

SQL, PL/SQL- The Programming Language of Oracle Ivan Bayross , BPB, 4th Edition.

Fundamentals of Database Systems by Ramez Elmasri, Shamkant B Navathe, 7th Edition, Pearson, 2015.

**B.Sc. Physical Science**
**SEMESTER –VI**
**SPH 396: Computer Networks**

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

**Preamble**: A computer network defined as a set of computers connected together for the purpose of sharing resources. With the result of rapid technological progress in the 21st century there is a lot progress in collecting, transporting, storing, and processing information. Organizations with hundreds of offices spread over a wide geographical area routinely expect to be able to examine the current status of even their most remote outpost at the push of a button.

To introduce the connecting devices and IEEE standards
To illustrate transmission modes, Multiplexing.
To analyze network addressing.
To introduce about primary and secondary servers

**UNIT-I**

**Connecting Devices:** Passive Hubs, Repeaters, Active Hubs, Bridges, Two-Layer Switches, Routers, Three-Layer Switches, Gateway. Backbone Networks – Bus Backbone, Star Backbone, Connecting Remote LANs. Virtual LANs : Membership, Configuration, Communication Between Switches, IEEE Standard, Advantages. (10)

**Learning Outcomes:**

By the end of this Unit, the student will be able to
Summarize Hubs, repeaters, Bridges, switches. (L2)
Understand virtual LANS, IEEE standards. (L3)
Develop communication between switches. (L3)

**UNIT- II**

**Digital Transmission:** Transmission Modes - Parallel Transmission, Serial Transmission.
**Multiplexing :** Frequency Division Multiplexing, Wavelength Division Multiplexing, Synchronous Time Division Multiplexing, Statistical Time Division Multiplexing. (12)

**Learning Outcomes:**

By the end of this Unit, the student will be able to
Understand transmission modes
Infer Multiplexing

**UNIT-III**

**Network Layer :** Logical Addressing – IPv4 Addresses : Address Space, Notations, Classful Addressing, Classless Addressing, Network Address Translation. IPv6 Addresses: Structure, Address Space.
**Internet Protocol :** Internetworking , Need for Network Layer, Internet as a Datagram Network, Internet as a Connectionless Network. IPv4 : Datagram, Fragmentation, Checksum, Options. (12)

**Learning Outcomes:**

By the end of this Unit, the student will be able to

Distinguish IPv4 and IPv6 addressing modes. (L4)

Identify fragmentation and checksum. (L3)

**UNIT-IV**

**Transport Layer:** Process-to-Process Delivery - Client/Server Paradigm, Multiplexing and Demultiplexing, Connectionless versus Connection Oriented Service, Reliable Versus Unreliable, Three protocols.

**User Datagram Protocol :** Well-Known Ports for UDP, User Datagram, Checksum, UDP Operation, Use of UDP. (10)

**Learning Outcomes:**

By the end of this Unit, the student will be able to

Able to understand connectionless and connection oriented services.

Distinguish between reliable and unreliable services.

Understand the three protocols. (L3)

**UNIT-V**

**Congestion Control and Quality of Service:** Data Traffic -Traffic Descriptor, Traffic Profiles. **Congestion :** Network Performance, Congestion Control - Open Loop Congestion Control, Closed Loop Congestion Control.

**Application Layer:** Domain Name System - Name Space - Flat Name Space, Hierarchical Name Space. Domain Name Space - Label, Domain Name, Domain.

**Distribution of Name Space:** Hierarchy of Name Servers, Zone, Root Server, Primary and Secondary Servers. (10)

By the end of this Unit, the student will be able to

Outline data traffic and traffic profiles.(L2)

Distinguish open loop congestion and closed loop congestion. (L3)

Identify primary and secondary Servers. ( L4)

**Course Outcomes:**

Upon completion of the course, the student is able to

To spell how the connecting devices works.

To distinguish connection oriented and connectionless services. To describe congestion contral

**Text Book :**

Data Communication and Networking by Behrouz A Forouzan, Tata McGraw Hill, 4th Edition, 2006.

**Reference Books :**

Data and Computer Communications ,William Stallings, Pearson, 9th Edition,2013.

Computer Networks ,Andrew S. Tanenbaum, Prentice Hall, 5th Edition,2013.

**B.Sc. Physical Science**
**SEMESTER – VI**
**SPH344: Information Security Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks
Credits: 2

**List of Experiments**

Study of various cryptographic techniques

Problems on Substitution techniques.

Problems on Transposition techniques

Introduction to Unix, Vi Editor.

Usage of the following commands in unix: ls, pwd, tty, cat, who, who am I, rm, mkdir, rmdir, cd.

Usage of following commands in unix : cal, cat(append), cat(concatenate), mv, cp, man, date.

Implement Substitution technique

Implement Transposition technique

Study of Open SSL

Implement Symmetric key Algorithm – DES using open SSL

Implement Asymmetric key Algorithm – RSA using open SSL

Implement Hash Algorithm – SHA using open SSL

**Text Books:**

Cryptography and Network Security, Behrouz A. Forouzan, TMH, Special Indian Edition, 2007.

Unix Concepts and Applications, Sumitabha Das, 4th Edition, TMH,2006.

**Reference Books:**

Introduction to Unix and Shell Programming by M.G. Venkateshmurthy, Pearson, 1st Edition, 2005.

**B.Sc. Physical Science**
**SEMESTER – VI**
**SPH346: Database Applications Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks
Credits: 2

**List of Experiments**

Perform Table Creation using SQL.

Perform Insertion, Deletion, Updation using SQL.

Perform Table Creation using Constraints Specification.

Perform Simple SQL Queries.

Perform Simple Queries using Logical operators.

Perform Simple queries using Date functions.

Perform Simple queries using String Functions.

Perform Simple PL/SQL program.

Perform PL/SQL programs using if, for, while.

Perform Grant, Revoke privileges.

Perform Programs on Exception Handling.

Create a Database- define Procedures, Functions, Triggers.

**Text Books:**

1.SQL, PL/SQL- The Programming Language Of Oracle, Ivan Bayross , BPB, 4th Ed. 2010.
2.Oracle Database 11g- The Complete Reference , Kevin Loney, TMH, Indian Edition, 2008.

**B.Sc. Physical Science**
**SEMESTER – VI**
**SPH 348: Computer Networks Lab**

Hours per week: 4 Continuous Evaluation: 100 Marks
Credits: 2

**List of Experiments:**

Study of Network Devices in detail.
Study of different types of Network Cables and practically implement the cross-wired cable and straight cabling.
Study of Network IP.
Study of Basic Network Commands and Network Configuration commands.
Network Sharing.
Connect Two Computers (One to One).
Connect Computers in a LAN.
Configuring a Switch.
Client – Server configuration.
Study of Network tools.

**B.Sc. Physical Science**
**SEMESTER –VI**
**SSE 372: Basic Instrumentation Skills – II**

Hours per week: 2 Sessionals: 100 Marks
Credits: 2

Preamble: This course was designed to learn the instrumentation skills

Objective: Able to handle various instruments

**UNIT- I**

Signal Generators and Analysis Instruments: Block diagram, explanation and specifications of low frequency signal generators. Pulse generator, and function generator. Brief idea for testing, specifications, Distortion factor meter, wave analysis

**Learning Outcomes:**

To understand signal generation instruments
To know their specifications

**UNIT - II**

Impedance Bridges: Block diagram of bridge, working principles of basic balancing type) RLC bridge, Specifications of RLC bridge

**Learning Outcomes:**

1.To study different bridge circuits
2. Must understand their operation

**UNIT – III**

Q-Meters: Block diagram &working principles of a Q-Meter, Digital LCR bridges.

**Learning Outcomes:**

Able to understand the block diagrams
To know their principle of working

**UNIT- IV**

Digital Instruments: Principle and working of digital meters. Comparison of analog &digital instruments, Characteristics of a digital meter, working principles of digital voltmeter

**Learning Outcomes:**

Able to understand thedigital technology
To know how to handle the digital instruments

**UNIT- V**

Digital Multimeter: Block diagram and working of a digital multimeter working principle of time interval, frequency and period measurement using universal counter/ frequency counter, time-base stability, accuracy and resolution.

**Learning Outcomes:**

To understand the basic concepts of digital multimeter
To develop the skills to make measurements using digital multimeter

**Course Outcomes:**

To understand signal generation instruments **(L2).**

Must understand the operation of various instruments **(L1**).

To study different bridge circuits **(L5)**.

Able to know the digital technology **(L3).**

To know how to handle the digital instruments **(L4)**.

**Reference Books:**


A text book in Electrical Technology -B L Theraja -S Chand and Co.

Performance and design of AC machines -M G Say ELBS Edn.

Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.

Logic circuit design, Shimon P. Vingron, 2012, Springer.

Digital Electronics, SubrataGhoshal, 2012, Cengage Learning.

Electronic Devices and circuits, S. Salivahanan& N.S. Kumar, 3rd Ed., 2012, Tata McGraw Hill.

Electronic circuits: Handbook of design and applications, U. Tietze, Ch. Schenk, 2008, Springer

8. Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India

**B.Sc. Physical Science**
**SEMESTER – VI**
**SSE 374 :Pesticide Chemistry**

Credits :2 Continuous Evaluation:100 Marks

General introduction to pesticides (natural and synthetic), benefits and adverse effects, changing concepts of pesticides, structure activity relationship, synthesis and technical manufacture and uses of representative pesticides in the following classes: Organochlorines (DDT, Gammexene,); Organophosphates (Malathion, Parathion ); Carbamates (Carbofuran and carbaryl); Quinones ( Chloranil), Anilides (Alachlor and Butachlor).

**B.Sc. Physical Science**
**SEMESTER – VI**
**SSE 376: Transportation and Game Theory**

Credits: 2 Continuous Evaluation:100 Marks

Transportation problem and its mathematical formulation, northwest-corner method,Least costmethod and Vogel approximation method for determination of starting basic solution, algorithm for solving transportation problem.

Non- Degeneracy and Degeneracy in transportation Problems.

Assignment problem and its mathematical formulation, Hungarian method for solving assignment problem, Travelling Salesman Problem.

Game theory: formulation of two person zero sum games, solving two person zero sum games, games with mixed strategies, Dominance principle, Graphical solution procedure.

Game theory: Mixed strategies using Linear Programming techniques, Algebric Methods, Matrix method and short cut method.

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**Text Books :**

"Linear Programming and Network Flows" by Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali ,John Wiley and Sons, India, 2004, 2nd edition.

Introduction to Operations Research ,Frederick S. Hiller and Gerald J. Lieberman, Tata McGraw Hill, Singapore, 2009, 9th edition.

Operations Research: An Introduction, Hamdy A. Taha PHI 2006, 8th edition.

**Course Learning Outcomes:**

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

Develop a transportation model

Evaluate non- Degeneracy and Degeneracy in transportation Problems

Explain assignment problem and its mathematical formulation and travelling salesman problem

Understand concept of two person zero sum games

Evaluate mixed strategies using linear programming techniques

**B.Sc. Physical Science**
**SEMESTER – VI**
**SSE 378: Graph Theory**

Credits :2 Continuous Evaluation:100 Marks

Definition, examples and basic properties of graphs, pseudo graphs.
Complete graphs, bi- partite graphs, isomorphism of graphs

Paths and circuits Eulerian circuits, Hamiltonian cycles, the adjacency matrix

Weighted graph, Spanning trees, Kruskal's algorithm ,Travelling salesman's problem
Shortest path algorithms :Dijkstra's algorithm, Floyd- Warshall algorithm.

**Text Books:**

Discrete Mathematics with Graph Theory, Edgar G. Goodaire and Michael M. Parmenter, Pearson Education (Singapore) P. Ltd., Indian Reprint, 2003,2nd edition.
Applied Abstract Algebra,Rudolf Lidl and Gunter Pilz, Springer (SIE), Indian reprint,2004, 2nd edition .

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

Define graph and its properties
Explain different types of graphs
Explain Eulerian circuits and Hamiltonian cycles
Understand kruskal's algorithm to find minimum spanning tree
Evaluate problems on Dijkstra's algorithm

**B.Sc. Physical Science**
**SEMESTER – VI**
**SSE 380 : Concepts of Ethical Hacking**

Credits :2 Continuous Evaluation:100 Marks

Ethical Hacking overview - Hacking Laws - Footprinting - Google Hacking – Scanning – Enumeration -System Hacking - Trojans and Backdoors -Viruses and Worms - Sniffers - Social Engineering -Denial of Service - Buffer Overflows -Web Servers and Applications - Hacking Wireless Networks - Cryptography - Hacking with Linux - IDS, Firewalls, Honeypots - Penetration Testing.

**Text Books:**

Hands-On Ethical Hacking and Network Defense – By Michael T. Simpson, Kent Backman, James Corley , Cengage Learning, 2010.

Official Certified Ethical Hacker Review Guide – By Steven DeFino, Barry Kaufman, Nick Valenteen, Cengage Learning, 2009.

The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy By Patrick Engebretson ,Second Edition 2013.