

GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT (GITAM)

(Deemed to be University, Estd. u/s 3 of UGC Act 1956)

VISA KHAPATNAM *HYDERABAD *BENGALURU

Accredited by NAAC with 'A' Grade



REGULATIONS AND SYLLABUS

of

Bachelor of Science

in

PHYSICAL SCIENCE

(Maths, Physics, Chemistry/Electronics/Comp.Science)

(w.e.f. 2016-17 admitted batch)

Website: www.gitam.edu

B.Sc. PHYSICAL SCIENCE REGULATIONS

(W.e.f. 2016-17 admitted batch)

1.0 ADMISSIONS

Admissions into B.Sc. Physical Science program of GITAM University are governed by GITAM University admission regulations.

2.0 ELIGIBILITY CRITERIA

- 2.1 A pass in Intermediate with Maths, Physics and Chemistry and with a minimum aggregate of 50% marks or any other equivalent Examination approved by GITAM University.
- 2.2 Admissions into B.Sc. Physical Science will be based on the marks obtained in intermediate or equivalent examination and the rule of reservation, wherever applicable.

3.0 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.

4.0 STRUCTURE OF THE PROGRAMME

- 4.1 The program consists of:
 - (i) Ability enhancement compulsory core courses (AECC)
 - (ii) Core Courses (compulsory) (CC)
 - (iii) Discipline specific electives (DSE)
 - (iv) Discipline Specific Core (DSC)
 - (v) Open electives are of general nature either related or unrelated to the discipline.
 - (vi) 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.
 - Two credits for three hours of practicals.
- 4.4 The curriculum of six semesters B.Sc. Physical Science program is designed to have a total of 140 credits for the award of B.Sc. Physical Science degree.

5.0 MEDIUM OF INSTRUCTION:

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

6.0 REGISTRATION

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

7.0 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 the end - semester examination and he/she will not be allowed to register for subsequent semester of study. He /She have to repeat the semester along with his / her juniors.
- 7.2 However, the Vice Chancellor on the recommendation of the Principal/ Director of the University College / Institute may condone the shortage of attendance to the students whose attendance is between 66% and 74% on genuine medical grounds and on payment of prescribed fee.

8.0 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 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.
- 8.2.1 Practical/ Viva voce/ Seminar 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) Two mid semester examinations shall be conducted for 15 marks each. (ii) 5 marks are allocated for quiz. (iii) 5marks are allocated for assignments.
		60	Semester-end examination	The semester-end examination shall be for a maximum of 60 marks.
	Total	100		
2	Practicals	40	Continuous evaluation	Forty (40) marks for continuous evaluation is distributed among the components: regularity, preparation for the practical, performance, submission of records and oral presentations in the laboratory. Weightage for each component shall be announced at the beginning of the Semester.
		60	Continuous evaluation	Sixty (60) marks for two tests of 30 marks each (one at the mid-term and the other towards the end of the Semester) conducted by the concerned lab Teacher and another faculty member of the department who is not connected to the lab, as appointed by the HoD.
	Total	100		

9.0 REAPPEARANCE

9.1 A student who has secured 'F' grade in a Theory course shall have to reappear at the subsequent semester end examinations held for that course.

9.1.1 A student who has secured 'F' grade in a Practical course shall have to attend Special Instruction Classes held during summer.

9.1.2 A student who has secured 'F' Grade in Project work / Industrial Training etc shall have to improve his/her report and reappear for Viva – voce at the time of Special Examination to be conducted in the summer vacation.

10.0 SPECIAL EXAMINATION

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

11.0 BETTERMENT OF GRADES

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 Theory courses of any Semester of his/her choice, conducted in Summer Vacation along with the Special Examinations. Betterment of Grades is permitted 'only once' immediately after completion of the program of study.

12.0 GRADING SYSTEM

- 12.1 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	-

- 12.2 A student who earns a minimum of 4 grade points (P grade) in a course is declared to have successfully completed the course, and is deemed to have earned the credits assigned to that course, subject to securing a GPA of 5 for a Pass in the semester.

13.0 GRADE POINT AVERAGE

- 13.1 A Grade Point Average (GPA) for the semester/trimester will be calculated according to the formula:

$$\text{GPA} = \frac{\sum [C \times G]}{\sum C}$$

Where

C = number of credits for the course,

G = grade points obtained by the student in the course.

- 13.2 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.
- 13.3 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

Distinction	$\geq 8.0^*$
First Class	≥ 7.0
Second Class	≥ 6.0
Pass	≥ 5.0

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

14.0 ELIGIBILITY FOR AWARD OF THE B.Sc. DEGREE

- 14.1 Duration of the program: A student is ordinarily expected to complete B.Sc. program in six semesters of three years. However a student may complete the program in not more than five years including study period.
- 14.2 However the above regulation may be relaxed by the Vice Chancellor in individual cases for cogent and sufficient reasons.
- 14.3 A student shall be eligible for award of the B.Sc Degree if he / she fulfills all the following conditions.
- a) Registered and successfully completed all the courses and projects.
 - b) Successfully acquired the minimum required credits as specified in the curriculum corresponding to the branch of his/her study within the stipulated time.
 - c) Has no dues to the Institute, hostels, Libraries, NCC / NSS etc, and
 - d) No disciplinary action is pending against him / her.
- 14.4 The degree shall be awarded after approval by the Academic Council

15.0 Discretionary Power:

Notwithstanding 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, ELECTRONICS, MATHEMATICS)

Course Code	Subject	Category	Instruction Hours/week		Credits	Scheme of Instruction		
			L	P		CE	SE	Total Marks
SFC 101	English Communication Skills	AECC	3	0	2	40	60	100
SPH 103	Mechanics	CC	4	0	4	40	60	100
SPH 123	Mechanics Lab	PPC	0	3	2	100	--	100
SPH 107	Basic Circuit Theory	CC	4	0	4	40	60	100
SPH 127	Basic Circuits Lab	PPC	0	3	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, CHEMISTRY, MATHEMATICS)

Course Code	Subject	Category	Instruction Hours/week		Credits	Scheme of Instruction		
			L	P		CE	SE	Total Marks
SFC 101	English Communication Skills	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	3	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	3	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 Communication Skills	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	3	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	3	2	100	--	100

II Semester

B. Sc. Physical Science (PHYSICS, ELECTRONICS, MATHEMATICS)

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	3	2	100	--	100
SPH 108	Electronic Devices & Circuits	CC	4	0	4	40	60	100
SPH 126	Electronic Devices & Circuits Lab	PPC	0	3	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, CHEMISTRY, MATHEMATICS)

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	3	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	3	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	3	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	3	2	100	--	100

III SEMESTER

B. Sc. Physical Science (PHYSICS, ELECTRONICS, MATHEMATICS)

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	3	2	100	--	100
SPH 207	Digital Electronics	CC	4	0	4	40	60	100
SPH 227	Digital Electronics Lab	PPC	0	3	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
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

B. Sc. Physical Science (PHYSICS, CHEMISTRY, MATHEMATICS)

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	3	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	3	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
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

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	3	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	3	2	100	--	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, ELECTRONICS, MATHEMATICS)

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	3	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	3	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

B. Sc. Physical Science (PHYSICS, CHEMISTRY, MATHEMATICS)

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	3	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	3	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

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	3	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	3	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, ELECTRONICS, MATHEMATICS)

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 353**	Nuclear and Solid State Physics	DSE	4	0	4	40	60	100
SPH 355***	Electronic Devices and Circuits	DSE	4	0	4	40	60	100
Choose any one (*corresponding to theory course)								
SPH321*	Modern Physics lab	PPC	0	3	2	100	--	100
SPH323**	Nuclear and solid state physics lab	PPC	0	3	2	100	--	100
SPH325***	Electronic Devices & circuits Lab	PPC	0	3	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	3	2	100	--	100
SPH 329\$\$	Electronic communications lab	PPC	0	3	2	100	--	100
SPH 331\$\$\$	Consumer electronics lab	PPC	0	3	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, CHEMISTRY, MATHEMATICS)

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 353**	Nuclear and Solid State Physics	DSE	4	0	4	40	60	100
SPH 355***	Electronic Devices and Circuits	DSE	4	0	4	40	60	100
Choose any one (*corresponding to theory course)								
SPH321*	Modern Physics lab	PPC	0	3	2	100	--	100
SPH323**	Nuclear and solid state physics lab	PPC	0	3	2	100	--	100
SPH325***	Electronic Devices & circuits Lab	PPC	0	3	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	3	2	100	--	100
SPH 341 ^{##}	Green chemistry lab	PPC	0	3	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 353**	Nuclear and Solid State Physics	DSE	4	0	4	40	60	100
SPH 355***	Electronic Devices and Circuits	DSE	4	0	4	40	60	100
Choose any one (*corresponding to theory course)								
SPH321*	Modern Physics lab	PPC	0	3	2	100	--	100
SPH323**	Nuclear and solid state physics lab	PPC	0	3	2	100	--	100
SPH325***	Electronic Devices & circuits Lab	PPC	0	3	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	3	2	100	--	100
SPH345&&	Cryptography Lab	PPC	0	3	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, ELECTRONICS, MATHEMATICS)

Course Code	Subject	Categor y	Instruction Hours/week		Credit s	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 354**	Materials Science	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	3	2	100	--	100
SPH324**	Materials Science Lab	PPC	0	3	2	100	--	100
SPH326***	Electronic Communications Lab	PPC	0	3	2	100	--	100
Choose any one								
SPH371	Microcontrollers& Applications	DSE	4	0	4	40	60	100
SPH373	VLSI Design	DSE	4	0	4	40	60	100
SPH375	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	3	2	100	--	100
SPH 330\$\$	VLSI design Lab	PPC	0	3	2	100	--	100
SPH 332\$\$\$	MATLAB	PPC	0	3	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, CHEMISTRY, MATHEMATICS)

Course Code	Subject	Categor y	Instruction Hours/week		Credit s	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 354**	Materials Science	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	3	2	100	--	100
SPH324**	Materials Science Lab	PPC	0	3	2	100	--	100
SPH326***	Electronic Communications Lab	PPC	0	3	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	3	2	100	--	100
SPH 342 ^{##}	Instrumental methods of analysis Lab	PPC	0	3	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 354**	Materials Science	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	3	2	100	--	100
SPH324**	Materials Science Lab	PPC	0	3	2	100	--	100
SPH326***	Electronic Communications Lab	PPC	0	3	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	3	2	100	--	100
SPH346&&	Database applications Lab	PPC	0	3	2	100	--	100
SPH348&&	Computer networks Lab	PPC	0	3	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 COMMUNICATION SKILLS

No. of hours per week: 03

Credits: 02

UNIT- I

Textual Lessons 1 & 2
Synonyms & Antonyms, One word substitutes,
Words often confused, Phrasal Verbs

UNIT- II

Textual Lesson–3
Foreign Phrases, Tenses, Concord

UNIT –III

Textual Lesson - 4
Error Analysis, Single Sentence Definition, Paragraph Writing

UNIT -IV

Textual Lesson - 5
Essay Writing, Dialogue Writing, Reading Comprehension

UNIT- V

Textual Lesson–6
Note Making, Precis Writing

Text Books:

Part – 1 (Communicate Units 1 to 6 only) of Creative English for Communication, N.Krishna Swamy & Sriraman. Macmillan India Ltd (2005 version)

Supplementary Reading:

Current English for Colleges, N. Krishna Swamy & T. Sri Raman. Macmillan.
Examine your English Margaret Maison, Macmillan.

B.Sc. Physical Science

SEMESTER –I

SPH 103 :Mechanics

No. of hours per week: 04

Credits: 04

UNIT -I

Vector Analysis(13 hrs)

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.

UNIT – II

Mechanics of particles (10 hrs)

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.

UNIT - III (16 hrs)

Mechanics of Rigid bodies : 8 hrs

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.

Mechanics of continuous media : 8 hrs

Elastic constants of isotropic solids and their relation, Poisson's ratio and expression for Poisson's ratio in terms of γ , n , k . Classification of beams, types of bending, point load, distributed load, shearing force and bending moment, sign conventions.

UNIT IV (10 hrs)

Complex vibrations

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

UNIT V(17hrs)

Vibrating strings and Bars

Transverse wave propagation along a stretched string, general solution of wave equation and its significance, modes of vibration of stretched string clamped at ends, overtones and harmonics. 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.

TEXT BOOKS

1. B.Sc Physics Vol.1, Telugu Academy, Hyderabad
2. Mechanics & Properties of Matter, J.C. Upadhyaya, *Himalaya Publishing House, Mumbai, 2015.*
3. Unified Physics Vol.1, Mechanics, Waves & Oscillations, S.L.Gupta and Sanjeev Gupta, Jai Prakash Nath & Co., Meerut

REFERENCE BOOKS:

1. Fundamentals of Physics Vol. I - Resnick-Halliday-Krane, *Wiley India 2007*
2. College Physics-I. T. Bhimasankaram and G. Prasad. *Himalaya Publishing House.*
3. University Physics-FW Sears, MW Zemansky & HD Young, *Narosa Publications, Delhi*
4. Mechanics, S.G.Venkatachalapathy, *Margham Publication, 2003*

B.Sc. Physical Science
SEMESTER –I

SPH 123 :Mechanics Lab

Work load: 3 hrs / week

Credits: 2

1. Determination of 'g' by compound/bar pendulum
2. Simple pendulum normal distribution of errors-estimation of time period and the error of the mean by statistical analysis
3. Determination of the elastic constants of the material of a flat spiral spring.
4. Determination of moment of inertia of a cylindrical rod -bifilar suspension
5. Verification of laws of vibrations of stretched string –sonometer
6. Determination of velocity of transverse wave along a stretched string-sonometer
7. Determination of frequency of a bar –Melde's experiment.
8. Viscosity of liquid by logarithmic decrement method
9. Bifilar suspension –moment of inertia.
10. Rigidity modulus of material of a wire-dynamic method (torsional pendulum)
11. Fly-wheel
12. Determination of Y of bar –cantilever.

**B.Sc. Physical Science
SEMESTER –I**

SPH 107 : BASIC CIRCUIT THEORY

No. of hrs/week: 4

Credits: 4

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.

UNIT - II (12hrs)

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.

UNIT- III (12hrs)

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.

UNIT - IV (10hrs)

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.

UNIT- V (12hrs)

CATHODE RAY OSCILLOSCOPE

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

TEXTBOOKS:

1. Electric circuits by David A. Bell 7th edition Oxford higher education
2. Robert L Boylestad, "Introductory circuit analysis", Universal Book Stall Fifth edition,2003.
3. Circuit analysis byP.Gnanasivam-Pearson education.

REFERENCE BOOKS

1. Networks, lines&fields by Ryder-PHI
2. Circuits and Networks-A.Sudhakar and Shyammohan-TMH
3. Unified electronics (Circuit analysis and electronic devices) by Agarwal-Arora.

**B.Sc. Physical Science
SEMESTER –I**

SPH 127 : BASIC CIRCUITS LAB

No. of hrs/week:3

Credits: 2

(Any six experiments should be done)

1. Measurement of D.C&A.C voltage, frequency using CRO.
2. Thevenin's theorem - Verification.
3. Norton's theorem - Verification.
4. Maximum power transfer theorem - Verification.
5. CR Circuit - Frequency response (Low pass and High pass)
6. LR Circuit- Frequency response (Low pass and High pass)
7. LCR Series resonance circuit - frequency response, Determination of Q and Band width
8. LCR parallel resonance circuit - frequency response, Determination of Q and Band width.
9. Verification of Kirchhoff's laws.

4.

LAB MANUAL

1. Zbar, Malvino and Miller. Basic Electronics, A Text Lab Manual, Tata McGraw. Hill.

B.Sc. Physical Science SEMESTER –I

SPH 101 :Differential Calculus

No. of hrs/week: 4

Credits: 4

UNIT-I

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

UNIT-II

Partial differentiation, Euler's theorem on homogeneous functions.

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.

UNIT-IV

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

UNIT-V

Taylor's series, Maclaurin's series of $\sin x$, $\cos x$, e^x , $\log(1+x)$, $(1+x)^m$, Maxima and Minima, Indeterminate forms.

Books Recommended :

1. "Elements of Real Analysis" by Shanthi Narayan and Dr. M.D. Raisinghania, published by S.Chand & Company Ltd., New Delhi
2. "A Text Book of B.Sc. Mathematics Volume-II" by V.Venkateswara Rao, N Krishna Murthy, B.V.S.S. Sarma and S. Anjaneya Sastry, published by S.Chand & Company Ltd., New Delhi.
3. "Calculus Single Variable" by Howard Anton, Irl Bivens and Stephen Davis, published by John Wiley and Sons, Inc., 2002.
4. "Calculus and Analytic Geometry" by George B. Thomas, Jr. and Ross L. Finney, published by Pearson Education, 2007, 9th edition.

B.Sc. Physical Science SEMESTER –I

SPH 105: ATOMIC STRUCTURE, BONDING, GENERAL ORGANIC CHEMISTRY & ALIPHATIC HYDROCARBONS

No. of hrs/week: 4

Credits: 4

Section A: Inorganic Chemistry-1

UNIT-I

Atomic Structure: Review of: Bohr's theory and its limitations, dual behaviour of matter and 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 ψ and ψ^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.

UNIT-II

Chemical Bonding and Molecular Structure

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

Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, 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^+ .

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.

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's synthesis, from Grignard reagent. *Reactions:* Free radical Substitution: Halogenation.

UNIT- V

Alkenes: (Upto 5 Carbons) *Preparation:* Elimination reactions: Dehydration of alkenes and dehydrohalogenation 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 CaC₂ and conversion into higher alkynes; 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.

Reference Books:

1. Lee, J.D. *Concise Inorganic Chemistry* ELBS, 1991.
2. Cotton, F.A., Wilkinson, G. & Gaus, P.L. *Basic Inorganic Chemistry*, 3rd ed., Wiley.
3. Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. *Inorganic Chemistry: Principles of Structure and Reactivity*, Pearson Education India, 2006.
4. McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.
5. Sykes, P. *A Guidebook to Mechanism in Organic Chemistry*, Orient Longman, New Delhi (1988).
6. Eliel, E.L. *Stereochemistry of Carbon Compounds*, Tata McGraw Hill education, 2000.
7. Finar, I.L. *Organic Chemistry* (Vol. I & II), E.L.B.S.
8. Morrison, R.T. & Boyd, R.N. *Organic Chemistry*, Pearson, 2010.
9. 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**

No. of hrs/week:3

Credits: 2

Section A: Inorganic Chemistry - Volumetric Analysis

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
2. Estimation of oxalic acid by titrating it with KMnO_4 .
3. Estimation of water of crystallization in Mohr's salt by titrating with KMnO_4 .
4. Estimation of Fe (II) ions by titrating it with $\text{K}_2\text{Cr}_2\text{O}_7$ using internal indicator.
5. Estimation of Cu (II) ions iodometrically using $\text{Na}_2\text{S}_2\text{O}_3$.

Section B: Organic Chemistry

1. Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing upto two extra elements)
2. Separation of mixtures by Chromatography: Measure the R_f value in each case (combination of two compounds to be given)
 - (a) 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
 - (b) Identify and separate the sugars present in the given mixture by paper chromatography.

Reference Books:

1. Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012.
2. Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009.
3. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., *Textbook of Practical Organic Chemistry*, Prentice-Hall, 5th edition, 1996.
4. 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++

No. of hrs/week: 4

Credits: 4

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.

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.

UNIT -III

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

UNIT- IV

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

UNIT- V

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

Books Recommended

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

Reference Books:

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

No. of hrs/week: 3

Credits: 2

1. Write a C++ program to demonstrate the usage of data types & operators.
2. Write a C++ program to demonstrate Class and Object.
3. Write a C++ program to demonstrate Control structures.
4. Write a C++ program to demonstrate operator overloading.
5. Write a C++ program to demonstrate function overloading using Arrays.
6. Write a C++ program to demonstrate different types of Arrays.
7. Write a C++ program to demonstrate Constructors and Constructor overloading.
8. Write a C++ program to demonstrate Copy constructor and Destructor.
9. Write a C++ program to demonstrate Single Inheritance, Multiple Inheritance.
10. Write a C++ program to demonstrate Multi level Inheritance, Hierarchal Inheritance.
11. Write a C++ program to demonstrate Pointers.
12. Write a C++ program to demonstrate Run time polymorphism and Compile time Polymorphism.

Books Recommended

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

Reference Books:

1. 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

No. of hours per week: 03

Credits: 02

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)

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

UNIT-III

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.

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 Forest conservation act.

UNIT-V

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

Text Books:

1. Text Book of Environmental studies for Undergraduate courses by Bharucha Erach Published by V.G.C
2. Environmental Science: A Global Concern by William P.Cunningham and Baraba Woodworth Saigo.
3. A text book of Environmental Science by P.C.Joshi
4. A text book of Environmental Science by Arvind Kumar
5. A text book of Environmental Science by S.C.Santra
6. Ecology & Environment by P.D.Sharma

**B.Sc. Physical Science
SEMESTER –II**

SPH 104 :Waves and Optics

No. of hrs/week: 4

Credits: 4

UNIT- I (12 hrs)

Superposition of Two Collinear Harmonic oscillations: Linearity and Superposition Principle. (1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats).

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

Waves Motion- General: Transverse waves on a string. Travelling and standing waves on a string. Normal Modes of a string. Group velocity, Phase velocity. Plane waves. Spherical waves, Wave intensity.

UNIT-II (14 hrs)

Interference:

Principle of superposition-coherence-temporal coherence and spatial coherence-conditions for interference of light. Oblique incidence of a plane wave on a thin film due to reflected and transmitted light (cosine law) –colors of thin films-Non reflecting films-interference by a plane parallel film illuminated by a point source- 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.

UNIT- III (12 hrs)

Diffraction:

Introduction, distinction between Fresnel and Fraunhofer diffraction, Fraunhofer diffraction – Diffraction due to single slit and circular aperture-Limit of resolution-Fraunhofer diffraction due to double slit-Fraunhofer diffraction pattern with N slits (diffraction grating). Resolving power of grating-Determination of wavelength of light in normal and oblique incidence methods using diffraction grating.

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

UNIT -IV(10 hrs)

Polarisation:

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, analysis of light by Laurent's half shade polarimeter-Babinet's compensator.

UNIT -V (12 hrs)

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, principles of fiber communication (qualitative treatment only), advantages of fiber optic communication.

TEXT BOOKS:

1. BSc Physics, Vol.2, Telugu Academy, Hyderabad
2. A Text Book of Optics-N Subramanyam, L Brijlal, S.Chand& Co.
3. Unified Physics Vol.II Optics & Thermodynamics – Jai Prakash Nath&Co.Ltd., Meerut

REFERENCE BOOKS:

1. Optics,F..A. Jenkins and H.G. White, Mc Graw-Hill
2. Optics, AjoyGhatak,Tata Mc Graw-Hill.
3. Fundamentals of Physics. Halliday/Resnick/Walker.C. Wiley India Edition 2007
4. Introduction of Lasers – Avadhanulu, S.Chand& Co.
5. Fundamentals of Optics, H.R. Gulati and D.R. Khanna, 1991, R. Chand Publication
6. Principles of Optics- BK Mathur, Gopala Printing Press, 1995

B.Sc. Physical Science
SEMESTER –II

SPH 122 : Waves and OpticsLab

No. of hrs/week: 3

Credits: 2

1. Determination of radius of curvature of a given convex lens-Newton's rings.
2. Resolving power of grating.
3. Study of optical rotation –polarimeter.
4. Dispersive power of a prism.
5. Determination of wavelength of light using diffraction grating- minimum deviation method.
6. Wavelength of light using diffraction grating-normal incidence method.
7. Refractive index of a liquid-hallow prism
8. Determination of thickness of a thin fiber by wedge method
9. Spectrometer- i-d curve.
10. Determination of wavelength-Hartmann formula (prism)

B.Sc. Physical Science
SEMESTER –II

SPH 108 :ELECTRONIC DEVICES & CIRCUITS

No. of hrs/week: 4

Credits: 4

UNIT- I (12 hrs)

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.

UNIT- II (16 hrs)

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 current amplifier. The C.E amplifier-analysis and parameters, Transistor as a switch.

UNIT - III (12 hrs)

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.

UNIT - IV (8 hrs)

PHOTO ELECTRIC DEVICES:

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

UNIT - V (12 hrs)

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).

TEXTBOOKS

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

REFERENCE BOOKS

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

**B.Sc. Physical Science
SEMESTER –II**

SPH 126 : ELECTRONIC DEVICES & CIRCUITS LAB

No. of hrs/week: 3

Credits: 2

1. V-I Characteristics of Junction Diode.
2. V-I Characteristics of Zener Diode.
3. Regulated Power Supply using Zener Diode.
4. IC Regulated Power Supply
5. BJT input and output Characteristics (CE Configuration) and determination of h-parameters.
6. Characteristics of UJT.
7. Characteristics of JFET
8. LDR characteristics
9. Characteristics of L and π section filters using full wave rectifier.

LAB MANUAL

1. Zbar, Malvino and Miller, Basic Electronics, A Text Lab Manual, Tata McGraw Hill.
2. Sugaraj Samuel R., Horsley Solomon, B.E.S. Practicals.

B.Sc. Physical Science
SEMESTER –II

SPH 102 :Differential Equations

No. of hrs/week: 4

Credits: 4

UNIT-I

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

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

UNIT-IV

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

UNIT-V

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

Books Recommended

1. "A Text Book of B.Sc. Mathematics Volume-I" by V.Venkateswara Rao , N Krishna Murthy, B.V.S.S. Sarma and S. Anjaneya Sastry, published by S.Chand & Company Ltd., New Delhi.
2. "Differential Equations" by Shepley L. Ross 3rd Edition, published by John Wiley and Sons, 1984
3. "Elements of Partial Differential Equations" by Ian N Sneddon, International Edition, 1967, published by Dover Publications.

**B.Sc. Physical Science
SEMESTER –II**

**SPH 106 : CHEMICAL ENERGETICS, EQUILIBRIA & FUNCTIONAL ORGANIC
CHEMISTRY**

No. of hrs/week: 4

Credits: 4

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 K_p , and K_c

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

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 and sulphonation. 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's ether synthesis: Elimination vs substitution.

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: KNH_2/NH_3 (or $NaNH_2/NH_3$).

Alcohols: Preparation: Preparation of 1° , 2° and 3° alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters.

Reactions: With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk. $KMnO_4$, acidic dichromate, conc. HNO_3). Oppeneauer oxidation **Diols:** (Upto 6 Carbons) oxidation of diols. Pinacol-Pinacolone rearrangement.

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): (Formaldehyde, acetaldehyde, acetone and benzaldehyde)

Preparation: from acid chlorides and from nitriles.

Reactions – Reaction with HCN , ROH , $NaHSO_3$, NH_2-G derivatives. Iodoform test. Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation. Clemensen reduction and Wolff Kishner reduction. Meerwein-Ponndorf Verley reduction.

Reference Books:

1. Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. *Organic Chemistry*, John Wiley & Sons (2014).
2. McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.
3. Sykes, P. *A Guidebook to Mechanism in Organic Chemistry*, Orient Longman, New Delhi (1988).
4. Finar, I.L. *Organic Chemistry* (Vol. I & II), E.L.B.S.
5. Morrison, R.T. & Boyd, R.N. *Organic Chemistry*, Pearson, 2010.
6. Bahl, A. & Bahl, B.S. *Advanced Organic Chemistry*, S. Chand, 2010.
7. Barrow, G.M. *Physical Chemistry* Tata McGraw-Hill (2007).

**B.Sc. Physical Science
SEMESTER –II**

**SPH 124 : CHEMICAL ENERGETICS, EQUILIBRIA & FUNCTIONAL ORGANIC
CHEMISTRY LAB**

No. of hrs/week: 3

Credits: 2

Section A: Physical Chemistry

Thermochemistry

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

Ionic equilibria pH

measurements

- a) 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.
- b) 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.

Section B: Organic Chemistry

1. Purification of organic compounds by crystallization (from water and alcohol) and distillation.
2. Criteria of Purity: Determination of melting and boiling points.
3. 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
 - (c) Oxime and 2,4-dinitrophenylhydrazone of aldehyde/ketone

Reference Books

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

B.Sc. Physical Science
SEMESTER –II

SPH 110 : Data Structures and File Processing

No. of hrs/week: 4

Credits: 4

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. (10)

UNIT-II

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. (10)

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. (10)

UNIT-IV

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. (10)

UNIT-V

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

Text Book:

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

Reference Books:

1. Data Structures and Algorithms in C++ by Adam Drozdek, Cengage Learning, 3rd Edition, 2006.
2. Data Structures and Algorithms in C++ by Brijendra Kumar Joshi, Tata McGraw Hill, 2010.

B.Sc. Physical Science
SEMESTER –II

SPH 128 : Data Structures and File Processing Lab

No. of hrs/week: 3

Credits: 2

1. Write a C++ program to convert a sentence from lower case to upper case , count number of vowels and delete blank spaces.
2. Write a C++ program to implement Stack operations.
3. Write a C++ program to implement queue operations..
4. Write a C++ program to implement the operations in Linked list
5. Write a C++ program to concatenate two files and copy the contents of one file to another file.
6. Write a C++ program for direct access of records in a file.
7. Write a C++ program to implement field organization using length indicator.
8. Write a C++ program for fixed length field organization.
9. Write a C++ program for index access of records in a file.
10. Write a C++ program for accessing records in a file using index(record organization).
11. Write a C++ program to print a line if it contains more than 80 characters.
12. Write a C++ program for reading and writing contents to a file from console.
13. Write a C++ program to reverse the contents of the given file.
14. Write a C++ program to search for a given record using sequential search
15. Write a C++ program to search for a given record using simple Hashing.
16. Write a C++ program to sort records in a file.

Text Book:

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

Reference Books:

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

B.Sc. Physical Science SEMESTER –III

SPH 203 : Thermal Physics and Statistical Mechanics

No. of hrs/week: 4

Credits: 4

UNIT I (11 hrs)

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.

UNIT II(14 hrs)

Thermodynamics

Introduction- Isothermal and adiabatic process- Reversible and irreversible processes-Carnot's engine and its efficiency-Carnot's theorem-Second law of thermodynamics. Kelvin's and Clausius 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.

UNIT III(11 hrs)

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.

UNIT IV(14 hrs)

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.

UNIT V(10 hrs)Statistical Mechanics

Phase space, Macrostate and Microstate Statistical basis, Probability, Principle of equal apriori probability, some basic rules of probability theory, permutations and combinations, Entropy and Thermodynamic probability.

TEXT BOOKS:

- 1.BSc Physics, Vol.2, Telugu Akademy, Hyderabad
- 2.Thermodynamics, R.C. Srivastava, Subit K. Saha &Abhay K. Jain Eastern Economy Edition.
- 3.Unified Physics Vol.2, Optics & Thermodynamics, Jai Prakash Nath&Co.Ltd., Meerut
- 4 Heat ,Thermodynamics and Statistical Physics, Brij lal, Dr.N Subrahmanyam, P.S. Hemne, S Chand & Co
5. A text Book of Heat J.B.Rajam

REFERENCE BOOKS:

1. Fundamentals of Physics. Halliday/Resnick/Walker.C. Wiley India Edition 2007
2. Heat, Thermodynamics and Statistical Physics-N Brij Lal, N Subrahmanyam, PS Hemne, S.Chand& Co.,2012
3. Heat and Thermodynamics- MS Yadav, Anmol Publications Pvt. Ltd, 2000
4. University Physics, HD Young, MW Zemansky,FW Sears, Narosa Publishers, New Delhi
5. Text Book of +3 Physics – Samal, Mishra &Mohanty, National Library, Min.of Culture, Govt of India.
6. Modern Engineering Physics, A.S. Vasudeva, S.Chand& Co.,

B.Sc. Physical Science
SEMESTER –III

SPH 223 :Thermal Physics and Statistical Mechanics Lab

No. of hrs/week: 3

Credits: 2

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

B.Sc. Physical Science
SEMESTER –III
SPH 207 :DIGITAL ELECTRONICS

No. of hrs/week: 4

Credits: 4

UNIT - I (12 hrs)

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.

UNIT- II (12 hrs)

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.

UNIT- III (12 hrs)

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).

UNIT- IV (12hrs)

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).

UNIT- V (12 hrs)

MEMORY DEVICES

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

TEXTBOOKS

1. G.K.Kharate-Digital electronics-Oxford university press
2. R.P. Jain, "Modern digital Electronics", 3rd Edition, TMH, 2003.
- 3.Puri, V.K., Digital Electronics, Tata McGraw Hill
- 4.Morris mano M., Computer System Architecture, 2nd Edition, Prentice Hall, 1998
- 5.Malvino and Leach, Digital Principles and applications, McGraw Hill, 1996, IV Edition

REFERENCE BOOKS

- 1.Millman 1. Micro Electronics, McGraw Hill International Book Company, New Delhi 1990 Edition.
- 2.Morris Mano M., "Digital Logic and Computer Design" PHI, 2005.
- 3.Godse A.P., Digital Electronics, Technical Publications.
- 4.Unified Electronics (Digital Electronics and Microprocessors) by Agarwal- Agarwal

**B.Sc. Physical Science
SEMESTER –III**

SPH 227 :DIGITAL ELECTRONICS LAB

No. of hrs/week: 3

Credits: 2

1. Verification of I C (basic) logic Gates
2. Universality of NAND & NOR Gates.
3. Verification of Boolean laws using NAND Gates (Associative, Commutative & Distributive Laws)
4. Study of RS, D, T and JK Flip-Flops with IC's
5. Half and Full Adders using Simple & NAND Gates.
6. 4-bit binary parallel adder and Subtractor IC 7483 using PSPICE simulation
7. Study of 7490 BCD Counter - MOD Counters using PSPICE simulation.
8. BCD to Seven segment decoder 7447/7448 using PSPICE simulation.

LAB MANUAL

1. Zbar, Malvino and Miller, Basic Electronics, A Text Lab Manual, Tata McGraw Hill.
2. R. Sugaraj Samuel & Horsley Solomon, B.E.S. Practical.

B.Sc. Physical Science SEMESTER –III

SPH 201 :Real Analysis

No. of hrs/week: 4

Credits: 4

UNIT-I

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

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).

UNIT-III

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

UNIT-V

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

Books Recommended

1. "Calculus Vol.I : One Variable Calculus, with an Introduction to Linear Algebra" by Tom. M. Apostol, published by John Wiley and Sons (Asia) P. Ltd., 2002.
2. "Introduction to Real Analysis" by Robert.G. Bartle and Donald. R Sherbert, published by John Wiley and Sons(Asia) Ltd., 2000.
3. "Intermediate Real Analysis" by Emanuel Fischer published by Springer Verlag, 1983.
4. "Elementary Analysis: The Theory of Calculus" by Kenneth A. Ross, published by Springer Verlag, 2003.

**B.Sc. Physical Science
SEMESTER –III**

**SPH 205 : SOLUTIONS, PHASE EQUILIBRIUM, CONDUCTANCE,
ELECTROCHEMISTRY & FUNCTIONAL GROUP ORGANIC CHEMISTRY-II**

No. of hrs/week: 4

Credits: 4

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).

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.

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 their interconversion.

Reactions: Comparative study of nucleophilicity of acyl derivatives. Reformatsky Reaction, Perkin condensation.

Amines and Diazonium Salts

Amines (Aliphatic and Aromatic): (Upto 5 carbons)

Preparation: from alkyl halides, Gabriel's Phthalimide synthesis, Hofmann Bromamide reaction.

Reactions: Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, with HNO_2 , Schotten – Baumann Reaction. Electrophilic substitution (case aniline): nitration, bromination, sulphonation.

Diazonium salts: *Preparation:* from aromatic amines

Reactions: conversion to benzene, phenol, dyes.

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 $-\text{COOH}$ group, acetylation of $-\text{NH}_2$ group, complexation with Cu^{2+} ions, ninhydrin test.

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

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

UNIT-V

Carbohydrates: Classification, and General Properties, Glucose and Fructose (open chain and cyclic structure), Determination of configuration of monosaccharides, absolute configuration of Glucose and Fructose, Mutarotation, ascending and descending in monosaccharides. Structure of disaccharides (sucrose, cellobiose, maltose, lactose) and polysaccharides (starch and cellulose) excluding their structure elucidation.

Reference Books:

1. Barrow, G.M. *Physical Chemistry* Tata McGraw-Hill (2007).
2. Morrison, R. T. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. *Organic Chemistry (Volume 1)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Finar, I. L. *Organic Chemistry (Volume 2)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
5. Nelson, D. L. & Cox, M. M. *Lehninger's Principles of Biochemistry 7th Ed.*, W. H. Freeman.
6. 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

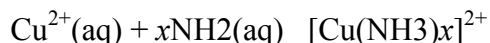
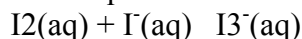
No. of hrs/week: 4

Credits: 4

Section A: Physical Chemistry

Distribution

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



Phase equilibria

- a) Construction of the phase diagram of a binary system (simple eutectic) using cooling curves.
- b) Determination of the critical solution temperature and composition of the phenol water system and study of the effect of impurities on it.
- c) Study of the variation of mutual solubility temperature with concentration for the phenol water system and determination of the critical solubility temperature.

Conductance

- I. Determination of cell constant
- II. Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.
- III. Perform the following conductometric titrations:
 - i. Strong acid vs. strong base
 - ii. Weak acid vs. strong base

Potentiometry

Perform the following potentiometric titrations:

- i. Strong acid vs. strong base
- ii. Weak acid vs. strong base
- iii. Potassium dichromate vs. Mohr's salt

Section B: Organic Chemistry

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

II

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

Reference Books:

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

B.Sc. Physical Science
SEMESTER –III

SPH 209 : Design and Analysis of Algorithms

No. of hrs/week: 4

Credits: 4

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

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.

UNIT- III

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

UNIT – IV

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

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

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 – 11th chapter)

Text Books:

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

B.Sc. Physical Science
SEMESTER –III

SPH 229 : Design and Analysis of Algorithms Lab

No. of hrs/week: 3

Credits: 2

1. Write a C++ program to implement Bubble sort.
2. Write a C++ program to implement Insertion Sort.
3. Write a C++ program implement Selection Sort.
4. Write a C++ program to implement Quick Sort.
5. Write a C++ program to implement Merge Sort.
6. Write a C++ program to implement Shell Sort.
7. Write a C++ program to Find Maximum and Minimum using Divide and Conquer.
8. Write a C++ program to implement Strassen's Matrix Multiplication.
9. Write a C++ program to implement Breadth First Search, Depth First Search.
10. Write a C++ program on Knapsack Problem.
11. Write a C++ program to find Minimum Cost Spanning Tree.
12. Write a C++ program to find All pairs Shortest Path.
13. Write a C++ program to find Single Source Shortest Path.
14. Write a C++ program to evaluate an expression using Horner's Rule.
15. Write a C++ program to perform string matching – Horspools or Boyer- Moore algorithm.

Text Books:

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

B.Sc. Physical Science SEMESTER –III

SSE 271 :Physics Workshop Skill

No. of hrs/week: 2

Credits: 2

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 welding defects. Common materials used for manufacturing like steel, copper, iron, metal sheets, composites and alloy, wood. Concept of machine processing, introduction to common machine tools like lathe, shaper, drilling, milling and surface machines. Cutting tools, lubricating oils. Cutting of a metal sheet using blade. Smoothing of cutting edge of sheet 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 circuit having discrete components (R, L, C, diode) and ICs on PCB. Operation of oscilloscope. Making regulated power supply. Timer circuit, Electronic switch using transistor and relay.

Introduction to prime movers: Mechanism, gear system, wheel, Fixing of gears with motor axle. Lever mechanism, Lifting of heavy weight using lever. braking systems, pulleys, working principle of power generation systems. Demonstration of pulley experiment.

Reference Books:

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

B.Sc. Physical Science
SEMESTER –III

SSE 273 :BASIC ANALYTICAL CHEMISTRY

No. of hrs/week: 2

Credits: 2

Introduction: Introduction to Analytical Chemistry and its interdisciplinary nature. Concept of sampling. Importance of accuracy, precision and sources of error in analytical measurements. Presentation of experimental data and results, from the point of view of significant figures.

Analysis of soil: Composition of soil, Concept of pH and pH measurement, Complexometric titrations, Chelation, Chelating agents, use of indicators

- a. Determination of pH of soil samples.
- b. 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.

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

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

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

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

- a. Paper chromatographic separation of mixture of metal ion (Fe^{3+} and Al^{3+}).
- b. 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

- a. Analysis of deodorants and antiperspirants, Al, Zn, boric acid, chloride, sulphate.
- b. Determination of constituents of talcum powder: Magnesium oxide, Calcium oxide, Zinc oxide and Calcium carbonate by complexometric titration.

Suggested Applications (Any one):

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

**B.Sc. Physical Science
SEMESTER –III**

SSE 275 :Logic and Sets

No. of hrs/week: 2

Credits: 2

Unit-I

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

Unit-II

Propositional equivalence: Logical equivalences.

Unit-III

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

Unit-IV

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.

Unit-V

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

Book Recommended

1. "Discrete and Combinatorial Mathematics" by Ralph P. Grimaldi and B.V. Raman published by Pearson Education, 1998.
2. "Naïve Set Theory" by Paul R. Halmos published by Springer, 1974.
3. "Theory of Sets" by E. Kamke published by Dover Publications, 1950.

B.Sc. Physical Science
SEMESTER –III

SSE 277 :Computer Graphics

No. of hrs/week: 2

Credits: 2

UNIT- I

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

UNIT- II

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

UNIT-III

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

UNIT- IV

Conic-section generation, polygon filling, anti aliasing.

UNIT - V

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

Text Book:

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

Reference Books :

1. Computer Graphics by D. Hearn and M.P. Baker, Prentice–Hall of India, 2nd Ed., 2004.
2. Procedural Elements in Computer Graphics by D.F. Rogers, TMH, 2nd Ed., 2001.

B.Sc. Physical Science SEMESTER –IV

SPH 204 :Electricity & Magnetism

No. of hrs/week: 4

Credits: 4

UNIT I (10 hrs)

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.

UNIT II (12 hrs)

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.

UNIT III (17 hrs)

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,

UNIT IV (11 hrs)

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.

UNIT V (10 hrs)

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.

TEXTBOOKS

1. BSc Physics, Vol.3, Telugu Academy, Hyderabad
2. Electricity and Magnetism, D.N. Vasudeva. S. Chand & Co.
3. Unified Physics Vol.3, Electricity, Magnetism and Electronics, S.L. Gupta and Sanjeev Gupta, Jai Prakasah Nath & Co., Meerut.

REFERENCE BOOKS

1. Fundamentals of Physics- Halliday/Resnick/Walker - Wiley India Edition 2007.
2. Berkeley Physics Course – Vol. II - Electricity and Magnetism – Edward M Purcell – The McGraw-Hill Companies.
3. Electricity and Magnetism Brijlal and Subramanyam. Ratan Prakashan Mandir.
4. Electricity and Magnetism, C.J. Smith, Edward Arnold Ltd.

B.Sc. Physical Science
SEMESTER –IV

SPH 222 :Electricity & MagnetismLab

No. of hrs/week: 3

Credits: 2

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

B.Sc. Physical Science
SEMESTER –IV
SPH 208 :ANALOG & DIGITAL IC APPLICATIONS

No. of hrs/week: 4

Credits: 4

UNIT- I (12 hrs)

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.

IC 555 timer - pin functions - internal architecture

UNIT - II (12 hrs)

OP-AMP CIRCUITS

Summing amplifier - Differential amplifier - Op-amp frequency response - Comparator-Integrator - Differentiator - Triangular Wave generators - Square Wave generators - Active filter(Basics) – Lowpass filter - High pass filter - Band pass filter . IC 555 applications - Astable, Monostable and Schmitt trigger.

UNIT- III (12 hrs)

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.

UNIT - IV (12 hrs)

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.

UNIT - V (12 hrs)

DIGITAL SYSTEM INTERFACING AND APPLICATIONS

Digital system interfacing of LEDs and Multidigit 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.

TEXT BOOKS

DIGITAL

1. G.K.Kharate - Digital electronics-Oxford university press
2. Floyd Thomas L Digital Fundamentals Pearson Education
3. Raj kamal Digital System Principles and Design Wheeler
4. Moriss Mano Digital Circuit Design PHP
5. Malvino Leach Digital Principles and Applications TMH
6. Strangio Digital Electronics TMH
7. Floyd, Jain Digital Fundamentals TMH

8. Anand Kumar A. Switching Theory and Logic design PHI
9. Unified electronics (Digital electronics and Microprocessors) by Agarwal- Agarwal
10. Unified electronics (Analog circuits and communication) by Agarwal- Agarwal

ANALOG

1. Microelectronic circuits by Sedra&Smith-6th edition-Oxford
2. Electronic Devices and Circuits David A.Bell, Fifth edition, Oxford university press
3. Jacob Millman and Christos C.Halkias, Integrated Electronics, McGraw Hill.
4. D.RoyChoudary, Shail Jain, Linear integrated Circuits, New Age International Pvt. Ltd.,2000.
5. Operational Amplifiers and Linear I.Cs-by David A.Bell 3rd edition, Oxford university press.
6. Sedha, R.S. A Text Book of Applied Electronics, S. Chand & company Ltd.
7. Ramakant A. Gayakwad, OP-AMP and Linear ICs, 4th Edition, Prentice Hall/Pearson Education, L 994.
8. G.K.Mithal, Basic Electronic Devices and circuits, 2nd Edition, G.K.Publishers Pvt. Ltd.,

REFERENCE BOOKS:

1. Allen Mottershead, Electronic Devices and Circuits-an Introduction - Prentice Hall.
2. Mithal G.K., Electronic Devices and Circuits, Khanna Publishers.
3. Donald L.Schilling, Charles Belove, Discrete and Integrated Electronic Circuits, McGraw Hill.
4. Jacob Millman, Micro Electronics, McGraw Hill.

B.Sc. Physical Science
SEMESTER –IV
SPH 226 :ANALOG & DIGITAL IC APPLICATIONS LAB

No. of hrs/week: 3

Credits: 2

- I. OP-AMP -Inverting and Non-inverting amplifiers.
2. OP-AMP - Sine Wave Generator (weinbridge oscillator)
3. Binary to Grey and Grey to binary code converter
4. Design of 4-bit priority encoder
5. OP-AMP - Square wave generator using PSPICE simulation
6. Schmitt Trigger using IC 555 timer using PSPICE simulation
7. Study of presettable binary up/down counter using PSPICE simulation.
8. Design and verification of 4-bit ripple counter. Using PSPICE simulation.
9. OP-AMP integrator and differentiator.
10. AstableMultivibrator –determination of frequency (using IC-555)

LAB MANUAL

1. Zbar, Malvino and Miller, Basic Electronics, A Text Lab Manual, Tata McGraw Hill.
- 2.Sugaraj Samuel R., Horsley Solomon, B.E.S. Practicals.

**B.Sc. Physical Science
SEMESTER –IV**

SPH 202 :Algebra

No. of hrs/week: 4

Credits: 4

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.

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.

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.

UNIT – IV

HOMOMORPHISM :

Definition of homomorphism – Image of homomorphism elementary properties of homomorphism – Isomorphism – automorphism definitions and elementary properties–kernel of a homomorphism – fundamental theorem on Homomorphism and applications.

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.

Books Recommended

1. “A Text Book of B.Sc. Mathematics Volume-I” by V.Venkateswara Rao , N Krishna Murthy, B.V.S.S. Sarma and S. Anjaneya Sastry, published by S.Chand& Company Ltd., New Delhi.
2. “A First Course in Abstract Algebra” by John B. Fraleigh published by Narosa Publishing house.
3. “Modern Algebra” by M.L. Khanna published by Jai Prakash Nath.
4. “A First Course in Abstract Algebra” by John B. Fraleigh ,7th Edition published by Pearson, 2002.
5. “Algebra” by Micheal Artin, 2nd Edition, published by Pearson, 2011.

**B.Sc. Physical Science
SEMESTER –IV**

**SPH 206 : COORDINATION CHEMISTRY, STATES OF MATTER & CHEMICAL
KINETICS**

No. of hrs/week: 4

Credits: 4

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).

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.

UNIT-III

Section B: Physical Chemistry-3 (30 Lectures)

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).

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.

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.

Reference Books:

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

B.Sc. Physical Science
SEMESTER –IV

SPH 224 : COORDINATION CHEMISTRY, STATES OF MATTER & CHEMICAL KINETICS LAB

No. of hrs/week: 3

Credits: 2

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⁺, Pb²⁺, Ag⁺, Bi³⁺, Cu²⁺, Cd²⁺, Sn²⁺, Fe³⁺, Al³⁺, Co²⁺, Cr³⁺, Ni²⁺, Mn²⁺, Zn²⁺, Ba²⁺, Sr²⁺, Ca²⁺, K⁺

Anions : CO₃²⁻, S²⁻, SO₃²⁻, S₂O₃²⁻, NO₃⁻, CH₃COO⁻, Cl⁻, Br⁻, I⁻, NO₃⁻, SO₄²⁻, PO₄³⁻, BO₃³⁻, C₂O₄²⁻, F⁻

(Spot tests should be carried out wherever feasible)

1. Estimate the amount of nickel present in a given solution as bis(dimethylglyoximate) nickel(II) or aluminium as oximate in a given solution gravimetrically.
2. Draw calibration curve (absorbance at λ_{max} vs. concentration) for various concentrations of a given coloured compound (KMnO₄/ CuSO₄) and estimate the concentration of the same in a given solution.
3. Determine the composition of the Fe³⁺-salicylic acid complex solution by Job's method.
4. Estimation of (i) Mg²⁺ or (ii) Zn²⁺ by complexometric titrations using EDTA.
5. Estimation of total hardness of a given sample of water by 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:

- a. Acid hydrolysis of methyl acetate with hydrochloric acid.
- b. Compare the strengths of HCl and H₂SO₄ by studying kinetics of hydrolysis of methyl acetate

Reference Books:

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

B.Sc. Physical Science
SEMESTER –IV

SPH 210 : Operating Systems

No. of hrs/week: 4

Credits: 4

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. (10)

UNIT-II

Process Management: Process Concept, Process Scheduling, Operations on Processes.

Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling algorithms. (10)

UNIT-III

Process Coordination: Synchronization: Background, The Critical-Section Problem.

Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention. (10)

UNIT-IV

Memory Management

Memory-Strategies: Background, Swapping, Contiguous memory Allocation, Paging, Segmentation.

Virtual-Memory Management: Background, Demand Paging, Copy-on-write, page Replacement. (10)

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. (10)

Text Book:

Operating System Concepts By Abraham Silberschatz, Peter B. Galvin, Greg Gagne, 8th Edition, 2011

Reference Books:

1. A.S. Tanenbaum, Modern Operating Systems, 3rd Ed., Prentice-Hall of India, 2008
2. Operating Systems: Internals And Design Principles By William Stallings, Prentice Hall Of India, 5th Edition, 2006.
3. Operating Systems: A Modern Approach By Gary Nutt, Addison Wesley, 3rd Edition, 2004.
4. Operating Systems: A Concept Based Approach By D.M.Dhamdhare, Tata Mcgraw-Hill, 2nd Edition, 2007.

B.Sc. Physical Science
SEMESTER –IV

SPH 228 : Operating Systems Lab

No. of hrs/week: 3

Credits: 2

1. Usage of following commands: ls, pwd, tty, cat, who, who am I, rm, mkdir, rmdir, touch, cd.
2. Usage of following commands: cal, cat(append), cat(concatenate), mv, cp, man, date.
3. Usage of following commands: chmod, grep, tput (clear, highlight), bc.
4. Write a shell script to check if the number entered at the command line is prime or not.
5. Write a shell script to modify “cal” command to display calendars of the specified months.
6. Write a shell script to accept a login name. If not a valid login name display message – “Entered login name is invalid”.
7. Write a shell script to display date in the mm/dd/yy format.
8. Write a shell script to display on the screen sorted output of “who” command along with the total number of users .
9. Write a shell script to display the multiplication table of any number.
10. Write a shell script to find the sum of digits of a given number.
11. Write a shell script to find the factorial of a given number.
12. Write a shell script to check whether the number is Armstrong or not.

Text Books:

1. Unix Shell Programming by Stephan G Kochan, Patrick Wood, Sams, 3rd Edition, 2003.
2. Introduction to Unix and Shell Programming by M.G. Venkateshmurthy, Pearson, 1st Edition, 2005.
3. Unix Concepts and Applications by Sumitabha Das, 4th Edition, TMH, 2006.

B.Sc. Physical Science SEMESTER –IV

SSE 272 :Radiation Safety

No. of hrs/week: 2

Credits: 2

The aim of this course is for awareness and understanding regarding radiation hazards and safety. The list of laboratory skills and experiments listed below the course are to be done in continuation of the topics

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.

B.Sc. Physical Science
SEMESTER –IV

SSE 274 :CHEMICAL TECHNOLOGY & SOCIETY

No. of hrs/week: 2

Credits: 2

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* 13th Ed

**B.Sc. Physical Science
SEMESTER –IV**

SSE 276 :Vector Calculus

No. of hrs/week: 2

Credits: 2

UNIT-I

Limits of vector point functions:

Scalar valued and vector valued point functions, limits, Directional derivatives along co-ordinate axis, along any line

Unit –II

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

UNIT-III

Vector identities

Gradient, Divergence, Cur, their geometrical interpretations and Successive operations

UNIT-IV

Line , surface and Volume integrals : Line Integral, Surface Integral, Volume Integral

UNIT-V

Stokes theorem, , Gauss divergence theorem and applications, Greens Theorem and applications.

TEXT BOOK :-

1. “A Text Book of Vector Calculus” by Shanti Narayan published by S. Chand & Company Pvt. Ltd., New Delhi.
2. “Vector Calculus” by R. Gupta published by Laxmi Publications.
3. “Calculus and Analytic Geometry” by George B. Thomas, Jr. and Ross L. Finney, published by Pearson Education, 2007, 9th edition.
4. “Calculus Single Variable” by Howard Anton, Irl Bivens and Stephen Davis, published by John Wiley and Sons, Inc., 2002.
5. “Vector Calculus” by Paul C. Matthews published by Springer Verlag London Limited, 1998.

**B.Sc. Physical Science
SEMESTER –IV**

SSE 278 :Number Theory

No. of hrs/week: 2

Credits: 2

Unit-I

Division algorithm, Lamé's theorem, linear Diophantine equation, fundamental theorem of arithmetic,

Unit-II

Prime counting function, statement of prime number theorem

Unit-III

Goldbach conjecture, binary and decimal representation of integers, linear congruences, complete set of residues.

Unit-IV

Number theoretic functions, sum and number of divisors, totally multiplicative functions, definition and properties of the Dirichlet product,

Unit-V

The Möbius inversion formula, the greatest integer function, Euler's phi-function.

Books Recommended:

1. "Elementary Number Theory" by David M. Burton published by Tata McGraw-Hill, 2007 6th edition.
2. "Applications of Abstract Algebra with MAPLE" by Richard E. Klima, Neil Sigmon and Ernest Stitzinger published by CRC Press, Boca Raton, 2000.
3. "Beginning Number Theory" by Neville Robbins published by Jones and Bartlett publications, 2nd edition.

B.Sc. Physical Science
SEMESTER –IV

SSE 280 : E-Commerce

No. of hrs/week: 2

Credits: 2

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:

1. Kenneth C.Laudon, Carol GuercioTravere, E-Commerce:Business, Technology, Society, 4Th Edition, Pearson ,2008
2. P.T. Joseph, *E-Commerce: An Indian Perspective*, Prentice-Hall of India, 2007.
3. E.M. Awad, Electronic Commerce from Vision to Fulfillment, 3rd Ed., PrenticeHall of India, 2006
4. Scott Bonneau, Tammy Kohl, Jeni Tennison, Jon Duckett and Kevin Williams, XML Design Handbook, Wrox Press Ltd., 2003.
5. Michael Cheshar, Ricky Kaura, and Peter Linton, Electronic Business and Commerce, Springer, 2003.
6. 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.
7. P. Weill and M.R. Vitale, Place to Space: Migrating to eBusiness Models, Harvard Business School Press, 2001.
8. D. Whiteley, E-commerce: Strategy, Technologies and Applications, Tata McGraw-Hill Edition, 2001.
9. 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

No. of hrs/week: 4

Credits: 4

UNIT I (12 hrs)

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 precession frequency. Fine structure of Sodium D lines. Stern and Gerlach experiment-

UNIT II (13 hrs)

Atoms in Electrical and Magnetic Fields

Zeeman Effect.NormalZeeman Effect.Experimental arrangement.Explanation of NormalZeeman Effect by Vector Atom Model.AnomalousZeeman 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.

UNIT III (12 hrs)

Matter waves

Matter waves, de Broglie's hypothesis-wavelength of matter waves, Properties of matter waves. Wave or Phase and group velocities- Davisson and Germer experiment-G.P.Thomson Experiment Young's double slit experiment.de Broglie Standing waves of electron in Bohr orbits.

UNIT IV (11 hrs)

Uncertainty Principle

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. Particle in a box and complementary principle of Bohr.

UNIT V (12 hrs)

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.

TEXTBOOKS

1. BSc Physics, Vol.4, Telugu Academy, Hyderabad
2. Modern Physics by R. Murugesan and Kiruthiga Siva Prasath. S. Chand & Co.
3. Unified Physics Vol.4, Electricity, Magnetism and Electronics, S.L. Gupta and Sanjeev Gupta, Jai PrakasahNath& Co., Meerut.

REFERENCE BOOKS

1. Modern Physics by G. Aruldas& P. Rajagopal. Eastern Economy Edition.
2. Concepts of Modern Physics by Arthur Beiser. Tata McGraw-Hill Edition.
3. Molecular Structure and Spectroscopy by G. Aruldas. Prentice Hall of India, New Delhi.
4. Spectroscopy –Atomic and Molecular by Gurdeep R Chatwal and ShyamAnand – Himalaya Publishing House.
5. Quantum Mechanics, Mahesh C Jain, Eastern Economy Edition.

B.Sc. Physical Science
SEMESTER – V

SPH 353 : Nuclear and Solid State Physics

No. of hrs/week: 4

Credits: 4

UNIT I (10 hrs)

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.

UNIT II (14 hrs)

Magnetic Properties of Matter & Superconductivity

Dia, Para, Ferromagnetic Materials. Classical Langevin Theory of Paramagnetism, Curie-Weiss's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains- Basic concepts- Superconductivity Experimental Results. Critical Temperature. Critical magnetic field- Meissner effect. Type I and type II Superconductors- applications of super conductors

UNIT III (10 hrs)

Nanomaterials : Introduction, nanoparticles, metal nanoclusters, semiconductor nanoparticles, carbon clusters, carbon nanotubes, quantum nanostructures- Applications of nano materials.

UNIT IV (10 hrs)

General Properties of Nuclei

Basic ideas of nucleus -size, mass, charge density (matter energy), binding energy, angular momentum, parity, magnetic moment, electric moments.
Liquid drop model – Shell model- Collective model, Magic numbers.

UNIT V (16 hrs)

Radioactivity decay

Alpha decay: basics of α -decay processes. Theory of α -decay, Gamow's theory, Geiger Nuttal law. β -decay, Energy kinematics for β -decay, positron emission, electron capture, neutrino hypothesis.

Detectors of nuclear Radiation -Ionization chamber, GM Counter, Wilson's cloud chamber, bubble chamber, scintillation counter- Ge-Li Detector

TEXT BOOKS

1. Elements of Solid State Physics, J.P. Srivastava, Prentice Hall of India Pvt., Ltd.
2. Modern Physics, R. Murugesan and Kiruthiga Siva Prasath, S. Chand & Co.
3. Unified Physics, Vol. 4. Modern Physics, S.L. Gupta & Sanjeev Gupta, Jai Prakash Nath & Co. Meerut.
4. Nuclear Physics, D.C. Tayal, Himalaya Publishing House.

REFERENCE BOOKS

1. Concepts of Modern Physics, Arthur Beiser Tata McGraw Hill Edition.
2. Nuclear Physics, Irving Kaplan, Narosa publishing House.
3. Introduction to Solid State Physics, C. Kittel, John Wiley & Sons.
4. Solid State Physics, A.J. Dekker, McMillan India.
5. *Physics of Magnetism*, Sushin Chikazumi, Stanley H. Charap, Krieger Pub Co (June 1978)

B.Sc. Physical Science
SEMESTER – V
SPH 355 :Electronic Devices and Circuits

No. of hrs/week: 4

Credits: 4

UNIT- I (12 hrs)

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

UNIT- II (16 hrs)

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 current amplifier. The C.E amplifier-analysis and parameters, Transistor as a switch.

UNIT - III (12 hrs)

FIELD EFFECT Transistors & UJT:FET - Construction - Working – Drain & Transfer characteristics -Parameters of FET - FET as an amplifier -MOSFET-Enhancement MOSFET-Depletion MOSFET-Construction & Working.

UNIT - IV (8 hrs)

PHOTO ELECTRIC DEVICES: Photo diode, Photo transistor, solar cell, LED and LCD Structure and operation, characteristics, spectral response and applications

UNIT - V (12 hrs)

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).

TEXTBOOKS

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

REFERENCE BOOKS

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

B.Sc. Physical Science
SEMESTER – V

SPH 321 : Modern Physics Lab

No. of hrs/week: 3

Credits: 2

1. e/m of an electron by Thomson method.
2. Determination of Planck's Constant (photocell)
3. Study of absorption of α rays.
4. Study of absorption of β rays.
5. Photoelectric effect .
6. Characteristics of a photo cell - Determination of stopping potential.
7. Characteristics and Spectral response (Selenium photo cell).
8. Verification of inverse square law of light using photovoltaic cell or LDR.

B.Sc. Physical Science
SEMESTER – V

SPH 323 :Nuclear and Solid State Physics Lab

No. of hrs/week: 3

Credits: 2

1. Determination of GM counter- Plateau and statistics.
2. Determination of Range of β particles.
3. Determination of Half life of the given radioactive substance.
4. Determination of magnetic Susceptibility.
5. Determination of M & H.
6. Determination of dead-time of GM counter.
7. Hysteresis curve of transformer core.
8. Analysis of X-ray diffraction pattern obtained by powder method to determine properties of crystals.
9. Applications of Fourier Transforms to find out reciprocal lattice
10. Debye- Scherer's formula experiment
11. Color verification of nano particle with size

B.Sc. Physical Science
SEMESTER – V

SPH 325 :ELECTRONIC DEVICES & CIRCUITS LAB

No. of hrs/week: 3

Credits: 2

1. V-I Characteristics of Junction Diode.
2. V-I Characteristics of Zener Diode.
3. Regulated Power Supply using Zener Diode.
4. IC Regulated Power Supply
5. BJT input and output Characteristics (CE Configuration) and determination of h-parameters.
6. Characteristics of UJT.
7. Characteristics of JFET
8. LDR characteristics
9. Characteristics of L and π section filters using full wave rectifier.
10. I-V characteristics of solar cell with variable intensity

B.Sc. Physical Science
SEMESTER – V

SPH 381 :ANALYTICAL METHODS IN CHEMISTRY

No. of hrs/week: 4

Credits: 4

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.

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;

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.

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.

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.

Reference Books:

1. Mendham, J., *A. I. Vogel's Quantitative Chemical Analysis 6th Ed.*, Pearson, 2009.
2. Willard, H.H. *et al.: Instrumental Methods of Analysis*, 7th Ed. Wardsworth Publishing Company, Belmont, California, USA, 1988.
3. Christian, G.D. *Analytical Chemistry*, 6th Ed. John Wiley & Sons, New York, 2004.
4. Harris, D.C.: *Exploring Chemical Analysis*, 9th Ed. New York, W.H. Freeman, 2016.
5. Khopkar, S.M. *Basic Concepts of Analytical Chemistry*. New Age International Publisher, 2009.
6. Skoog, D.A. Holler F.J. & Nieman, T.A. *Principles of Instrumental Analysis*, Cengage Learning India Ed.
7. Mikes, O. *Laboratory Hand Book of Chromatographic & Allied Methods*, Elles Harwood Series on Analytical Chemistry, John Wiley & Sons, 1979.
8. Ditts, R.V. *Analytical Chemistry; Methods of separation*, van Nostrand, 1974

B.Sc. Physical Science
SEMESTER – V

SPH 339 : ANALYTICAL METHODS IN CHEMISTRY LAB

No. of hrs/week: 3

Credits: 2

I. Separation Techniques

1. Chromatography:

(a) Separation of mixtures

5. Paper chromatographic separation of Fe^{3+} , Al^{3+} , and Cr^{3+} .

6. Separation and identification of the monosaccharides present in the given mixture (glucose & fructose) by paper chromatography. Reporting the R_f values.

(b) Separate a mixture of Sudan yellow and Sudan Red by TLC technique and identify them on the basis of their R_f values.

(c) Chromatographic separation of the active ingredients of plants, flowers and juices by TLC

II. Solvent Extractions:

(i) 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.

(ii) Solvent extraction of zirconium with amberlite LA-1, separation from a mixture of iron and gallium.

7. Determine the pH of the given aerated drinks fruit juices, shampoos and soaps.

8. Determination of Na, Ca, Li in cola drinks and fruit juices using flame photometric techniques.

9. Analysis of soil:

(i) Determination of pH of soil.

(ii) Total soluble salt

(iii) Estimation of calcium, magnesium, phosphate, nitrate

6. Ion exchange:

(i) Determination of exchange capacity of cation exchange resins and anion exchange resins.

(ii) Separation of metal ions from their binary mixture.

(iii) Separation of amino acids from organic acids by ion exchange chromatography.

III Spectrophotometry

1. Determination of pK_a values of indicator using spectrophotometry.
2. Structural characterization of compounds by infrared spectroscopy.
3. Determination of dissolved oxygen in water.
4. Determination of chemical oxygen demand (COD).
5. Determination of Biological oxygen demand (BOD).
6. Determine the composition of the Ferric-salicylate/ ferric-thiocyanate complex by Job's method.

Reference Books:

1. Mendham, J., *A. I. Vogel's Quantitative Chemical Analysis 6th Ed.*, Pearson, 2009.
2. Willard, H.H. *et al.: Instrumental Methods of Analysis*, 7th Ed. Wardsworth Publishing Company, Belmont, California, USA, 1988.
3. Christian, G.D. *Analytical Chemistry*, 6th Ed. John Wiley & Sons, New York, 2004.
4. Harris, D.C. *Exploring Chemical Analysis*, 9th Ed. New York, W.H. Freeman, 2016.
5. Khopkar, S.M. *Basic Concepts of Analytical Chemistry*. New Age International Publisher, 2009.
6. 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

No. of hrs/week: 4

Credits: 4

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.

UNIT 2: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

UNIT 3: Supercritical CO₂- 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

UNIT 4: 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.

UNIT5: Green Analytical Techniques

Micelle mediated extraction- Cloud point extraction and adsorptive micellar flocculation methods. Solid Phase Micro Extraction (SPME)

Text books:

1. Paul T. Anastas and John C. Warner, “Green Chemistry”, Oxford University Press, Indian Edition, 2008.
2. V. K. Ahluwalia and M. Kidwai, “New Trends in Chemistry”, Anamaya Publishers, 2nd Edition, 2007.
3. V. Kumar, “An Introduction to Green Chemistry”, Vishal Publishers, 1st Edition, 2007.
4. V. K. Ahluwalia and R. S. Varma, “Green Solvents”, Narosa Publishing, 1st Edition, 2009.
5. V.K.Ahluwalia and Renu Aggarwal, “Organic Synthetic Special Techniques”, Narosa, 2nd Edition, 2009.
6. V. K. Ahluwalia, “Green Chemistry - Environmentally Benign Reactions”, Ane books, India, 2006.
7. Matlack, A.S. *Introduction to Green Chemistry*, Marcel Dekker (2001).

**B.Sc. Physical Science
SEMESTER – V**

SPH 341 : GREEN CHEMISTRY LAB

No. of hrs/week: 3

Credits: 2

1. Safer starting materials

- ☐ Preparation and characterization of nanoparticles of gold using tea leaves.

2. Using renewable resources

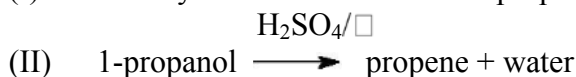
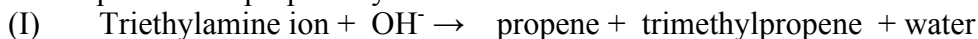
- ☐ Preparation of biodiesel from vegetable waste cooking oil.

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



- ☐ 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 from dry ice.

Mechanochemical solvent free synthesis of azomethines

6. Alternative sources of energy

1. Solvent free, microwave assisted one pot synthesis of phthalocyanine complex of copper (II).
2. Photoreduction of benzophenone to benzopinacol in the presence of sunlight.

Reference Books:

1. Anastas, P.T & Warner, J.C. *Green Chemistry: Theory and Practice*, Oxford University Press (1998).
2. Kirchoff, M. & Ryan, M.A. *Greener approaches to undergraduate chemistry experiment*. American Chemical Society, Washington DC (2002).
3. Ryan, M.A. *Introduction to Green Chemistry*, Tinnesand; (Ed), American Chemical Society, Washington DC (2002).
4. 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).
5. Cann, M.C. & Connelly, M. E. *Real world cases in Green Chemistry*, American Chemical Society (2008).

B.Sc. Physical Science
SEMESTER – V

SPH 371 :Microprocessors (Intel 8085)

No. of hrs/week: 4

Credits: 4

UNIT- I (12 hrs)

ARCHITECTURE OF 8085 MICROPROCESSOR

Functional block diagram of Intel 8085-Register structure-multiplexing&Demultiplexing 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

UNIT - II (12 hrs)

MEMORY-Instruction cycle - machine cycle - T-state -Timing diagrams for Opcode Fetch Cycle Memory Read, Memory Write, I/O Read, I/O Write, - Functional explanation for RAM, ROM, EPROM, EEPROM.

UNIT- III (12 hrs)

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.

UNIT- IV (12 hrs)

INTERFACING MEMORY - 2K X 8, 4K X 8 ROM, RAM to 8085, Interfacing an I/O port in Memory Mapped I/O and I/O Mapped I/O - Difference between I/O mapped and Memory Mapped I/O.

UNIT - V (12 hrs)

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.

TEXTBOOKS

1. Ramesh S. Gaonakar, Microprocessor Architecture, Programming and Application with the 8085-Penram International Publishing, Mumbai.
2. Ram, Fundamentals of microprocessors and microcomputers - Dhanpat Rai Publications, New Delhi
3. Microprocessors & Microcontrollers by N .Senthilkumar, M. Saravanan & S. Jeevananthan, 1st edition, Oxford press (Helpful for interfacing applications)
4. Microprocessors & Microcontrollers by B.P.Singh, Galgotia publications Pvt.Ltd.

REFERENCE BOOKS

1. Mathur A.P., Introduction to Microprocessors. (3rd edn., Tata McGraw, New Delhi,
2. Leventhal L.A., Microprocessor Organisation and Architecture, Prentice Hall India.
3. Microprocessor lab premier by K.A.Krishnamurthy

B.Sc. Physical Science
SEMESTER – V

SPH 327 :MICROPROCESSORS LAB

No. of hrs/week: 3

Credits: 2

Programs using Intel 8085

1. Addition & Subtraction (8 & 16-bits)
2. Multiplication & Division (8 - bit)
3. Largest & Smallest number in the given array.
4. Ascending & Descending order.
5. Binary to ASCII & ASCII to Binary, BCD to ASCII & ASCII to BCD.
6. Block Transfer of Data.
7. Waveform generation using DAC interface.
8. Stepper motor interface.

LAB MANUAL

1. Zbar, Malvino and Miller, Basic Electronics, A Text Lab Manual, Tata McGraw Hill.
2. Sugaraj Samuel R., Horsley Solomon, B.E.S. Practicals.
3. Vijayendran V., Fundamentals of microprocessor-8085, S.Viswanathan publishers Chennai.

B.Sc. Physical Science
SEMESTER – V

SPH 373 : ELECTRONIC COMMUNICATIONS

No. of hrs/week: 4

Credits: 4

UNIT- I (12 hrs)

BASICS OF COMMUNICATION SYSTEMS AND NOISE

Block diagram of communication system. Types of Electronic Communication systems: Simplex, Duplex. Analog /Digital Signals. Noise in communication: External noise- Atmospheric, space noise, man-made noise, internal noise- Thermal, Shot noise Definitions and relationship between Bit rate, Band rate, Bandwidth and signal to Noise Ratio.

UNIT - II (12 hrs)

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).

UNIT- III (12 hrs)

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.

UNIT- IV (12 hrs)

TRANSMITTERS & RECEIVERS

Transmitters: Communication channels for AM and FM broadcast, AM transmitter: Low level and high level modulation, FM transmitter.

Receivers: Receiver parameters, sensitivity, selectivity and fidelity, Super Heterodyne receiver, AM receivers, FM receivers. Frequency division multiplexing.

UNIT - V (12 hrs)

DIGITAL COMMUNICATION

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 Delta Modulation.

TEXTBOOKS

1. H. Taub and D. Schilling, Principles of Communication Systems, Tata McGraw-Hill (1999)
2. W. Tomasi, Electronic Communication Systems: Fundamental through Advanced, Pearson Education (2004)
3. L. E. Frenzel, Communication Electronics, Principle and Applications, Tata McGraw-Hill (2002)
4. L. W. Couch II, Digital and Analog Communication Systems, Pearson Education (2005)
5. H. P. Hsu, Analog and Digital Communication, Tata McGraw-Hill (2006)

REFERENCE BOOKS

1. S. Haykin, Communication Systems, Wiley India (2006)
2. G. Kennedy and B. Davis, Electronic communication systems, Tata McGraw Hill (1999)
3. R. P. Singh and S. D. Sapre, Communication Systems: Analog and Digital, Tata McGraw Hill (2007)
4. L. E. Frenzel, Communication electronics: Principles and applications. Tata McGraw Hill (2002)
5. T. G. Thomas and S. Chandra Sekhar, Communication theory, Tata McGraw Hill (2006)

B.Sc. Physical Science
SEMESTER – V
SPH 329 :ELECTRONIC COMMUNICATIONS LAB

No. of hrs/week: 3

Credits: 2

1. Study of Amplitude Modulation and Demodulation.
2. Study of Frequency Modulation and Demodulation
3. Study of Pulse Amplitude Modulation
4. Study of Pulse Width Modulation
5. Study of Pulse Position Modulation
6. Study of Pulse Code Modulation
7. Simulation of AM modulation and Demodulation using software.
8. Simulation of FM modulation and Demodulation using software.

B.Sc. Physical Science
SEMESTER – V

SPH 375 : CONSUMER ELECTRONICS

No. of hrs/week: 4

Credits: 4

UNIT-I (12 hrs)

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.

UNIT-II (12 hrs)

WASHING MACHINES - Electronic controller for washing machines - Washing machine hardware and software- Types of washing machines - Fuzzy logic washing machines Features of washing machines.

UNIT-III (12 hrs)

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 air conditioners.

UNIT-IV (12 hrs)

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 digital clock.

UNIT-V (12 hrs)

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.

TEXT BOOKS

1. S.P. Bali, Consumer Electronics - Pearson Education, New Delhi, 2005.
2. R. G. Gupta Audio and Video systems Tata McGraw Hill (2004)

**B.Sc. Physical Science
SEMESTER – V**

SPH 331 - CONSUMER ELECTRONICS LAB

No. of hrs/week: 3

Credits: 2

1. Study of PA systems for various situations - Public gathering, closed theatre /Auditorium, Conference room, Prepare Bill of Material (Costing)
2. Installation of Audio /Video systems - site preparation, electrical requirements, cables and connectors
3. Market Survey of Products (at least one from each module)
4. Identification of block and tracing the system. Assembly and Disassembly of system using Toolkit
5. Assembly and Disassembly of system& printer

NOTE: One activity as directed in practical course is equivalent to 4 experiments

B.Sc. Physical Science
SEMESTER – V
SPH 391 : Data Mining

No. of hrs/week: 4

Credits: 4

UNIT-I

Introduction- Basic Data Mining Tasks, Classification, Regression, Time Series Analysis, Prediction, Clustering, Summarization, Association Rules, Data Mining Versus Knowledge Discovery in Databases.

(10)

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.

(10)

UNIT-III

Classification: Issues in Classification, Statistical Based Algorithms, Distance Based Algorithms, Decision Tree Based Algorithms.

(10)

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.

(10)

UNIT-V

Association Rule: Introduction, Large Item Sets, Basic Algorithms, Apriori Algorithm, Sampling Algorithm, Partitioning, Parallel & distributed algorithms, Data parallelism, Task parallelism.

(10)

Text Books:

1. Data Mining- Introductory and Advanced topics by Margaret H.Dunham, Pearson Education, sixth impression, 2009.
2. Data mining Techniques by Arun K. Pujari, University Press, 2001.
3. Introduction to Data mining with Case Studies by G.K.Gupta, PHI India, 2006.

B.Sc. Physical Science
SEMESTER – V
SPH343: Data Mining Lab

No. of hrs/week: 3

Credits: 2

1. Introduction to the Weka machine learning toolkit
2. Performing data preprocessing for data mining in Weka
3. Classification using the Weka toolkit
4. Performing clustering in Weka
5. Association rule analysis in Weka
6. Data mining Case Study

B.Sc. Physical Science
SEMESTER – V
SPH 393 :CRYPTOGRAPHY

No. of hrs/week: 4

Credits: 4

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 .

(10)

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.

(14)

UNIT-III

Data Encryption Techniques: Algorithms For Block And Stream Ciphers, Symmetric Key Encryption, Data Encryption Standard (DES), Advanced Encryption Standard.

(10)

UNIT-IV

Algorithms for Public Key Encryption: RSA, DH Key Exchange, Digital Signatures,

(10)

UNIT –V

Message Authentication and Hash Functions: SHA, WHIRLPOOL

(6)

Text Books:

1. Cryptography and Network Security by Behrouz A. Forouzan, TMH, Special Indian Edition, 2007 (Unit I and Unit II)
2. Cryptography and Network Security Principles and Practices by William Stallings, PHI, 4th Edition, 2006.(Unit III, Unit IV and Unit V)

Reference Books:

1. Cryptography and Network Security by William Stallings, Pearson Education, 4th Edition, 2006
2. Cryptography and Network Security by Atul Kahate, Tata McGraw-Hill, New Delhi, 2003

B.Sc. Physical Science
SEMESTER – V
SPH 345 :CRYPTOGRAPHY LAB

No. of hrs/week: 3

Credits: 2

- 1) Study of various cryptographic techniques.
- 2) Problems on Substitution techniques.
- 3) Problems on Transposition techniques.
- 4) Introduction to Unix, Vi Editor.
- 5) Usage of the following commands in unix: ls, pwd, tty, cat, who, who am I, rm, mkdir, rmdir, cd.
- 6) Usage of following commands in unix : cal, cat(append), cat(concatenate), mv, cp, man, date.
- 7) Implement Substitution technique
- 8) Implement Transposition technique.
- 9) Study of Open SSL.
- 10) Implement Symmetric key Algorithm – DES using open SSL.
- 11) Implement Asymmetric key Algorithm – RSA using open SSL.
- 12) Implement Hash Algorithm – SHA using open SSL.

Text Books:

1. Cryptography and Network Security by Behrouz A. Forouzan, TMH, Special Indian Edition, 2007.
2. Unix Concepts and Applications by Sumitabha Das, 4th Edition, TMH, 2006.

Reference Books:

1. Introduction to Unix and Shell Programming by M.G. Venkateshmurthy, Pearson, 1st Edition, 2005.

B.Sc. Physical Science
SEMESTER – V

SPH 361 :MATRICES

No. of hrs/week: 4

Credits: 4

UNIT-I

\mathbb{R} , \mathbb{R}^2 , \mathbb{R}^3 as vector spaces over \mathbb{R} . Standard basis for each of them. Concept of Linear Independence and examples of different bases. Subspaces of \mathbb{R}^2 , \mathbb{R}^3 .

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.

UNIT-III

Types of matrices. Rank of a matrix. Invariance of rank under elementary transformations. Reduction to normal form, Solutions of linear homogeneous and non-homogeneous equations with number of equations and unknowns upto four.

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.

UNIT-V

Solutions of a system of linear equations using matrices. Illustrative examples of above concepts from Geometry, Physics, Chemistry, Combinatorics and Statistics.

Books Recommended

1. "Introduction to Algebra" by A.I. Kostrikin, published by Springer Verlag, 1984.
2. "Linear Algebra" by Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Prentice Hall of India Pvt. Ltd., New Delhi, 2004.
3. "Schaum's Outline of Matrix Operations: Theory and Problems of Matrix Operations" by Richard Bronson, published by Tata McGraw Hill, 1989.

**B.Sc. Physical Science
SEMESTER – V**

SPH 363 : STATICS & DYNAMICS

No. of hrs/week: 4

Credits: 4

UNIT-I

Conditions of equilibrium of a particle and of coplanar forces acting on a rigid Body

UNIT-II

Laws of friction, Problems of equilibrium under forces including friction

UNIT-III

Centre of gravity, Work and potential energy. Velocity and acceleration of a particle along a curve: radial and transverse components (plane curve)

UNIT-IV

Tangential and normal components (space curve),

UNIT-V

Newton's Laws of motion, Simple harmonic motion, Simple Pendulum, Projectile Motion.

Books Recommended

1. "Statics: A Text book for the Use of the Higher Divisions in Schools and for First Year Students at the Universities" by Arthur Stanley Ramsey published by CBS Publishers and Distributors (Indian Reprint), 1998.
2. "Statics and Dynamics with Background Mathematics" by Adrian Roberts published by Cambridge University Press, 2003.

**B.Sc. Physical Science
SEMESTER – V**

SPH 365 :LINEAR ALGEBRA

No. of hrs/week: 4

Credits: 4

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

UNIT – II

Matrices II : Condition for consistency, Crammer's rule, Characteristic values and characteristic vectors, Cayley-Hamilton theorem, Inverse of a matrix using Cayley-Hamilton theorem, 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.

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.

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.

Books Recommended

1. "A Text Book of B.Sc. Mathematics Volume-III" by V.Venkateswara Rao, N Krishna Murthy, B.V.S.S. Sarma and S. Anjaneya Sastry, published by S.Chand & Company Ltd., New Delhi.
2. "Linear Algebra" by A.R. Vasishtha and J.N. Sharma published by Krishna Prakashan Media (P) Ltd.
3. "Linear Algebra" by Kenneth Hoffman and Ray Alden Kunze published by Pearson Education (low priced edition), New Delhi.
4. "Linear Algebra" by Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, published by Prentice Hall of India Pvt. Ltd., 4th edition New Delhi, 2007.
5. "Rings and Linear Algebra" by Pundir, Pundir published by PragathiPrakashan

**B.Sc. Physical Science
SEMESTER – V**

SSE 371 :APPLIED OPTICS

No. of hrs/week: 2

Credits: 2

Theory includes only qualitative explanation. Minimum five experiments should be performed covering minimum three sections.

(i) Sources and Detectors (9 Periods)

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:

- a. V-I characteristics of LED
- b. Study the characteristics of solid state laser
- c. Study the characteristics of LDR
- d. Photovoltaic Cell
- e. Characteristics of IR sensor

(ii) Fourier Optics (6 Periods)

Concept of Spatial frequency filtering, Fourier transforming property of a thin lens

Experiments on Fourier Optics:

a. Fourier optic and image processing

1. Optical image addition/subtraction
2. Optical image differentiation
3. Fourier optical filtering
4. Construction of an optical 4f system

b. Fourier Transform Spectroscopy

Fourier Transform Spectroscopy (FTS) is a powerful method for measuring emission and absorption spectra, with wide application in atmospheric remote sensing, NMR spectrometry and forensic science.

Experiment:

To study the interference pattern from a Michelson interferometer as a function of mirror separation in the interferometer. The resulting interferogram is the Fourier transform of the power spectrum of the source. Analysis of experimental interferograms allows one to determine the transmission characteristics of several interference filters. Computer simulation can also be done.

(iii) Holography (6 Periods)

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:

1. Recording and reconstructing holograms
2. Constructing a Michelson interferometer or a Fabry Perot interferometer
3. Measuring the refractive index of air
4. Constructing a Sagnac interferometer
5. Constructing a Mach-Zehnder interferometer
6. White light Hologram

(iv) Photonics: Fibre Optics (9 Periods)

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:

1. Fundamental of optics, F. A. Jenkins & H. E. White, 1981, Tata McGraw hill.
2. LASERS: Fundamentals & applications, K.Thyagrajan & A.K.Ghatak, 2010, Tata McGraw Hill
3. Fibre optics through experiments,M.R.Shenoy, S.K.Khijwania, et.al. 2009, Viva Books
4. Nonlinear Optics, Robert W. Boyd, (Chapter-I), 2008, Elsevier.
5. Optics, Karl Dieter Moller, Learning by computing with model examples, 2007, Springer.
6. Optical Systems and Processes, Joseph Shamir, 2009, PHI Learning Pvt. Ltd.
7. Optoelectronic Devices and Systems, S.C. Gupta, 2005, PHI Learning Pvt. Ltd.
8. Optical Physics, A.Lipson, S.G.Lipson, H.Lipson, 4th Edn., 1996, Cambridge Univ. Press

**B.Sc. Physical Science
SEMESTER – V**

SSE 373 :PHARMACEUTICAL CHEMISTRY

No. of hrs/week: 2

Credits: 2

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, Ibuprofen); 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.

**B.Sc. Physical Science
SEMESTER – V**

SSE 375 :Theory of Equations

No. of hrs/week: 2

Credits: 2

Unit-I

General properties of polynomials, Graphical representation of a polynomials, maximum and minimum values of a polynomials

Unit-II

Quadratic Equations, General properties of equations, Descarte's rule of signs positive and negative rule,

Unit-III

Relation between the roots and the coefficients of equations. Symmetric functions, Applications symmetric function of the roots

Unit-IV

Transformation of equations.Solutions of reciprocal and binomial equations.

Unit-V

Algebraic solutions of the cubic and biquadratic.Properties of the derived functions.

Books Recommended

1. W.S. Burnside and A.W. Panton, *The Theory of Equations*, Dublin University Press, 1954.
2. C. C. MacDuffee, *Theory of Equations*, John Wiley & Sons Inc., 1954.

B.Sc. Physical Science SEMESTER – V

SSE 377 :Probability and Statistics

No. of hrs/week: 2

Credits: 2

UNIT I

Meaning and Scope of the Statistics Introduction, Frequency distribution, Graphic representation of a frequency distribution, measures of central tendency , measures of dispersion, coefficients of dispersion, moments, skewness, kurtosis

UNIT-II

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.

UNIT-III

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.

UNIT-IV

Random variables and distribution functions: One and two dimensional random variables (discrete and continuous).

UNIT V

Probability distribution: Discrete distributions Binomial, Poisson distributions and their properties and applications.

Prescribed Text Book :

1. “Fundamentals of Mathematical Statistics” by S.C. Gupta and V.K. Kapoor published by Sultan Chand & Sons
2. “Statistical Methods Combined Edition (Volumes I & II)” by N G Das published by McGraw Hill, 2008, 1st edition.
3. “Statistical Methods: Concepts, Application and Computation” by Y.P. Aggarwal published by Sterling Publishers, 1998.
4. “Introduction to Mathematical Statistics” by Robert V. Hogg, Joseph W. McKean, Allen Thornton Craig published by Pearson Education, Asia, 2007.
5. “Mathematical Statistics with Applications” by Irwin Miller and Marylees Miller published by Pearson Education, Asia, 2006, 7th edition.
6. “Introduction to Probability Models” by Sheldon M. Ross published by Academic Press, Indian Reprint, 2007, 9th edition.

B.Sc. Physical Science
SEMESTER – V

SSE 379 :Combinatorial Optimization

No. of hrs/week: 2

Credits: 2

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:

1. Combinatorial Optimization: Algorithms and Complexity by C.H. Papadimitriou and K. Steiglitz, Prentice-Hall of India, 2006
2. Optimization by K. Lange, Springer, 2004.
3. Linear Programming and Network Flows by Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, John Wiley and Sons, 2004.
4. Operations Research: An Introduction by H.A. Taha, 8th Ed., Prentice Hall, 2006.

B.Sc. Physical Science SEMESTER – VI

SPH 352 : Digital and Analog Electronics

No. of hrs/week: 4

Credits: 4

UNIT I (14 hrs)

Basic Electronics:

Intrinsic and Extrinsic semiconductors. Fermi level, continuity equation. PN junction 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 .

UNIT II (10 hrs)

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.

UNIT III (14 hrs)

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.

UNIT IV (10 hrs)

Digital principles

Differences between analog and digital circuits- Binary number system, conversion of Binary to Decimal system and vice versa. Binary addition and subtraction (1's and 2's complement methods).

UNIT V (12 hrs)

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.

TEXTBOOKS

1. BSc Physics, Vol.3, Telugu Academy, Hyderabad
2. Unified Electronics, Vol.3, Electronic Circuits and Digital Electronics, Agarwal and Agarwal, A.S. Prakashan, Meerut.
3. Principles of Electronics, V.K. Mehta, S.Chand & Co.,
4. Digital Principles and Applications, A.P. Malvino and D.P. Leach, Mc Graw Hill Edition.

REFERENCE BOOKS

1. Electronic Devices and Circuits, Millman and Halkias, Mc Graw Hill
2. Electricity, Magnetism with Electronics, K.K. Tewari, R.Chand & Co.,
3. Digital and analog systems circuits and Devices: An Introduction, Belov Schilling, Mc Graw Hill International Edition.

B.Sc. Physical Science
SEMESTER – VI

SPH 322 : Digital and Analog Electronics Lab

No. of hrs/week: 3

Credits: 2

1. Energy gap of semiconductor using a junction diode.
2. PN Junction Diode Characteristics
3. Zener Diode Characteristics
4. Zener Diode as Voltage Regulator
5. Transistor CE Characteristics- Determination of Hybrid Parameters
6. Logic Gates- OR,AND,NOT and NAND gates. Verification of Truth Tables.
7. Verification of De Morgan's Theorems
8. RC Circuit –Frequency response.
9. LR circuit-frequency response.
10. Full Wave Rectifier- C- type, L- type and π - type filters
11. Field Effect Transistor (FET) Characteristics

B.Sc. Physical Science SEMESTER – VI

SPH 354 : Materials Science

No. of hrs/week: 4

Credits: 4

Unit I (10 hrs)

Crystal Structure:

Solids: Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis – Central and Non-Central Elements. Unit Cell. Miller Indices. Reciprocal Lattice. Types of Lattices. Brillouin Zones. Diffraction of X-rays and neutrons by Crystals. Bragg's Law. Atomic and Geometrical factors, periodicity of wavefunctions,

Unit II (10 hrs)

Elementary Lattice Dynamics: Lattice Vibrations and Phonons: Linear Monoatomic and Diatomic Chains. Acoustical and Optical Phonons. Qualitative Description of the Phonon Spectrum in Solids. Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids. T^3 law

Unit III (16 hrs)

Magnetic Properties of Matter and Superconductivity: Dia-, Para-, Ferri- and Ferromagnetic Materials. Classical Langevin Theory of dia- and Paramagnetic Domains. Quantum Mechanical Treatment of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis and Energy Loss. **Basics of Superconductivity** Critical Temperature. Critical magnetic field. Meissner effect. Type I and type II Superconductors and applications of super conductors.

Unit IV (10 hrs)

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.

Unit V (12 hrs)

Elementary band theory: Bloch theorem and Kronig Penn model. Band Gaps. Conductors, Semiconductors and insulators. P and N type Semiconductors. Conductivity of Semiconductors, mobility, Hall Effect, Hall coefficient

Text Books:

1. Introduction to Solid State Physics, Charles Kittel, 8th Ed., 2004, Wiley India Pvt. Ltd.
2. Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India
3. Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill
4. Solid State Physics, Neil W. Ashcroft and N. David Mermin, 1976, Cengage Learning
5. Elementary Solid State Physics: Principles and Applications Addison-Wesley Series 1993 1st Ed

**B.Sc. Physical Science
SEMESTER – VI**

SPH 324 : Materials Science Lab

No. of hrs/week: 3

Credits: 2

1. Measurement of susceptibility of paramagnetic solution (Quinck's Tube Method)
2. To measure the Magnetic susceptibility of Solids by four probe method
3. To determine the Coupling Coefficient of a Piezoelectric crystal.
4. To measure the Dielectric Constant of dielectric Materials with frequency using LCR
5. To study the PE Hysteresis loop of a Ferroelectric Crystal.
6. To draw the BH curve of iron using a Solenoid and determine the energy loss from Hysteresis.
7. To measure the resistivity of a semiconductor (Ge) crystal with temperature by four-probe method (from room temperature to 150°C) and to determine its band gap.
8. To determine the Hall coefficient of a semiconductor sample.

B.Sc. Physical Science
SEMESTER – VI
SPH 356 : Electronic Communications

No. of hrs/week: 4

Credits: 4

UNIT- I (12 hrs)

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

UNIT - II (12 hrs)

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).

UNIT- III (12 hrs)

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.

UNIT- IV (12 hrs)

TRANSMITTERS & RECEIVERS

Transmitters: Communication channels for AM and FM broadcast, AM transmitter: Low level and high level modulation, FM transmitter.

Receivers: Receiver parameters, sensitivity, selectivity and fidelity, Super Heterodyne receiver, AM receivers, FM receivers. Frequency division multiplexing.

UNIT - V (12 hrs)

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 Delta Modulation.

TEXTBOOKS

1. H. Taub and D. Schilling, Principles of Communication Systems, Tata McGraw-Hill (1999)
2. W. Tomasi, Electronic Communication Systems: Fundamental through Advanced, Pearson Education (2004)
3. L.E. Frenzel, Communication Electronics, Principle and Applications, Tata McGraw-Hill (2002)
4. L. W. Couch II, Digital and Analog Communication Systems, Pearson Education (2005)

REFERENCE BOOKS

5. S. Haykin, Communication Systems, Wiley India (2006)
6. G. Kennedy and B. Davis, Electronic communication systems, Tata McGraw Hill (1999)
7. R. P. Singh and S. D. Sapre, Communication Systems: Analog and Digital, Tata McGraw Hill (2007)
8. L. E. Frenzel, Communication electronics: Principles and applications. Tata McGraw Hill (2002)
9. T.G. Thomas and S. Chandra Sekhar, Communication theory, Tata McGraw Hill (2006)

B.Sc. Physical Science
SEMESTER – VI

SPH 326 :ELECTRONIC COMMUNICATIONS LAB

No. of hrs/week: 3

Credits: 2

1. Study of Amplitude Modulation and Demodulation.
2. Study of Frequency Modulation and Demodulation
3. Study of Pulse Amplitude Modulation
4. Study of Pulse Width Modulation
5. Study of Pulse Position Modulation
6. Study of Pulse Code Modulation
7. AM modulation and Demodulation
8. FM modulation and Demodulation
9. Calculation of EMI Components

B.Sc. Physical Science SEMESTER – VI

SPH 382 :INDUSTRIAL CHEMICALS AND ENVIRONMENT

No. of hrs/week: 4

Credits: 4

Unit-I: Industrial Gases and Inorganic Chemicals

Industrial Gases: Large scale production, uses, storage and hazards in handling of the following 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 the following 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.

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 SO₂, CO₂, CO, NO_x, H₂S. Methods of estimation of CO, NO_x, SO_x and control procedures.

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 and nature of water pollutants, Techniques for measuring water pollution, Impacts of water pollution on hydrological and ecosystems.

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.

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.

Reference Books:

1. E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK.
2. R.M. Felder, R.W. Rousseau: *Elementary Principles of Chemical Processes*, Wiley Publishers, New Delhi.
3. J. A. Kent: *Riegel's Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.
4. S. S. Dara: *A Textbook of Engineering Chemistry*, S. Chand & Company Ltd. New Delhi.
5. K. De, *Environmental Chemistry*: New Age International Pvt., Ltd, New Delhi.
6. S. M. Khopkar, *Environmental Pollution Analysis*: Wiley Eastern Ltd, New Delhi.
7. S.E. Manahan, *Environmental Chemistry*, CRC Press (2005).
8. G.T. Miller, *Environmental Science* 11th edition. Brooks/ Cole (2006).
9. A. Mishra, *Environmental Studies*. Selective and Scientific Books, New Delhi (2005).

B.Sc. Physical Science
SEMESTER – VI

SPH 340: INDUSTRIAL CHEMICALS & ENVIRONMENTLAB

No. of hrs/week: 3

Credits: 2

1. Determination of dissolved oxygen in water.
2. Determination of Chemical Oxygen Demand (COD)
3. Determination of Biological Oxygen Demand (BOD)
4. Percentage of available chlorine in bleaching powder.
5. Measurement of chloride, sulphate and salinity of water samples by simple
6. titration method (AgNO_3 and potassium chromate).
7. Estimation of total alkalinity of water samples (CO_3^{2-} , HCO_3^-) using double
8. titration method.
9. Measurement of dissolved CO_2 .
10. Study of some of the common bio-indicators of pollution.
11. Estimation of SPM in air samples.
12. Preparation of borax/ boric acid.

Reference Books:

1. E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK.
2. R.M. Felder, R.W. Rousseau: *Elementary Principles of Chemical Processes*, Wiley Publishers, New Delhi.
3. J. A. Kent: *Riegel's Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.
4. S. S. Dara: *A Textbook of Engineering Chemistry*, S. Chand & Company Ltd. New Delhi.
5. K. De, *Environmental Chemistry*: New Age International Pvt., Ltd, New Delhi.
6. S. M. Khopkar, *Environmental Pollution Analysis*: Wiley Eastern Ltd, New Delhi.

B.Sc. Physical Science SEMESTER – VI

SPH 384 :INSTRUMENTAL METHODS OF ANALYSIS

No. of hrs/week: 4

Credits: 4

UNIT I - Thermal methods of analysis: Thermo gravimetry - theory, in-strumentation, applications with special reference to $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ and CaCO_3 . Basic idea of differential thermal analysis: principle and instrumentation. Difference between TGA and DTA. Differential scanning calorimetry: principle and instrumentation.

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

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.

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

UNIT V - X-ray Spectroscopy: X-ray spectrometers, energy dispersive and wavelength dispersive techniques, instrumentation, matrix effects and applications.

Textbooks:

1. Instrumental methods of analysis - H.H. Willard, Meritt Jr. and J.A. Dean, CBS Publishers and distributors, 6th edition, 1986.
2. Principles of instrumental analysis – Douglas A. Skoog, F. James Holler and R. Crouch, Cengage Learning, 6th edition, 2006.
3. Vogel's textbook of Quantitative Inorganic analysis - J. Basset, R.C. Denney, G.H. Jeffery and J. Mendham, Prentice Hall, 6th edition, 2000
4. Industrial methods of analysis - B.K.Sarma, Goel Publishing House, Meerut, 1997
5. Instrumental methods of Analysis – G.R. Chatwal and S. Anand, Himalaya publishing House, 13th reprint, 1999.
6. Analytical Chemistry – S.Usha Rani, Macmillan India Limited, 2001

Reference Books:

1. Instrumental methods of Analysis – Galen S. Ewing, Mcgraw Hill Higher Education, 5th edition, 1985
2. Handbook of Instrumental techniques for Analytical Chemistry, Frank Settle, Prentice Hall, 1997.

B.Sc. Physical Science
SEMESTER – VI

SPH 342 :INSTRUMENTAL METHODS OF ANALYSIS LAB

No. of hrs/week: 3

Credits: 2

1. Safety Practices in the Chemistry Laboratory
2. Titration curve of an amino acid.
3. Determination of a Mixture of Cobalt and Nickel (UV/Vis spec.)
4. IR Absorption Spectra (Study of Aldehydes and Ketones)
5. Determination of Calcium, Iron, and Copper in Food by Atomic Absorption
6. Quantitative Analysis of Mixtures by Gas Chromatography (i.e., chloroform and carbon tetrachloride)
7. Separation of Carbohydrates by HPLC
8. Potentiometric Titration of a Chloride-Iodide Mixture
9. Laboratory analysis to confirm anthrax or cocaine
10. Detection in the field and confirmation in the laboratory of flammable accelerants or explosives
11. Detection of illegal drugs or steroids in athletes
12. Detection of pollutants or illegal dumping

At least 8-10 experiments to be performed.

Reference Books:

- (i) Skoog, D.A. Holler F.J. & Nieman, T.A. *Principles of Instrumental Analysis*, Cengage Learning India Ed.
- (ii) 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 371 : MICROCONTROLLERS & APPLICATIONS

No. of hrs/week: 4

Credits: 4

UNIT- I (12 hrs)

8051 ARCHITECTURE - 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.

UNIT- II (12 hrs)

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.

UNIT- III (12 hrs)

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.

UNIT- IV (12 hrs)

INTERFACING - Keyboards - Displays - Stepper motor - ADC & DAC.

UNIT- V (12 hrs)

INTRODUCTION TO OTHER MICROCONTROLLERS - 6509 - PIC controllers - 6575 series - Introduction to Embedded Systems.

TEXTBOOKS

1. Kenneth 1. Ayala, "The 8051 Microcontroller, Architecture, Program and Application" Pen ram International.
2. Muhammed Ali Mazidi, Janice Gillispie Mazidi "The 8051 Microcontroller and Embedded Systems" -Low Price Edition.
3. Microprocessors & Microcontrollers by N. Senthilkumar, M. Saravanan & S. Jeevananthan, 1st edition. Oxford press (Helpful for interfacing applications)
4. Micro controllers: Theory & Application by Ajay V. Deshmukh Tata McGraw-Hill Education, 2005.

REFERENCE BOOKS

1. Programming and customizing the 8051 Microcontroller- by Myke Predko-TMH
2. Design with Microcontrollers by- J.B. Peatma TMH
3. Microcontroller Hand Book, INTEL, 2008.
4. Microprocessor, Microcontroller & Applications by D.A Godse A.P Godse Technical Publications 2008.

**B.Sc. Physical Science
SEMESTER – VI**

SPH 328 :MICROCONTROLLERS & APPLICATIONSLAB

No. of hrs/week: 4

Credits: 4

1. Multiplication of two numbers using MUL Command (later using counter method for repeated addition)
2. Division of two numbers using DIV command (later using counter method for repeated subtraction)
3. Pick Largest & smallest number among a given set of numbers
4. Interface a DAC & Generate a stair case wave form with step duration and no. of steps as variables.
5. Interface a stepper motor and rotate Clockwise or anti clockwise through given angle step.
6. Using Keil software, write a program to pick the smallest among a given set of numbers.
7. Using Keil software, write a program to pick the largest among a given set of numbers.
8. Using Keil software, write a program to generate a rectangular wave form at a specified port terminal.

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SPH 373 :VLSI DESIGN

No. of hrs/week: 4

Credits: 4

UNIT - I (12 hrs)

CMOS TECHNOLOGY

A 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.

UNIT- II (12 hrs)

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.

UNIT- III (12 hrs)

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.

UNIT- IV (10 hrs)

CMOS TESTING

Need for testing- Testers, Test fixtures and test programs- Logic verification- Silicon debug principles- Manufacturing test - Design for testability - Boundary scan

UNIT- V (14 hrs)

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

Benchmarks, Structural gate level description of decoder, equality detector, comparator, priority encoder, half adder, full adder, Ripple carry adder, D latch and D flip flop.

TEXTBOOKS

1. Weste and Harris: CMOS VLSI DESIGN (Third edition) Pearson Education
2. Uyemura J.P: Introduction to VLSI circuits and systems, Wiley

REFERENCE BOOKS

1. D.A Pucknell&K.Eshraghian Basic VLSI Design, Third edition, PHI
2. Wayne Wolf, Modern VLSI design, Pearson Education
3. M.J.S. Smith: Application specific integrated circuits, Pearson Education
4. J.Bhasker: Verilog HDL primer, BS publication
5. Ciletti Advanced Digital Design with the Verilog HDL, Prentice Hall of India

B.Sc. Physical Science
SEMESTER – VI

SPH 330 : VLSI DESIGN LAB

No. of hrs/week: 3

Credits: 2

- 1.Study of Simulation using tools
- 2.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
- 5.Study of Synthesis tools
- 6.Place and Route and Back annotation for FPGAs
- 7.Schematic Entry and SPICE Simulation a) CMOS Inverter b) Universal Gate
c) Differential Amplifier
- 8.Layout of a CMOS Inverter

**B.Sc. Physical Science
SEMESTER – VI**

**SPH 375 :MATHEMATICAL METHODS AND ANALYSIS
USING MATLAB**

No. of hrs/week: 4

Credits: 4

UNIT- I (12 hrs)

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 (12 hrs)

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 (12 hrs)

Laplace Transforms Applications.

1. Series RC circuit, RL circuit, RLC circuit,
2. 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 (12 hrs)

Fourier series and Transform

Fourier Series Definition, Evaluation of Fourier Co-efficient, Fourier series for Square, Triangular waves, 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 (12 hrs)

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

1. Diode characteristics
2. Ohm's Law
3. Filters, Phasors as per AC circuits

MATLAB Exercises

1. Real root of algebraic equation, curve fitting
2. Diode/BJT characteristics. Ohm's law filters performance.

TEXTBOOKS

1. RudraPratap Getting Started with MATLAB, 7th Edition Oxford University Press N Delhi
2. MATLAB and Simulink for engineers by Agamkumartyagi-Oxford University press.
3. Amos Gilat MATLAB : An introduction with applications, Wiley India
4. Stephen I. Chapman MATLAB Programming for Engineers. Thomas Learning

REFERENCE BOOKS

1. G K Mittal Network Analysis Khanna Publishers, New Delhi
2. Van Valkenberg Network Analysis, 3rd Edition Dorling Kindersley (India) Pvt Ltd.,
3. Umesh Sinha Network Analysis and Synthesis Satya Prakashan. Delhi.

**B.Sc. Physical Science
SEMESTER – VI**

SPH 332 :MATLAB

No. of hrs/week: 3

Credits: 2

1. CT and DT signals plotting
2. To find Laplace Transform and IL T of any given function.
3. RC / RL/RLC (series) circuit analysis for DC input
4. Transfer Function, Pole and Zero stability criteria and filters
5. To evaluate Fourier Co-efficient for given waveform Function.
6. To find Fourier Transform for given function.
7. Real root of algebraic equation, curve fitting
8. Diode/BJT characteristics. Ohm's law, filters performance

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SEMESTER – VI**

SPH 392 : INFORMATION SECURITY

No. of hrs/week: 4

Credits: 4

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. (10)

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. (10)

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. (10)

UNIT-IV

Cryptography: Classical Encryption Techniques, Substitution and Transposition Techniques. Symmetric Key Algorithms: Data Encryption Standard, Advanced Encryption Standards. (10)

UNIT-V

Public Key Encryption: RSA, Diffie Hellman Key Exchange, ECC Cryptography, Digital Signatures.

Message Authentication: MAC, Hash Functions. Message Digests, SHA, WHIRLPOOL. (10)

Text Books:

1. Principles Of Information Security By Michael E. Whitman And Herbert J. Mattord, Thomas India Edition, 2011.
2. Cryptography And Network Security Principles and Practices By William Stallings Prentice-Hall Of India ,4th Ed, 2006.

Reference Books:

1. Computer Security: Art And Science, Mathew Bishop, Addison-Wesley, 2003.
2. Computer Security Principles And Practice By William Stallings, Lawrie Brown, 2/E, Pearson, 2012.

B.Sc. Physical Science
SEMESTER – VI
SPH346 : INFORMATION SECURITY LAB

No. of hrs/week: 3

Credits: 2

- 1) Study of various cryptographic techniques
- 2) Problems on Substitution techniques.
- 3) Problems on Transposition techniques
- 4) Introduction to Unix, Vi Editor.
- 5) Usage of the following commands in unix: ls, pwd, tty, cat, who, who am I, rm, mkdir, rmdir, cd.
- 6) Usage of following commands in unix : cal, cat(append), cat(concatenate), mv, cp, man, date.
- 7) Implement Substitution technique
- 8) Implement Transposition technique
- 9) Study of Open SSL
- 10) Implement Symmetric key Algorithm – DES using open SSL
- 11) Implement Asymmetric key Algorithm – RSA using open SSL
- 12) Implement Hash Algorithm – SHA using open SSL

Text Books:

1. Cryptography and Network Security by Behrouz A. Forouzan, TMH, Special Indian Edition, 2007.
2. Unix Concepts and Applications by Sumitabha Das, 4th Edition, TMH, 2006.

Reference Books:

1. Introduction to Unix and Shell Programming by M.G. Venkateshmurthy, Pearson, 1st Edition, 2005.

B.Sc. Physical Science
SEMESTER – VI
SPH 394 : Database Applications

No. of hrs/week: 4

Credits: 4

Unit- I

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. (10)

Unit - II

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. (10)

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. (10)

Unit – IV

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. (10)

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. (10)

Text Book:

Database System Concepts, Sixth Edition by Avi Silberschatz, Henry F. Korth ,S. Sudarshan
Tata McGraw-Hill,2011.

References:

1. SQL, PL/SQL- The Programming Language of Oracle By Ivan Bayross , BPB, 4th Edition, 2010.
2. Fundamentals of Database Systems by Ramez Elmasri, Shamkant B Navathe, 7th Edition, Pearson, 2015.

B.Sc. Physical Science
SEMESTER – VI
SPH346 : Database Applications Lab

No. of hrs/week: 3

Credits: 2

1. Perform Table Creation using SQL.
2. Perform Insertion, Deletion, Updation using SQL.
3. Perform Table Creation using Constraints Specification.
4. Perform Simple SQL Queries.
5. Perform Simple Queries using Logical operators.
6. Perform Simple queries using Date functions.
7. Perform Simple queries using String Functions.
8. Perform Simple PL/SQL program.
9. Perform PL/SQL programs using if, for, while.
10. Perform Grant, Revoke privileges.
11. Perform Programs on Exception Handling.
12. Create a Database- define Procedures, Functions, Triggers.

Text Books:

1. SQL, PL/SQL- The Programming Language Of Oracle By Ivan Bayross , BPB, 4th Edition, 2010.
2. Oracle Database 11g- The Complete Reference by Kevin Loney, TMH, Indian Edition, 2008.

B.Sc. Physical Science
SEMESTER – VI
SPH 396 : Computer Networks

No. of hrs/week: 4

Credits: 4

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)

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)

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)

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)

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)

Text Book :

Data Communication and Networking by Behrouz A Forouzan, Tata McGraw Hill, 4th Edition, 2006.

Reference Books :

1. Data and Computer Communications by William Stallings, Pearson, 9th Edition, 2013.
2. Computer Networks by Andrew S. Tanenbaum, Prentice Hall, 5th Edition, 2013.

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SEMESTER – VI**

SPH 348 : Computer Networks Lab

No. of hrs/week: 3

Credits: 2

- 1) Study of Network Devices in detail.
- 2) Study of different types of Network Cables and practically implement the cross-wired cable and straight cabling.
- 3) Study of Network IP.
- 4) Study of Basic Network Commands and Network Configuration commands.
- 5) Network Sharing.
- 6) Connect Two Computers (One to One).
- 7) Connect Computers in a LAN.
- 8) Configuring a Switch.
- 9) Client – Server configuration.
- 10) Study of Network tools.

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SEMESTER – VI**

SPH 362 :NUMERICAL METHODS

No. of hrs/week: 4

Credits: 4

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.

UNIT – II

Solution of Algebraic and Transcendental Equations: The bisection method, The iteration method, The method of false position, Newton Raphson method, Generalized.

UNIT – III

System of Simultaneous Equations : Direct methods, Gauss Elimination Method, LU decomposition,
Iterative Methods : Gauss-Jacobi, Gauss-Siedel and SOR iterative methods.

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

UNIT –V

Numerical differentiation: forward difference, backward difference and central Differences.
Integration: Trapezoidal rule, Simpson's $1/3$ rule, Simpson's $3/8$ rule

Recommended Books

1. "Introductory Methods of Numerical Analysis" by S.S.Sastry published by Prentice Hall of India Pvt. Ltd., New Delhi. (Latest Edition)
2. "Higher Engineering Mathematics" by B.S. Grewal published by Khanna Publishers
3. "Mathematical Methods" by G. Shanker Rao published by I.K. International Publishing House Pvt. Ltd.
4. "Finite Differences and Numerical Analysis" by H.C Saxena published by S. Chand and Company, Pvt. Ltd., New Delhi.

**B.Sc. Physical Science
SEMESTER – VI**

SPH 364 :Complex Analysis

No. of hrs/week: 4

Credits: 4

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.

UNIT-II

Analytic functions, examples of analytic functions, exponential function, Logarithmic function, trigonometric function, derivatives of functions,

UNIT-III

Definite integrals of functions. Contours, Contour integrals and its examples, 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 of sequences and series, Taylor series and its examples.

UNIT-V

Laurent series and its examples, absolute and uniform convergence of power series.

Books Recommended

1. "Complex Analysis for Mathematics and Engineering" by John H. Mathews and Russell W. Howell published by Jones and Bartlett publishers, 5th edition.
2. "Complex Variables and Applications" by James Ward Brown and Ruel Vance Churchill published by Mc Graw-Hill Higher Education, 8th edition.
3. "Complex Analysis" by Joseph Bak and Donald J. Newman published by Springer-Verlag New York, Inc., New York, 1997, 2nd edition.

**B.Sc. Physical Science
SEMESTER – VI**

SPH 366 :Linear Programming

No. of hrs/week: 4

Credits: 4

Unit-I

Linear Programming Problems, Graphical Approach for Solving some Linear Programs.Convex Sets, Supporting and Separating Hyperplanes.

Unit-II

Theory of simplex method, optimality and unboundedness, the simplex algorithm, simplex method in tableau format

Unit-III

Introduction to artificial variables, two-phase method, Big-M method and their comparison.

Unit-IV

Duality, formulation of the dual problem, primal- dual relationships, economic interpretation of the dual,

Unit-V

Sensitivity analysis.

Recommended Books

1. “Operations Research” by S.D. Sharma published by Kedarnath and Ramnath Co.
2. “Linear Programming and Network Flows” by Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali published by John Wiley and Sons, India, 2004, 2nd edition.
3. “Introduction to Operations Research” by Frederick S. Hiller and Gerald J. Lieberman published by TataMcGraw Hill, Singapore, 2004, 8th edition.
4. “Operations Research: An Introduction” byHamdy A. Taha published byPrentice-HallIndia, 2006, 8th edition.

B.Sc. Physical Science SEMESTER – VI

SSE 372 :BASIC INSTRUMENTATION SKILLS

No. of hrs/week: 2

Credits: 2

This course is to get exposure with various aspects of instruments and their usage through hands-on mode. Experiments listed below are to be done in continuation of the topics.

Basic of Measurement: Instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements and loading effects. **Multimeter:** Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance.

Electronic Voltmeter: Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity. Principles of voltage measurement (block diagram only). Specifications of an electronic Voltmeter/Multimeter and their significance. **AC millivoltmeter:** Type of AC millivoltmeters: Amplifier- rectifier, and rectifier- amplifier. Block diagram of a millivoltmeter, specifications and their significance.

Cathode Ray Oscilloscope: Block diagram of basic CRO. Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only – no mathematical treatment), brief discussion on screen phosphor, visual persistence & chemical composition. Time base operation, synchronization. Front panel controls. Specifications of a CRO and their significance.

Use of CRO for the measurement of voltage (dc and ac frequency, time period). Special features of dual trace, introduction to digital oscilloscope, probes. Digital storage Oscilloscope: Block diagram and principle of working.

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.

Impedance Bridges & Q-Meters: Block diagram of bridge. working principles of basic (balancing type) RLC bridge. Specifications of RLC bridge. Block diagram & working principles of a Q- Meter. Digital LCR bridges.

Digital Instruments: Principle and working of digital meters. Comparison of analog & digital instruments. Characteristics of a digital meter. Working principles of digital voltmeter.

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.

The test of lab skills will be of the following test items:

1. Use of an oscilloscope.
2. CRO as a versatile measuring device.
3. Circuit tracing of Laboratory electronic equipment,

4. Use of Digital multimeter/VTVM for measuring voltages
5. Circuit tracing of Laboratory electronic equipment,
6. Winding a coil / transformer.
7. Study the layout of receiver circuit.
8. Trouble shooting a circuit
9. Balancing of bridges

Laboratory Exercises:

1. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance.
2. To observe the limitations of a multimeter for measuring high frequency voltage and currents.
3. To measure Q of a coil and its dependence on frequency, using a Q- meter.
4. Measurement of voltage, frequency, time period and phase angle using CRO.
5. Measurement of time period, frequency, average period using universal counter/ frequency counter.
6. Measurement of rise, fall and delay times using a CRO.
7. Measurement of distortion of a RF signal generator using distortion factor meter.
8. Measurement of R, L and C using a LCR bridge/ universal bridge.

Open Ended Experiments:

1. Using a Dual Trace Oscilloscope
2. Converting the range of a given measuring instrument (voltmeter, ammeter)

B.Sc. Physical Science
SEMESTER – VI

SSE 374 :PESTICIDE CHEMISTRY

No. of hrs/week: 2

Credits: 2

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

No. of hrs/week: 2

Credits: 2

UNIT-I

Transportation problem and its mathematical formulation, northwest-corner method, Least cost method and Vogel approximation method for determination of starting basic solution, algorithm for solving transportation problem

UNIT-II

Non- Degeneracy and Degeneracy in transportation Problems

UNIT-III

Assignment problem and its mathematical formulation, Hungarian method for solving assignment problem, Travelling Salesman Problem

UNIT-IV

Game theory: formulation of two person zero sum games, solving two person zero sum games, games with mixed strategies, Dominance principle, Graphical solution procedure

UNIT-V

Game theory: Mixed strategies using Linear Programming techniques, Algebraic Methods, Matrix method and short cut method

Books Recommended:

1. "Linear Programming and Network Flows" by Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali published by John Wiley and Sons, India, 2004, 2nd edition.
2. "Introduction to Operations Research" by Frederick S. Hiller and Gerald J. Lieberman published by Tata McGraw Hill, Singapore, 2009, 9th edition.
3. "Operations Research: An Introduction" by Hamdy A. Taha published by Prentice-Hall India, 2006, 8th edition.

**B.Sc. Physical Science
SEMESTER – VI**

SSE 378 :Graph Theory

No. of hrs/week: 2

Credits: 2

UNIT-I

Definition, examples and basic properties of graphs, pseudographs

UNIT-II

Complete graphs, bi-partite graphs, isomorphism of graphs

UNIT-III

Paths and circuits Eulerian circuits, Hamiltonian cycles, the adjacency matrix

UNIT-IV

Weighted graph, Spanning trees, Kruskal's algorithm, Travelling salesman's problem

UNIT-V

Shortest path algorithms :Dijkstra's algorithm, Floyd-Warshall algorithm.

Books Recommended:

1. "Discrete Mathematics with Graph Theory" by Edgar G. Goodaire and Michael M. Parmenter published by Pearson Education (Singapore) P. Ltd., Indian Reprint, 2003, 2nd edition.
2. "Applied Abstract Algebra" by Rudolf Lidl and Gunter Pilz published by Springer (SIE), Indian reprint, 2004, 2nd edition .

**B.Sc. Physical Science
SEMESTER – VI**

SSE 378 : Concepts of Ethical Hacking

No. of hrs/week: 2

Credits: 2

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:

- 1.Hands-On Ethical Hacking and Network Defense – By Michael T. Simpson, Kent Backman, James Corley , Cengage Learning, 2010.
2. Official Certified Ethical Hacker Review Guide – By Steven DeFino, Barry Kaufman, Nick Valenteen, Cengage Learning, 2009.
3. The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy By Patrick Engebretson ,Second Edition 2013.