



*Your Dreams Our Goal*

# POORNIMA UNIVERSITY

Member of Association of Indian Universities & Approved by UGC (Govt. of India) under 2(f) & 12(B)

## FACULTY OF SCIENCE & HUMANITIES

DEPARTMENT OF SCIENCE & HUMANITIES



## SCHEME & SYLLABUS BOOKLET

BATCH 2022-2025

**SCHEME**

**&**

**SYLLABUS**

**BATCH: 2022-25**

# INDEX

S. No	Contents
1	Vision, Mission and Quality Policy of University
2	Knowledge Wheel
3	Preamble
4	About Program and Program Outcomes (POs)
5	Examination System
6	Assessment & Grade Point Average: SGPA, CGPA
7	Guidelines for MOOC Courses
8	Teaching Scheme of all Semesters
9	Teaching Syllabus of all Semesters

**Disclaimer:** The scheme, syllabus and other materials published in this booklet may be changed or modified as per the requirement after approval of competent authority. The decision taken by the management of Poornima University will be final and abiding to all.

## Student Details

Name of Student:

Name of Program:

Semester:

Year:

Batch:

Faculty of:



*Your Dreams Our Goal*  
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### ***VISION***

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

### ***Mission***

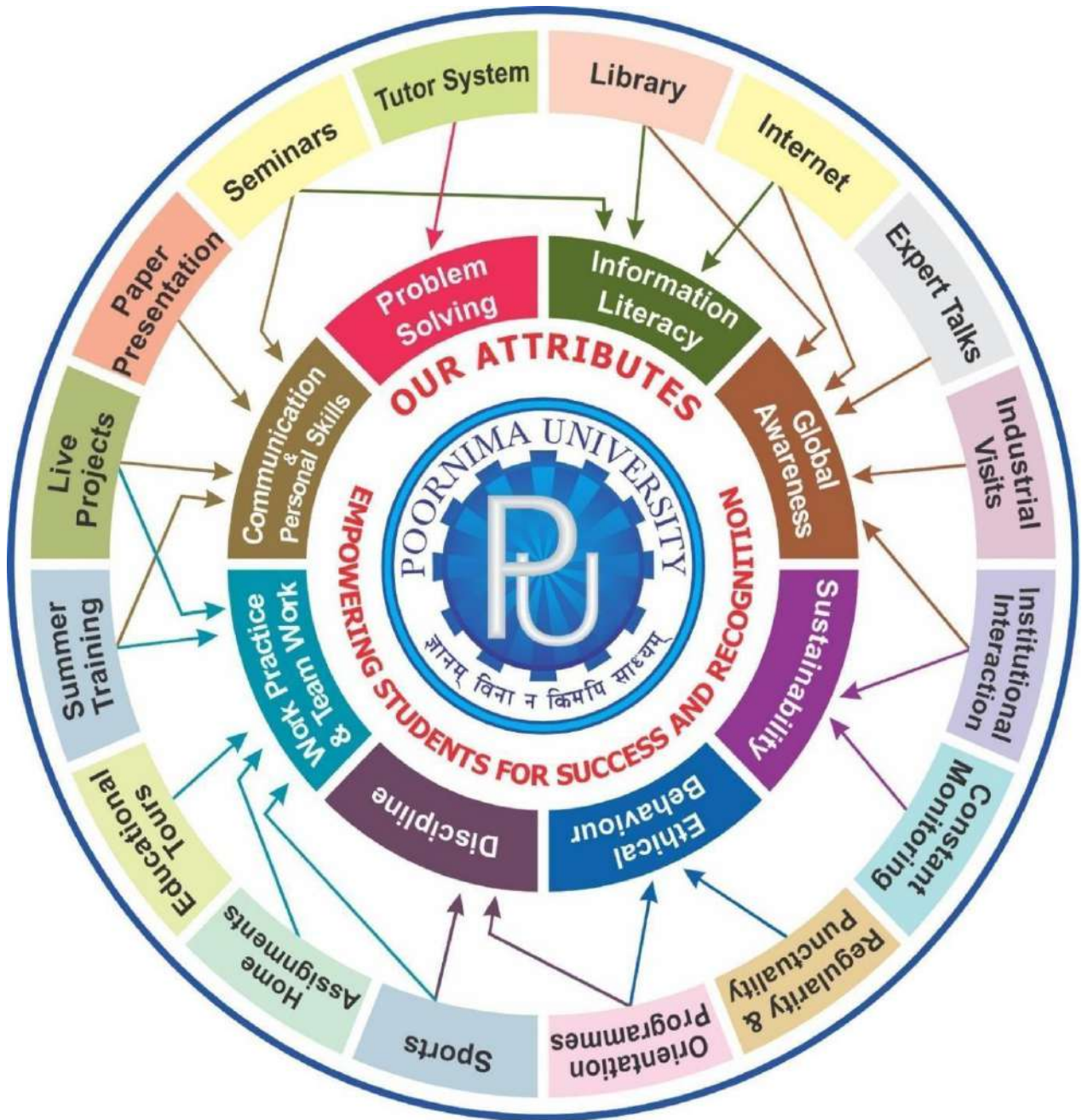
To evolve and develop skill based systems for effective delivery of knowledge so as to equip young professionals with dedication and commitment to excellence in all spheres of life.

### ***Quality Policy***

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

# Knowledge Wheel

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



## **About Program and Program Outcomes (PO):**

**Title of the Programme:** Bachelor of Science (B. Sc.)

**Nature of the Programme:** B. Sc. is three-year full-time programme.

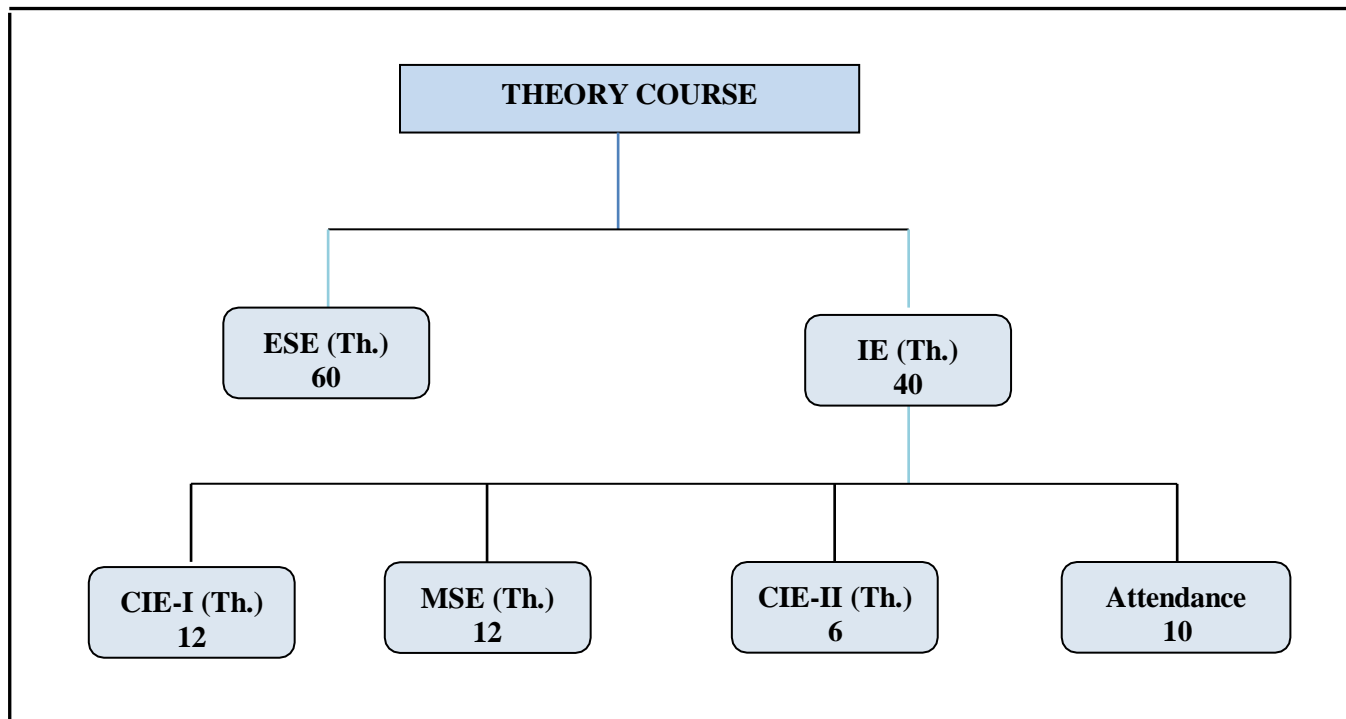
### **Program Outcomes (PO):**

Science Graduates will be able to:

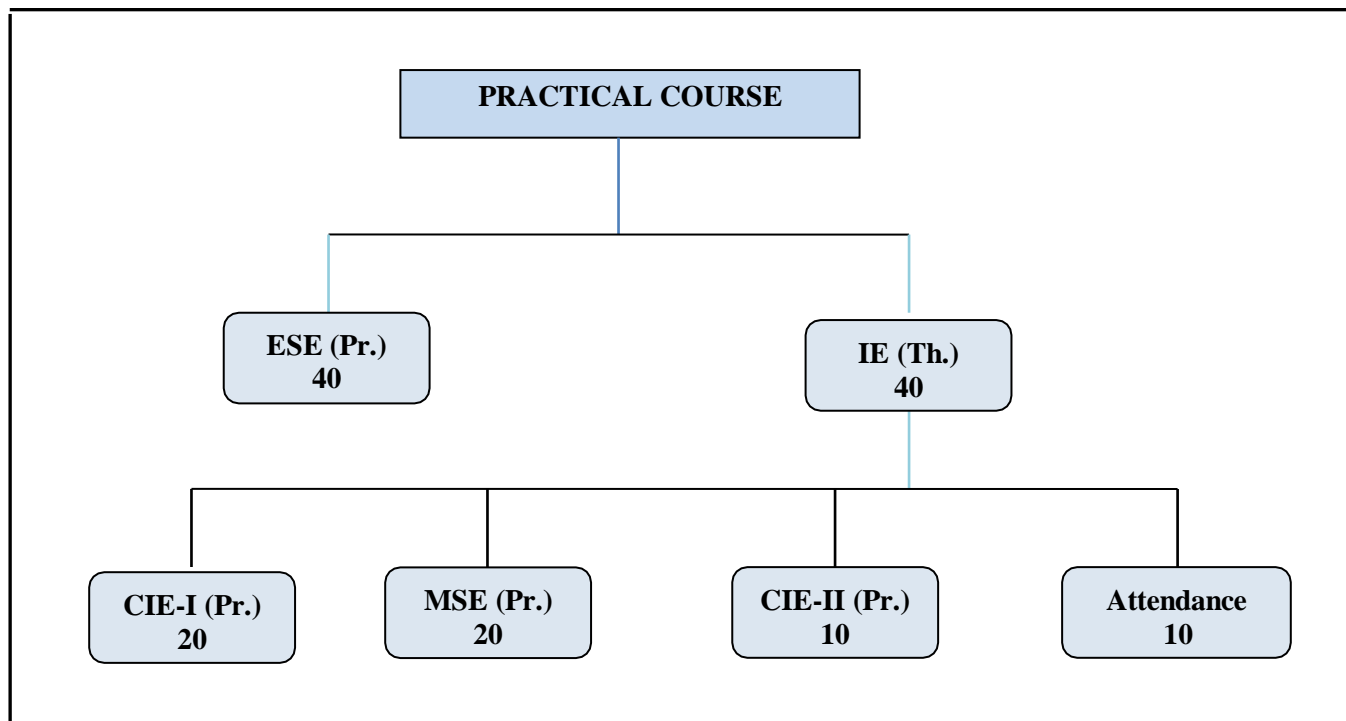
1. **Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of B.Sc. program.
2. **Scientific reasoning and Problem solving:** Ability to analyze, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences  
Capacity to extrapolate from what one has learned and apply their competencies to solve real life situations
3. **Analytical reasoning and Research related skills:** Define problems, formulate hypotheses, test, analyze, interpret and draw conclusions from data and report the results of an experiment or investigation
4. **Critical thinking:** identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.
5. **Digital literacy:** Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.
6. **Reflective thinking:** Possess knowledge of Critical sensibility to lived experiences, with self-awareness and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.
7. **Environment and sustainability:** Appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.
8. **Moral and ethical awareness:** Ability to embrace ethical values in conducting one's life, formulates a position about an ethical issue from multiple perspectives, and use ethical practices in all work.
9. **Leadership qualities:** Capability for mapping out the tasks of a team or an organization, and setting direction to work effectively and respectfully with diverse teams; and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team.
10. **Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; present complex information in a clear and concise manner.
11. **Project management and finance:** Ability to work independently, identify appropriate resources required for a project, and manage a project.
12. **Lifelong learning:** Ability to acquire knowledge and skills in learning activities throughout life aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place.

## Examination System:

### A. Marks Distribution of Theory Course:



### B. Marks Distribution of Practical Course :



**Th. :** Theory, **Pr. :** Practical, **ESE:** End Semester Examination, **MSE:** Mid Semester Examination, **CIE:** Continuous Internal Evaluation.



## Marks Distribution of Attendance:

Guidelines for Marks Distribution of Attendance Component		
S No.	Total Course Attendance (TCA) range in Percentage	Marks allotted (out of 10)
1	$95\% \leq \text{TCA}$	10
2	$90\% \leq \text{TCA} < 95\%$	9
3	$85\% \leq \text{TCA} < 90\%$	8
4	$80\% \leq \text{TCA} < 85\%$	7
5	$70\% \leq \text{TCA} < 80\%$	6
6	$60\% \leq \text{TCA} < 70\%$	5
7	$50\% \leq \text{TCA} < 60\%$	4
8	$40\% \leq \text{TCA} < 50\%$	3
9	$30\% \leq \text{TCA} < 40\%$	2
10	$20\% \leq \text{TCA} < 30\%$	1
11	$\text{TCA} < 20\%$	0

## CO Wise Marks Distribution:

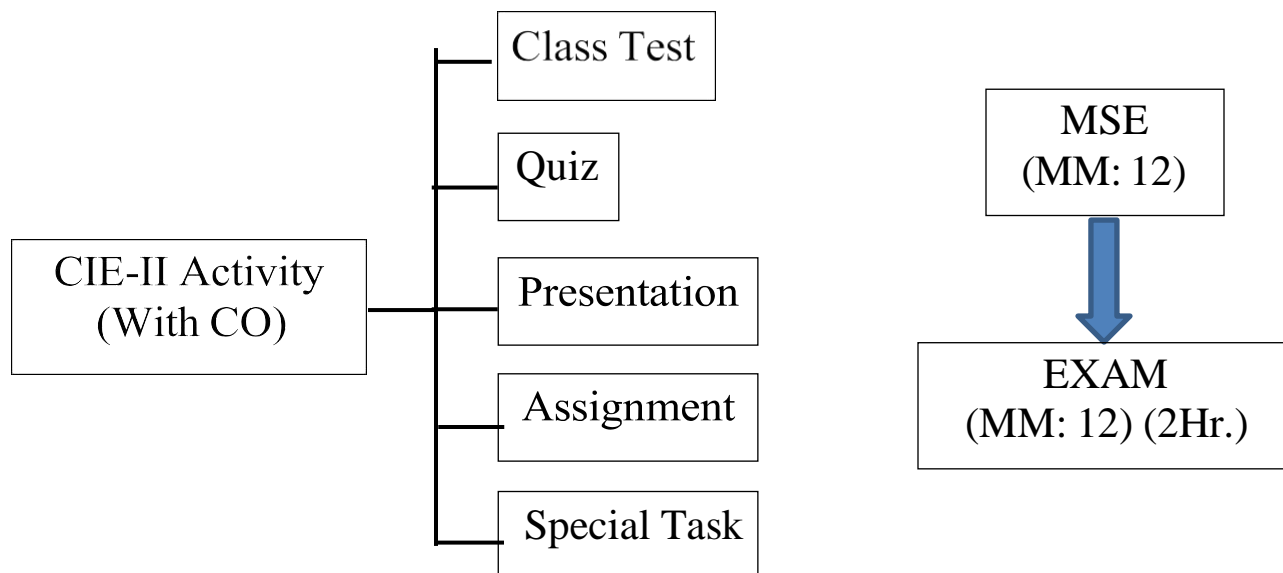
	Theory Subject		Practical/ Studio Subject	
	Maximum Marks	CO to be Covered	CO to be Covered	Maximum Marks
<b>CIE-I (Class Test)</b>	12 ( 6 + 6)	1 & 2	1 & 2	20 (10 + 10)
<b>MSE</b>	12 ( 6 + 6)	3 & 4	3 & 4	20 (10 + 10)
<b>CIE-II (Activity/ Assignment )</b>	6 (6)	5	5	10 (10)
<b>Attendance</b>	10	-	-	10
<b>ESE</b>	60	-	-	40
<b>TOTAL</b>	100	-	-	100



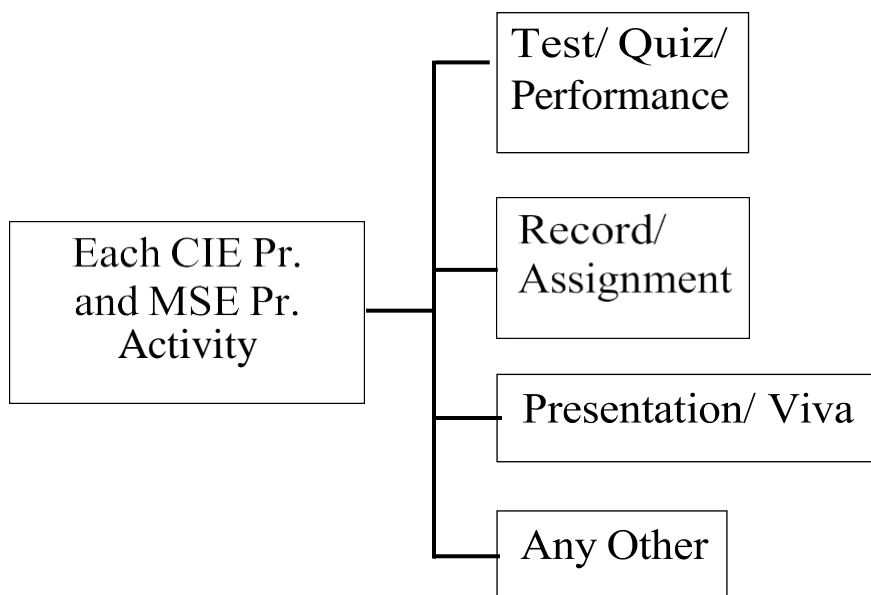
**Minimum Passing Percentage in All Exams:**

S. No.	Program	Minimum Passing Percentage in All Exam	
		ESE Component	Total Component
1	Course Work for Ph. D Registration	-----	50 %
2	B. Arch.	45 %	50 %
3	MBA, MHA, MPH, MCA, M. Tech., M. Plan. and M. Des.	40 %	40 %
4	B. Tech., B. Des., BCA, B.Sc., BVA, B. Voc., BBA, B.Com., B.A. and Diploma	35 %	40 %
5	B. Sc. (Hospitality & Hotel Administration)	35 %	40 % (Theory) & 50 % (Practical)

**Break-up of Internal Exam (Theory):**



**Break-up of Internal Exam (Practical):**



**Assessment & Grade Point Average: SGPA, CGPA:**

**SGPA Calculation**

$$SGPA = \frac{C_1G_1 + C_2G_2 + \dots + C_nG_n}{C_1 + C_2 + \dots + C_n}$$

$SGPA = \frac{\sum_i C_i \times G_i}{\sum_i C_i}$	<p>Where ( as per teaching Scheme &amp; Syllabus ) :</p> <p><math>C_i</math> is the number of Credits of Courses <math>i</math>,</p> <p><math>G_i</math> is the Grade Point for the Course <math>i</math> and <math>i = 1, 2, \dots, n</math></p> <p><math>n</math> = number of courses in a programme in the Semester</p>
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**CGPA Calculation**

$$CGPA = \frac{C_1G_1 + C_2G_2 + \dots + C_nG_n}{C_1 + C_2 + \dots + C_n}$$

$CGPA = \frac{\sum_i C_i \times G_i}{\sum_i C_i}$	<p>Where ( as per teaching Scheme &amp; Syllabus ) :</p> <p><math>C_i</math> is the number of Credits of Courses <math>i</math>,</p> <p><math>G_i</math> is the Grade Point for the Course <math>i</math> and <math>i = 1, 2, \dots, n</math></p> <p><math>n</math> = number of courses in a programme of all the Semester up to which CGPA is computed.</p>
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## Grading Table:

**Grading Table-A: For B.Arch. and course work for Ph.D. Registration**

Academic Performance	Grade	Grade Point	Marks Range ( in %)
Outstanding	A+	10	$90 \leq x \leq 100$
Excellent	A	9	$80 \leq x < 90$
Very good	B+	8	$70 \leq x < 80$
Good	B	7	$60 \leq x < 70$
Average	C	6	$50 \leq x < 60$
Fail	F	0	$x < 50$

**Grading Table-B: For all courses except B.Arch. and course work for Ph.D. Registration**

Academic Performance	Grade	Grade Point	Marks Range ( in %)
Outstanding	A+	10	$90 \leq x \leq 100$
Excellent	A	9	$80 \leq x < 90$
Very good	B+	8	$70 \leq x < 80$
Good	B	7	$60 \leq x < 70$
Average	C	6	$50 \leq x < 60$
Satisfactory	D	5	$40 \leq x < 50$
Fail	F	0	$x < 40$

*Calculation of SGPA*

$$SGPA = \frac{\sum C_i \times G_i}{\sum C_i}$$

$$SGPA = \frac{C_1G_1 + C_2G_2 + \dots + C_nG_n}{C_1 + C_2 + \dots + C_n}$$

*Calculation of CGPA*

$$CGPA = \frac{\sum C_i \times G_i}{\sum C_i}$$

$$CGPA = \frac{C_1G_1 + C_2G_2 + \dots + C_nG_n}{C_1 + C_2 + \dots + C_n}$$

where (as per teaching scheme & syllabus):  $C_i$  is the number of credits of subject  $i$ ,  $G_i$  is the Grade Point for the subject  $i$  and  $i = 1$  to  $n$ ,  $n$  = number of subjects in a course in the semester

## Award of Class:

CGPA	Equivalent Division
$7.50 \leq CGPA$	First Division with Distinction
$6.50 \leq CGPA < 7.50$	First Division
$5.50 \leq CGPA < 6.50$	Second Division
$4.50 \leq CGPA < 5.50$	Pass Class

The multiplication factor for conversion of CGPA to percentage is Equivalent % of Marks =  $(CGPA - 0.5) \times 10$ .

For Example if CGPA = 5.5 then % is  $(5.5 - 0.5) \times 10 = 50\%$ .

## **Guidelines for MOOC COURSES:**

1. Applicable from the session 2020 – 21 onwards, for students aspiring for HONOURS Degree.
2. The UGC has issued UGC (Credit Framework for Online Learning Courses) Regulation, 2016. These shall apply to all universities established or incorporated by or under a Central Act, a Provincial Act, or a State/Union Territory Act and all institutions recognized by or affiliated to such Universities and all institutions deemed to be universities under Section 3 of the UGC Act, 1956.
3. All India Council for Technical Education (AICTE) has introduced Model Curriculum for Bachelor programs of 4 years/ 3 Years, and additional credits will be required to be done for the degree of Bachelor program with Honours. These additional credits will have to be acquired with online courses (MOOCs) as per AICTE.
4. This creates an excellent opportunity for students to acquire the necessary skill set for employability through massive online courses where the rare expertise of world famous experts from academics and industry are available.
5. Students are required to complete additional credits through MOOCs within 4 years/ 3years of time (whatever be applicable time for the completion of registered program) so as to become eligible for Honours degree as per norms.
6. It is necessary to complete minimum MOOCs credit course as mentioned below for becoming eligible for the Honours degree in the registered program.
7. MOOC Course Credits shall be calculated as per details given below:
8. Student are required to give the prior information about MOOCs courses to his respective HOD and COE, in which he/she wants to register for online certification.
9. After getting permission from respective HOD, a student can register for the MOOC certification courses.
10. After successful completion of the said MOOC course, the student shall submit the certificate of completion to the respective department. If he/ she fails to provide the certificates of MOOC courses before last teaching day of the semester then these certificates will not be considered later.

**Required credits for Honours :**

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

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

**Attached Items:**

Open Elective Booklet	Annexure-1
Soft Skills Booklet	Annexure-2
Value Added Course Booklet	Annexure-3

POORNIMA UNIVERSITY								
Faculty of Science & Humanities								
B.Sc. (PCM), Batch: 2022-25								
Teaching Scheme for First Year First Semester								
Course Code	Course Name	Teaching Scheme(Hrs per Week)			Marks Distribution			Credits
		Lecture (L)	Tutorials (T)	Practical (P)	IE	ESE	Total	
<b>A</b>	<b>University Core Courses</b>							
<b>A.1</b>	<b>Theory</b>							
<b>BULCSA1101</b>	Environmental Studies	2	-	-	40	60	100	2
<b>A.2</b>	<b>Practical</b>							
	Nil	-	-	-	-	-	-	-
<b>B.</b>	<b>Department Core Courses</b>							
<b>B.1</b>	<b>Theory</b>							
<b>BSACSA1101</b>	Mechanics	3	-	-	40	60	100	3
<b>BSACSA1102</b>	Electromagnetism	3	-	-	40	60	100	3
<b>BSACSA1103</b>	Inorganic Chemistry	3	-	-	40	60	100	3
<b>BSACSA1104</b>	Organic Chemistry	3	-	-	40	60	100	3
<b>BSACSA1105</b>	Calculus	3	-	-	40	60	100	3
<b>BSACSA1106</b>	Vector Calculus and Matrices	3	-	-	40	60	100	3
<b>B.2</b>	<b>Practical</b>							
<b>BSACSA1201</b>	Chemistry Lab-I	-	-	2	60	40	100	1
<b>BSACSA1202</b>	Physics Lab-I	-	-	2	60	40	100	1
<b>C.</b>	<b>Department Elective: Any One</b>							
	NIL	-	-	-	-	-	-	-
<b>D.</b>	<b>Open Elective: Anyone</b>							
	NIL	-	-	-	-	-	-	-
<b>E.</b>	<b>Humanities and Social Sciences including Management courses OR Ability Enhancement Compulsory Course (AECC)</b>							
<b>BULCHU1201</b>	Foundation English	-	-	2	60	40	100	1
<b>F.</b>	<b>Skill Enhancement Courses (SEC) OR Project work, Seminar and Internship in Industry or Elsewhere</b>							
	NIL	-	-	-	-	-	-	-
<b>G.</b>	<b>Discipline, Value Added Courses &amp; Social Outreach</b>							
<b>BSACSA1601</b>	Discipline, Value Added Courses & Social Outreach							
	Talent Enrichment Programme (TEP-I)	-	-	-	50	-	50	1
	Library / MOOC / Online Certification Courses							
	<b>Total</b>	20		6				24
	<b>Total Teaching Hours</b>		26					24

**POORNIMA UNIVERSITY**

**Faculty of Science & Humanities**

**B.Sc. (PCM), Batch: 2022-25**

**Teaching Scheme for First Year Second Semester**

CourseCode	Course Name	Teaching Scheme (Hrs per Week)			Marks Distribution			Credits
		Lecture (L)	Tutorials (T)	Practical (P)	IE	ESE	Total	
<b>A.</b>	<b>University Core Courses</b>							
<b>A.1</b>	<b>Theory</b>							
	Nil	-	-	-	-	-	-	-
<b>A.2</b>	<b>Practical</b>							
	Nil	-	-	-	-	-	-	-
<b>B.</b>	<b>Department Core Courses</b>							
<b>B.1</b>	<b>Theory</b>							
<b>BSACSA2101</b>	Optics	3	-	-	40	60	100	3
<b>BSACSA2102</b>	Waves and Oscillations	3	-	-	40	60	100	3
<b>BSACSA2103</b>	Organic Chemistry	3	-	-	40	60	100	3
<b>BSACSA2104</b>	Physical Chemistry	3	-	-	40	60	100	3
<b>BSACSA2105</b>	Numerical Analysis	3	-	-	40	60	100	3
<b>BSACSA2106</b>	Differential Equations	3	-	-	40	60	100	3
<b>B.2</b>	<b>Practical</b>							
<b>BSACSA2201</b>	Chemistry Lab-II	-	-	2	60	40	100	1
<b>BSACSA2202</b>	Physics Lab-II	-	-	2	60	40	100	1
<b>C.</b>	<b>Department Elective: Anyone</b>							
	NIL	-	-	-	-	-	-	-
<b>D.</b>	<b>Open Elective: Anyone</b>							
	As per Annexure	2	-	-	40	60	100	2
<b>E.</b>	<b>Humanities and Social Sciences including Management courses OR Ability Enhancement Compulsory Course (AECC)</b>							
<b>BULCHU2201</b>	Human Values & Professional Ethics	-	-	2	60	40	100	1
<b>F.</b>	<b>Skill Enhancement Courses (SEC) OR Project work, Seminar and Internship in Industry or Elsewhere</b>							
	NIL	-	-	-	-	-	-	-
<b>G.</b>	<b>Discipline, Value Added Courses &amp; Social Outreach</b>							
<b>BSACSA2601</b>	Discipline, Value Added Courses & Social Outreach							
	Talent Enrichment Programme (TEP-II)	-	-	-	50	-	50	1
	Library / MOOC / Online Certification Courses							
	<b>Total</b>	20		6				
	<b>Total Teaching Hours</b>		26					24



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**Faculty of Science & Humanities**

**B.Sc. (PCM), Batch: 2022-25**

**Teaching Scheme for Second Year Third Semester**

Course Code	Course Name	Teaching Scheme (Hrs per Week)			Marks Distribution			Credits
		Lecture (L)	Tutorials (T)	Practical (P)	IE	ESE	Total	
<b>A.</b>	<b>University Core Courses</b>							
<b>A.1</b>	<b>Theory</b>							
	NIL	-	-	-	-	-	-	-
<b>A.2</b>	<b>Practical</b>							
		-	-	-	-	-	-	-
<b>B.</b>	<b>Department Core Courses</b>							
<b>B.1</b>	<b>Theory</b>							
<b>BSACSA3101</b>	Electronic Devices and Circuits	3	-	-	40	60	100	3
<b>BSACSA3102</b>	Inorganic Chemistry	3	-	-	40	60	100	3
<b>BSACSA3103</b>	Physical Chemistry	3	-	-	40	60	100	3
<b>BSACSA3104</b>	Analytical Geometry	3	-	-	40	60	100	3
<b>B.2</b>	<b>Practical</b>							
<b>BSACSA3201</b>	Chemistry Lab-III	-	-	2	60	40	100	1
<b>BSACSA3202</b>	Physics Lab-III	-	-	2	60	40	100	1
<b>C.</b>	<b>Department Elective: Anyone</b>							
<b>BSAESA3101</b>	Thermodynamics Statistical Physics				40	60	100	
<b>BSAESA3102</b>	Analog and Digital Circuits	3	0	0	40	60	100	3
<b>BSAESA3103</b>	Environment Management				40	60	100	
<b>-D.</b>	<b>Open Elective: Anyone</b>							
	<b>As per Annexure</b>	2	-	-	40	60	100	2
<b>E.</b>	<b>Humanities and Social Sciences including Management courses OR Ability Enhancement Compulsory Course (AECC)</b>							
<b>BULCHU3201</b>	Communication Skills -I	-	-	2	60	40	100	1
<b>F.</b>	<b>Skill Enhancement Courses (SEC) OR Project work, Seminar and Internship in Industry or Elsewhere</b>							
<b>BSACCE3201</b>	Office Automation Tool	-	-	2	60	40	100	1
<b>G.</b>	<b>Discipline, Value Added Courses &amp; Social Outreach</b>							
<b>BSACSA3601</b>	Discipline, Value Added Courses & Social Outreach							
	Talent Enrichment Programme (TEP-III)	-	-	-	50	-	50	1
	Library / MOOC /Online Certification Courses							
	<b>Total</b>	17		8				
	<b>Total Teaching Hours</b>		25					22

POORNIMA UNIVERSITY								
Faculty of Science & Humanities								
B.Sc. (PCM), Batch: 2022-25								
Teaching Scheme for Second Year Fourth Semester								
Course Code	Course Name	Teaching Scheme (Hrs per Week)			Marks Distribution			Credits
		Lecture (L)	Tutorials (T)	Practical (P)	IE	ESE	Total	
<b>A.</b>	<b>University Core Courses</b>							
<b>A.1</b>	<b>Theory</b>							
	NIL	-	-	-	-	-	-	-
<b>A.2</b>	<b>Practical</b>							
	NIL	-	-	-	-	-	-	-
<b>B.</b>	<b>Department Core Courses</b>							
<b>B.1</b>	<b>Theory</b>							
BSACSA4101	Inorganic Chemistry	3	-	-	40	60	100	3
BSACSA4102	Organic Chemistry	3	-	-	40	60	100	3
BSACSA4103	Statistics and Probability Theory	3	-	-	40	60	100	3
BSACSA4104	Abstract Algebra	3	-	-	40	60	100	3
<b>B.2</b>	<b>Practical</b>							
BSACSA4201	Chemistry Lab-IV	-	-	2	60	40	100	1
BSACSA4202	Physics Lab-IV	-	-	2	60	40	100	1
<b>C.</b>	<b>Department Elective: AnyOne</b>							
BSAESA4101	Analog and Digital Electronics	3	-	-	40	60	100	3
BSAESA4102	Operating Systems				40	60	100	
<b>D.</b>	<b>Open Elective: Anyone</b>							
	As per Annexure	2	-	-	40	60	100	2
<b>E.</b>	<b>Humanities and Social Sciences including Management courses OR Ability Enhancement Compulsory Course (AECC)</b>							
BULCHU4201	Communication Skills -II	-	-	2	60	40	100	1
<b>F.</b>	<b>Skill Enhancement Courses (SEC) OR Project work, Seminar and Internship in Industry or Elsewhere</b>							
BSACCE4201	Computer Hardware and Troubleshooting Laboratory	-	-	2	60	40	100	1
BSACSA4202	Technical Seminar	-	-	2	60	40	100	1
<b>G.</b>	<b>Discipline, Value Added Courses &amp; Social Outreach</b>							
BSACSA4601	Discipline, Value Added Courses & Social Outreach	-	-	-	50	-	50	1
	Talent Enrichment Programme (TEP-IV)							
	Library / MOOC / Online Certification Courses							
	<b>Total</b>	17		10				23
	<b>Total Teaching Hours</b>	27						23

POORNIMA UNIVERSITY								
Faculty of Science & Humanities								
B.Sc. (PCM), Batch: 2022-25								
Teaching Scheme for Third Year Fifth Semester								
Course Code	Course Name	Teaching Scheme (Hrs per Week)			Marks Distribution			Credits
		Lecture (L)	Tutorials (T)	Practical (P)	IE	ESE	Total	
<b>A.</b>	<b>University Core Courses</b>							
<b>A.1</b>	<b>Theory</b>							
	NIL	-	-	-	-	-	-	-
<b>A.2</b>	<b>Practical</b>							
	NIL	-	-	-	-	-	-	-
<b>B.</b>	<b>Department Core Courses</b>							
<b>B.1</b>	<b>Theory</b>							
<b>BSACSA5101</b>	Nuclear Physics	3	-	-	40	60	100	3
<b>BSACSA5102</b>	Atomic and Molecular Spectroscopy	3	-	-	40	60	100	3
<b>BSACSA5103</b>	Organic Chemistry	3	-	-	40	60	100	3
<b>BSACSA5104</b>	Optimization Techniques	3	-	-	40	60	100	3
<b>B.2</b>	<b>Practical</b>							
<b>BSACSA5201</b>	Chemistry Lab-V	-	-	2	60	40	100	1
<b>BSACSA5202</b>	Physics Lab-V	-	-	2	60	40	100	1
<b>C.</b>	<b>Department Elective: AnyOne</b>							
<b>BSAESA5101</b>	Real Analysis		-	-	40	60	100	
<b>BSAESA5102</b>	Data Structure	3			40	60	100	3
<b>D.</b>	<b>Open Elective: Anyone</b>							
	As per Annexure	2	-	-	40	60	100	2
<b>E.</b>	<b>Humanities and Social Sciences including Management courses OR Ability Enhancement Compulsory Course (AECC)</b>							
<b>BULCHU5201</b>	Professional Skills -I	-	-	2	60	40	100	1
<b>F.</b>	<b>Skill Enhancement Courses (SEC) OR Project work, Seminar and Internship in Industry or Elsewhere</b>							
<b>BSACSA5401</b>	Industrial Training & Seminar	-	-	2	60	40	100	6
<b>G.</b>	<b>Discipline, Value Added Courses &amp; Social Outreach</b>							
<b>BSACSA5601</b>	Discipline, Value Added Courses & Social Outreach							
	Talent Enrichment Programme (TEP-V) Library / MOOC / Online Certification Courses	-	-	-	50	-	50	1
	<b>Total</b>	17		8				27
	<b>Total Teaching Hours</b>		25					27

**POORNIMA UNIVERSITY**

**Faculty of Science & Humanities**

**B.Sc. (PCM), Batch: 2022-25**

**Teaching Scheme for Third Year Sixth Semester**

Course Code	Course Name	Teaching Scheme (Hrs per Week)			Marks Distribution			Credits
		Lecture (L)	Tutorials (T)	Practical (P)	IE	ESE	Total	
<b>A.</b>	<b>University Core Courses</b>							
<b>A.1</b>	<b>Theory</b>							
	NIL	-	-	-	-	-	-	-
<b>A.2</b>	<b>Practical</b>							
	NIL	-	-	-	-	-	-	-
<b>B.</b>	<b>Department Core Courses</b>							
<b>B.1</b>	<b>Theory</b>							
<b>BSACSA6101</b>	Quantum Mechanics	3	-	-	40	60	100	3
<b>BSACSA6102</b>	Physical Chemistry	3	-	-	40	60	100	3
<b>BSACSA6103</b>	Complex Analysis	3	-	-	40	60	100	3
<b>B.2</b>	<b>Practical</b>							
	NIL	-	-	-	-	-	-	-
<b>C.</b>	<b>Department Elective: At least One</b>							
	NIL	-	-	-	-	-	-	-
<b>D.</b>	<b>Open Elective: Anyone</b>							
	NIL	-	-	-	-	-	-	-
<b>E.</b>	<b>Humanities and Social Sciences including Management courses OR Ability Enhancement Compulsory Course (AECC)</b>							
<b>BULCHU6201</b>	Professional Skills -II	-	-	2	60	40	100	1
<b>F.</b>	<b>Skill Enhancement Courses (SEC) OR Project work, Seminar and Internship in Industry or Elsewhere</b>							
<b>BSACSA6401</b>	Dissertation	-	-	14	60	40	100	8
<b>G.</b>	<b>Discipline, Value Added Courses &amp; Social Outreach</b>							
<b>BSACSA6601</b>	Discipline, Value Added Courses & Social Outreach							
	Talent Enrichment Programme (TEP-VI)	-	-	-	50	-	50	1
	Library / MOOC / Online Certification Courses							
	<b>Total</b>	<b>9</b>		<b>16</b>				<b>19</b>
	<b>Total Teaching Hours</b>		<b>25</b>					

# CORE THEORY

**Code: BULCSA1101      ENVIRONMENTAL STUDIES      2.0 Credits [LTP: 2-0-0]**

**COURSE OUTCOMES:** Students will be able to:

CO1: Understand the scope of environmental studies and explain the concept of ecology, ecosystem and biodiversity.

CO2: Implement innovative ideas of controlling different categories of Environmental Pollution.

CO3: Explain different environmental issues together with various Environmental Acts, regulations and International Agreements.

CO4: Summarize social issues related to population, resettlement and rehabilitation of project affected persons and demonstrate disaster management with special reference to floods, earthquakes, cyclones, landslides.

CO5: Determine the local environmental assets with simple ecosystems and identify local flora and fauna.

## A. OUTLINE OF THE COURSE

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

## B. DETAILED SYLLABUS

Unit	Unit Details
<b>1.</b>	<b>Introduction to Environmental studies</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Multidisciplinary nature of environmental studies</li> </ul> <p>Concept of sustainability and sustainable development.</p> <ul style="list-style-type: none"> <li>• Ecosystem: Structure and function of ecosystem</li> <li>• Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies\</li> <li>• Case studies of the following ecosystems: Forest ecosystem, Grassland ecosystem, Desert ecosystem</li> <li>• Aquatic ecosystems</li> <li>• Biodiversity and Conservation</li> <li>• Conclusion &amp; Real Life Application</li> </ul>
<b>2.</b>	<b>Environmental Pollution and its Control</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution</li> <li>• Nuclear hazards and human health risks</li> <li>• Solid waste management: Control measures of urban and industrial waste.</li> <li>• Pollution case studies</li> <li>• Conclusion &amp; Real Life Application</li> </ul>
<b>3.</b>	<b>Environmental Policies &amp; Practices</b>

	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture</li> <li>• Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies.</li> <li>• Environment Laws: Environment Protection Act; Air (Prevention &amp; Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act.</li> <li>• International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD)</li> <li>• Conclusion &amp; Real Life Application</li> </ul>
<b>4.</b>	<b>Human Communities and the Environment</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Human population growth: Impacts on environment, human health and welfare.</li> <li>• Resettlement and rehabilitation of project affected persons; case studies.</li> <li>• Disaster management: floods, earthquake, cyclones and landslides.</li> <li>• Conclusion &amp; Real Life Application</li> </ul>
<b>5.</b>	<b>Field Work</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.</li> <li>• Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.</li> <li>• Study of common plants, insects, birds and basic principles of identification.</li> <li>• Study of simple ecosystems-pond, river, Delhi Ridge, etc.</li> <li>• Conclusion &amp; Real Life Application</li> </ul>

### C. RECOMMENDED STUDY MATERIAL:

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

**COURSE OUTCOMES:** Students will be able to:

CO1: Compare Inertial and non-inertial frames of reference using velocity, acceleration and coordinate system.

CO2: Differentiate among Elastic constants: Young's Modulus, Bulk Modulus, Modulus of Rigidity, Poisson's ratio and bending of beam.

CO3: Compute center of mass, motion of a system with varying mass and Charged particle scattering by nucleus charged particle scattering by nucleus

CO4: Solve the problems of bodies moving under the central forces using gravitational interaction, Kepler's law and different trajectories

CO5: Relate time dilation, length contraction, mass energy relation Lorentz transformation and variation of mass with velocity using Einstein's special theory of relativity.

### A. OUTLINE OF THE COURSE

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

### B. DETAILED SYLLABUS

Unit	Unit Details
1.	<b>Frames of Reference</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Inertial and non-inertial frames of references</li> <li>• Transformation of displacement</li> <li>• Velocity and acceleration in different coordinate system</li> <li>• Galilean transformation</li> <li>• Transformation of velocity and acceleration between rotating frames</li> <li>• Pseudo forces</li> <li>• Coriolis force and its application</li> <li>• Motion relative to earth</li> <li>• Conclusion &amp; Real life applications</li> </ul>
2.	<b>Elastic Properties of Matter</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Elastic constants: Young's Modulus, Bulk Modulus, Modulus of Rigidity</li> <li>• Poisson's ratio</li> <li>• Relations between the elastic constants, torsion of a cylinder</li> <li>• Bending of beams: Bending moment, Cantilever,</li> <li>• Principal moments and axes.</li> <li>• Kinematics of moving fluids, equation of continuity, Euler's equation,</li> <li>• Bernoulli's theorem.</li> <li>• Conclusion &amp; Real life applications</li> </ul>



<b>3.</b>	<b>Centre of Mass</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Centre of mass of a two particle system</li> <li>• Motion of centre of mass and reduced mass conservation of linear momentum</li> <li>• Elastic and inelastic collision of two particles in laboratory and center of mass frames</li> <li>• Motion of a system with varying mass</li> <li>• Angular momentum conservation with examples</li> <li>• Charged particle scattering by nucleus</li> <li>• Conclusion &amp; Real life applications</li> </ul>
<b>4.</b>	<b>Motion Under Central Forces</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Motion under central forces</li> <li>• Gravitational interaction, general solution under gravitational interaction</li> <li>• Discussion of trajectories</li> <li>• Cases of elliptical and circular orbits</li> <li>• Kepler's laws</li> <li>• Conclusion &amp; Real life applications</li> </ul>
<b>5.</b>	<b>Special Theory of Relativity</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Michelson Morley experiment</li> <li>• Postulates of special theory of relativity</li> <li>• Lorentz transformations</li> <li>• Length contraction</li> <li>• Time dilation</li> <li>• Addition of velocities</li> <li>• Variation of mass with velocity</li> <li>• Mass-energy relation</li> <li>• Relativistic energy-momentum relation</li> <li>• Conclusion &amp; Real life applications</li> </ul>

### C. RECOMMENDED STUDY MATERIAL:

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

**COURSE OUTCOMES:** Students will be able to:

CO1: Explain the basic field vectors and their physical significance

CO2: Apply and acquire knowledge about electric field lines, electric flux, Gauss's law and its applications.

CO3: Learn and exhibit knowledge of electric potential and its various applications, relation between electric field and electric potential.

CO4: Discuss the dielectric and polarization properties of matter

CO5: Interpret the deeper knowledge of various laws of electromagnetic induction and A.C. Circuits.

### A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Scalar and Vector Fields	6
2.	Electric Field in Matter	8
3.	Magnetic Fields in Matter	8
4.	Dielectric	7
5.	Maxwell's Equations and Electromagnetic Waves	7

### B. DETAILED SYLLABUS

Unit	Unit Details
1.	<b>Scalar and Vector Fields</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Coulomb's law, Gauss's law.</li> <li>• Gradient of a scalar function, Vector Flux</li> <li>• Divergence of a vector function</li> <li>• Line Integral of vector field</li> <li>• Curl of vector function</li> <li>• Physical significance of curl</li> <li>• Gauss divergence theorem</li> <li>• Stoke's theorem</li> <li>• Poisson's and Laplace's equations</li> <li>• Solution of Laplace's equation for simple cases.</li> <li>• Conclusion &amp; Real life applications</li> </ul>
2.	<b>Electric Field in Matter</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• The moment of a charge distribution.</li> <li>• Atomic and molecular dipoles.</li> <li>• Atomic polarizability.</li> <li>• Permanent dipole moment, dielectrics.</li> <li>• The Capacitor filled with a dielectric.</li> <li>• The potential and field due to a polarized sphere.</li> <li>• Conclusion &amp; Real life applications</li> </ul>
3.	<b>Magnetic Fields in Matter</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> </ul>

	<ul style="list-style-type: none"> <li>• Electric current due to orbital electron, the field of current loop, Bohr magneton.</li> <li>• Orbital gyro magnetic ratio Electron spin and magnetic moment.</li> <li>• Magnetic susceptibility, magnetic field caused by magnetized matter.</li> <li>• Magnetization current. Free current and the field H.</li> <li>• Conclusion &amp; Real life applications</li> </ul>
<b>4.</b>	<b>Dielectric</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Dielectric. Dielectric sphere placed in a uniform field.</li> <li>• The field of charge in dielectric medium and Gauss's law.</li> <li>• The connection between electric susceptibility and atomic polarizability.</li> <li>• Polarization in changing field.</li> <li>• The bound charge (polarization) current.</li> <li>• Conclusion &amp; Real life applications</li> </ul>
<b>5.</b>	<b>Maxwell's Equations and Electromagnetic Waves</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Maxwell's equations in differential and integral form.</li> <li>• Maxwell's displacement current</li> <li>• Maxwell's equations in free space</li> <li>• Poynting theorem</li> <li>• EM Wave equation</li> <li>• EM waves in a non-conducting dielectric medium</li> <li>• Plane monochromatic waves in a non-conducting medium</li> <li>• Energy flux in a plane electromagnetic wave</li> <li>• Radiation pressure</li> <li>• Conclusion &amp; Real life applications</li> </ul>

**C. RECOMMENDED STUDY MATERIAL:**

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

**COURSE OUTCOMES:** Students will be able to:

CO1: Analyze the atoms on the basis of atomic theory and periodic properties.

CO2: Identify the properties, interaction and energies of compounds with respect to their chemical bonding.

CO3: Predict the anomalous change in geometry of molecules on account of valence bond theory, VSEPR theory and Molecular orbital Theory.

CO4: Compare the trends in characteristic properties and synthesis of hydrides of s block and p block elements.

CO5: Categorize the properties of noble gases and its compounds with use in daily life applications.

#### A. OUTLINE OF THE COURSE

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

#### B. DETAILED SYLLABUS

Unit	Unit Details
1.	<b>Atomic Structure &amp; Periodic Properties</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Bohrs Theory and its limitation</li> <li>• Heisenberg uncertainty principle</li> <li>• Quantum number and its Significance</li> <li>• Aufbau Principle, Hund's multiplicity rule and Pauli's exclusion principle</li> <li>• Electronic configuration of elements</li> <li>• Effective nuclear charge and shielding</li> <li>• Atomic and ionic radii</li> <li>• Ionization energy, electrode potential (use of redox potential-reaction feasibility)</li> <li>• Electron affinity and electro negativity evaluation</li> <li>• Trends in periodic table</li> <li>• Applications in predicting and explaining the chemical behavior</li> <li>• Periodic properties</li> <li>• Conclusion &amp; Real life applications</li> </ul>
2.	<b>Ionic Bond, Metallic Bond &amp; Weak Interactions</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Ionic bond-General characteristics</li> <li>• Radius ratio effect and coordination number</li> <li>• Lattice defects, lattice energy and Born-Haber cycle</li> <li>• Solvation energy and solubility of ionic solids</li> <li>• Polarizing power and polarizability</li> <li>• Fajan's rules</li> </ul>

	<ul style="list-style-type: none"> <li>• Metallic Bond- Free electron, valence bond and band theories</li> <li>• Weak Interactions- Hydrogen bonding, Vander walls Force</li> <li>• Conclusion &amp; Real life applications</li> </ul>
<b>3.</b>	<b>Covalent Bond</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Valence bond theory and its limitations</li> <li>• Valence shell electron pair repulsion (VSEPR) theory with suitable examples(NH<sub>3</sub>, H<sub>3</sub>O<sup>+</sup>, SF<sub>4</sub>, ClF<sub>3</sub>, ICl<sub>2</sub>, H<sub>2</sub>O)</li> <li>• Molecular orbital theory</li> <li>• Bonding, nonbonding and antibonding molecular orbital's</li> <li>• Linear combination of atomic orbital's (LCAO)-homonuclear and heteronuclear (CO and NO) diatomic molecules.</li> <li>• Multicenter bonding in electron deficient molecules,</li> <li>• Bond strength and bond energy</li> <li>• Percentage ionic character from dipole moment and electro negativity difference</li> <li>• Conclusion &amp; Real life applications</li> </ul>
<b>4.</b>	<b>s-Block Elements &amp; p-Block Elements</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• s-Block Elements -Comparative study, diagonal relationships</li> <li>• Solvation and complexation tendencies including their function in biosystems</li> <li>• Hydride- classification, preparation and characteristics</li> <li>• Introduction to alkyl and aryls</li> <li>• p-Block elements-Comparative study in periodicity, diagonal relationship</li> <li>• Hydrides of boron, diborane and higher boranes, borazine, borohydrides, fullerenes, carbides, fluorocarbons, silicates (structural principle), tetrasulphur tetranitride,</li> <li>• Basic properties of halogens, interhalogens and polyhalides</li> <li>• Conclusion &amp; Real life applications</li> </ul>
<b>5.</b>	<b>Chemistry of Noble Gases</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Chemical properties of Noble gases</li> <li>• Chemistry of Xenon</li> <li>• Structure and bonding in Xenon compound</li> <li>• Theories of Bonding in noble gases compound</li> <li>• Conclusion &amp; Real life applications</li> </ul>

### C. RECOMMENDED STUDY MATERIAL:

S. No	Reference Book	Author	Edition	Publication
1	A New Concise Inorganic Chemistry	J. D. Lee	Latest	Chapman & Hall, London
2	Modern Inorganic Chemistry	R. C. Aggarwal	Latest	KitabMahal, Allahabad

3	Basic Chemistry	Inorganic	F. A. Cotton, G. Wilkinson, and Paul L. Gaus	Latest	John Wiley & Sons, New York
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**COURSE OUTCOMES:** Students will be able to:

CO1: Demonstrate electronic displacements according to bonding, shapes, reactivity and energy consideration of reaction intermediate

CO2: Classify Hydrocarbons and discuss the methods of preparation of Hydrocarbons.

CO3: Categorize the stability and reactivity of hydrocarbons as per bonding and structure of hydrocarbons.

CO4: Compare the physical and chemical properties of Hydrocarbons.

CO5: Analyze the applications of various hydrocarbons and their derivatives.

#### A. OUTLINE OF THE COURSE

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

#### B. DETAILED SYLLABUS

Unit	Unit Details
1.	<b>Fundamentals of Organic Chemistry</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Electronic displacements: inductive effect, electromeric effect, resonance and hyperconjugation</li> <li>• Cleavage of Bonds: homolysis and heterolysis</li> <li>• Structure, shape and reactivity of organic molecules: nucleophiles and electrophiles</li> <li>• Reactive Intermediates: carbocations, carbanions and free radicals, nitrene, carbene, benzyne, Assigning formal charge</li> <li>• Types of organic reactions, energy considerations.</li> <li>• Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereochemical studies)</li> <li>• Conclusion &amp; Real life applications</li> </ul>
2.	<b>Alkanes</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Alkanes:(Upto 5 Carbons)</li> <li>• IUPAC nomenclature of branched and unbranched alkyl group</li> <li>• Classification of carbon atoms in alkanes, Physical properties</li> <li>• Preparation: catalytic hydrogenation, Wurtz reaction, Kolbe synthesis, decarboxylation of carboxylic acid, Grignard reagent, Corey-house reaction</li> <li>• Reactions: free radical substitution: halogenations</li> <li>• Reactivity and selectivity</li> <li>• Conclusion &amp; Real life applications</li> </ul>
3.	<b>Alkenes</b>



	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Alkenes: (Upto 5 Carbons)</li> <li>• Preparation: elimination reactions: dehydration of alcohols and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (partial catalytic hydrogenation) and trans alkenes (birch reduction), Hofmanns elimination</li> <li>• Chemical reactions of alkenes –electrophilic and free radical additions. Epoxidation, mechanisms involved in hydrogenation, oxidation with <math>\text{KMnO}_4</math>, Substitution at the allylic and vinylic positions of alkenes, polymerization of alkenes</li> <li>• Reactions: cis-addition (alk. <math>\text{KMnO}_4</math>) and trans-addition (bromine), addition of HX (Markownikoff's and anti-Markownikoff's addition), hydration, ozonolysis, oxymercuration–demercuration, Hydroboration-oxidation.</li> <li>• Industrial application of ethylene and propene</li> <li>• Conclusion &amp; Real life applications</li> </ul>
4.	<b>Alkynes</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Alkynes: (Upto 5 Carbons)</li> <li>• Preparation: Acetylene from <math>\text{CaC}_2</math> and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides, acidity of alkynes</li> <li>• Reactions: formation of metal acetylides, addition of bromine and alkaline <math>\text{KMnO}_4</math>,</li> <li>• ozonolysis and oxidation with hot alkaline. <math>\text{KMnO}_4</math>,hydroboration- oxidation, metal ammonia reduction, polymerization</li> <li>• Conclusion &amp; Real life applications</li> </ul>
5.	<b>Cycloalkanes, Cycloalkenes&amp;Dienes</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Cycloalkanes: Nomenclature, method of formation, chemical reactions</li> <li>• Baeyer strain theory and its limitations</li> <li>• Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings, Mohrs Sachse theory</li> <li>• The case of cyclopropane ring: banana bond</li> <li>• Cycloalkenes: Nomenclature, method of formation, chemical reactions</li> <li>• Dienes: Nomenclature and classification of dienes</li> <li>• Structure of allenes and butadiene, methods of formation, polymerization, chemical reactions, 1,2and 1,4- additions, Diels-Alder reaction</li> <li>• conjugated and cumulated dienes</li> <li>• Conclusion &amp; Real life applications</li> </ul>

**C. RECOMMENDED STUDY MATERIAL:**

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

**COURSE OUTCOME:**

Students would be able to:

CO1: Solve mathematical problems using ordinary, partial differentiation equations.

CO2: Obtain Maxima and Minima of functions of two or more variables.

CO3: Calculate radius of curvature and asymptotes of curves using cartesian form and polar form.

CO4: Solve the integration, surface and volume of curves using Beta and Gamma functions.

CO5: Evaluate double and triple integrals using volume and surface area.

**A. OUTLINE OF THE COURSE**

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

**B. DETAILED SYLLABUS**

Unit	Unit Details
1.	<b>Differential Calculus I</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Successive differentiation,</li> <li>• Partial differentiation</li> <li>• Euler's theorem on homogeneous functions.</li> <li>• Total differentiation</li> <li>• Conclusion &amp; Real life applications</li> </ul>
2.	<b>Differential Calculus II</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Maxima and minima for functions of two or more variables</li> <li>• Lagrange's method (without proof)</li> <li>• Derivative of length of an arc</li> <li>• Conclusion &amp; Real life applications</li> </ul>
3.	<b>Geometrical Applications of Differential Calculus</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Curvature, Radius of Curvature (Cartesian Curves only)</li> <li>• Asymptotes</li> <li>• Curve tracing for standard Curves (Cartesian and Polar Curves)</li> <li>• Conclusion &amp; Real life applications</li> </ul>
4.	<b>Integral Calculus</b>

	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Beta and gamma Functions</li> <li>• Reduction formulae (simple Standard Formulae)</li> <li>• Volume and surface of solid of revolution</li> <li>• Conclusion &amp; Real life applications</li> </ul>
<b>5.</b>	<b>Multiple Integrals and Its Applications</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Double integral in Cartesian and polar coordinates</li> <li>• Change of order of integration,</li> <li>• Triple integral</li> <li>• Applications of multiple integrals in volume and surface</li> <li>• Conclusion &amp; Real life applications</li> </ul>

**C. RECOMMENDED STUDY MATERIAL:**

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

**COURSE OUTCOME:**

Students would be able to:

CO1: Manipulate vectors to perform geometrical calculations in three dimensions.

CO2: Obtain important features of del operator and its various forms in gradient, divergence and curl.

CO3: Use Green's theorem, Stokes theorem and the Divergence theorem to compute integrals

CO4: Analysis the basic concept of matrices and their various properties.

CO5: Obtain the solution of Eigen value and Eigen vectors and inverse of matrix using Cayley Hamilton theorem.

**A. OUTLINE OF THE COURSE**

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

**B. DETAILED SYLLABUS**

Unit	Unit Details
1	<b>Vector Calculus I</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Scalar and Vector quantity,</li> <li>• Representation of vectors, Laws of vector additions,</li> <li>• Product of two vectors, Scalar and vector fields,</li> <li>• Derivative of a vector function, Velocity and accelerations</li> <li>• Conclusion &amp; Real life applications</li> </ul>
2	<b>Vector Calculus II</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Del operator, Gradient, Divergence and Curl.</li> <li>• Directional derivative</li> <li>• Integration of vectors,</li> <li>• Line Integral</li> <li>• Conclusion &amp; Real life applications</li> </ul>
3	<b>Vector Calculus III</b>

	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Surface and Volume Integration.</li> <li>• Green's, Gauss's and Stokes's theorem(without Proof) and their simple applications</li> <li>• Conclusion &amp; Real life applications</li> </ul>
<b>4</b>	<b>Matrix</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Types of matrices and elementary operations on matrices</li> <li>• Rank of a matrix, Normal form</li> <li>• Consistency of system of linear simultaneous equations ( Homogeneous and Non homogeneous) and its solutions</li> <li>• Conclusion &amp; Real life applications</li> </ul>
<b>5</b>	<b>Eigen Values and Eigen Vectors</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Characteristic equation</li> <li>• Eigen values and Eigen vectors</li> <li>• Cayley - Hamilton theorem and its application to find inverse of matrix</li> <li>• Diagonalisation of matrix</li> <li>• Conclusion &amp; Real life applications</li> </ul>

### C. RECOMMENDED STUDY MATERIAL:

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

**COURSE OUTCOMES:** Students will be able to:

CO1: Design and carry out scientific experiments as well as accurately record and analyze the results of such experiments.

CO2: Impart the students a thorough knowledge of Systematic qualitative analysis of mixtures containing two acid and two basic radicals

CO3: Develop skills for quantitative estimation using the different branches of volumetric Analysis.

CO4: Develop skills required for the qualitative analysis of organic compounds

CO5: Learn and apply basic techniques used in the organic laboratory for preparation, purification and identification of organic compounds.

### LIST OF EXPERIMENTS

<b>Inorganic Chemistry</b>	
<b>1</b>	To analyze mixture contains two acidic and two basic radicals in a given mixture.
<b>2</b>	To analyze mixture contains two acidic and two basic radicals in a given mixture.
<b>3</b>	To analyze mixture containing three acidic and three basic radicals.
<b>4</b>	To analyze mixture containing three acidic and three basic radicals.
<b>5</b>	To analyze mixture containing three acidic and three basic radicals.
<b>6</b>	Estimation of $\text{KMnO}_4$ by oxalic acid.
<b>Organic Chemistry</b>	
<b>7</b>	To detect the functional group from the given organic compound (Alcohol/carbonyl compound).
<b>8</b>	To detect the functional group from the given organic compound (Nitrogen containing compound).
<b>9</b>	To determine the melting point of given organic compound (Naphthalene).
<b>10</b>	To determine the melting point of given organic compound (Urea).
<b>11</b>	To determine the boiling point of given organic compound (Ethanol).
<b>12</b>	To determine the boiling point of given organic compound (Benzene).



**COURSE OUTCOMES:**

Students will be able to:

CO1: Learn the constants of elasticity by the help of different methods.

CO2: Learn the concept of Poisson's ratio and surface tension of water

CO3: Learn conversion of Galvanometer to Ammeter and Voltmeter

CO4: Learn to evaluate of RLC and CR, DC circuits

CO5: Identify and calculate the magnetic field around a current carrying circular coil

**LIST OF EXPERIMENTS**

1	Study of bending of a beam and determination of Young's modulus
2	Modulus of rigidity by Dynamical method (Maxwell's needle)
3	Elastic constant by Searle's method
4	To determine the Poisson's ratio of a rubber tube
5	Determination of surface tension of water by Jaegger's method
6	Convert Galvanometer to ammeter into a given range.
7	Convert Galvanometer to voltmeter into a given range.
8	Study of phase relations in CR circuit
9	Study of phase relations in LCR circuit
10	Study of Faraday's Law
11	To determine the modulus of rigidity by statically method.
12	To study the magnetic field along the axis of a current carrying circular coil and find the radius of circular coil.

**COURSE OUTCOMES:** Students would be able to:

CO1: Demonstrate the grammar skills involved in writing sentences and short paragraphs.

CO2: Build up a good command over and vocabulary to be able to ace error spotting. CO3: Define unknown words in sentence level context using a picture dictionary or by creating a memory link for support.

CO4: Understand, analyze and effectively use the conventions of the English language.

CO5: Develop their interest in reading and enhance their oral and silent reading skills along with sharpen their critical and analytical thinking.

#### A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1	Basics of Grammar	8
2	Spotting the Grammatical Errors and Rectification	2
3	Vocabulary Building	4
4	Basics of Writing Skills	2
5	Reading Comprehension	8

#### B. DETAILED SYLLABUS

LIST OF LABS	
1.	Parts of Speech: Theory & Practice through various Exercises
2.	Sentence Structures: Theory & Practice through various Exercises
3.	Tenses: Theory & Practice through various Exercises
4.	Spotting the Errors: Applying the rules and Practice Questions
5.	Vocabulary Building-I: Practice by sentence formation
6.	Vocabulary Building-II: Practice by sentence formation
7.	Paragraph Writing
8.	Article Writing
9.	Précis Writing
10.	Formal & Informal Letter Writing
11.	Reading Comprehension- I: Beginner's level reading and Answering the Questions (Competitive Exams)
12.	Reading Comprehension- II: Intermediate's level reading and Answering the Questions (Competitive Exams)

**OVERVIEW AND OBJECTIVES:**

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

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

**COURSE OUTCOMES:**

Students will be able to-

CO1: Exercise the method to produce coherent sources and phenomena of interference.

CO2: Prepare & demonstrate the comprehensive knowledge of polarization and its applications.

CO3: Produce Holography and LASER assembly, types of LASER and its wide application from medical to industry

CO4: Learn & exhibit the in-depth knowledge of Laser light and apply it for suitable applications

CO5: Prepare the arrangement of Fraunhofer diffraction and apply it for suitable applications.

**A. OUTLINE OF THE COURSE**

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

**B. DETAILED SYLLABUS**

Unit	Unit Details
1.	<b>Interference</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Division of Amplitude and Division of Wave front</li> <li>• Interference in Thin Films: Parallel and Wedge-shaped Films</li> <li>• Fringes of Equal Inclination and Fringes of Equal Thickness</li> <li>• Newton's Rings: Measurement of Wavelength and Refractive Index</li> <li>• Michelson's Interferometer and their applications</li> <li>• Conclusion &amp; Real life applications</li> </ul>
2.	<b>Polarization</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Concept of polarization</li> <li>• Different kind of polarized lights</li> <li>• Malus law and Brewster's law</li> <li>• Double refraction</li> <li>• Quarter wave and half wave plate</li> <li>• Production and detection of different polarized lights</li> <li>• Specific Rotation: Half shade polarimeter</li> <li>• Determination of specific rotation of sugar solution by polarimeters</li> <li>• Conclusion &amp; Real life applications</li> </ul>
3.	<b>Laser</b>

	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Theory of LASER action: Absorption, spontaneous emission and stimulated emission</li> <li>• Einstein's coefficients</li> <li>• Threshold conditions for LASER Action</li> </ul>
	<ul style="list-style-type: none"> <li>• Method and Mechanism of production of He-Ne LASER, Semiconductor Laser</li> <li>• Application of Laser</li> <li>• Conclusion &amp; Real life applications</li> </ul>
<b>4.</b>	<b>Holography</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Holography versus photography</li> <li>• Principle of Holography</li> <li>• Applications of Holography in Microscopy and Interferometry</li> <li>• Optical Fibre: Principle, construction</li> <li>• Numerical Aperture Derivation</li> <li>• Conclusion &amp; Real life applications</li> </ul>
<b>5.</b>	<b>Fraunhofer Diffraction</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Diffraction due to (1) a Single Slit (2) a Plane Transmission Grating</li> <li>• Characteristics of plane transmission grating</li> <li>• Rayleigh's criterion of resolution</li> <li>• Resolving Power and Dispersive Power of a Plane Diffraction Grating</li> <li>• Comparison of grating and prism spectra</li> <li>• Conclusion &amp; Real life applications</li> </ul>

### C. RECOMMENDED STUDY MATERIAL:

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

**COURSE OUTCOMES:**

Students will be able to:

CO1: Produce about simple harmonic motion of different systems.

CO2: Point out about superposition of two Collinear Harmonic Oscillations.

CO3: Learn and exhibit knowledge about system having two degrees of freedom.

CO4: Prepare equation of motion of waves and its properties.

CO5: Classify the waves in bounded medium and its properties with respect to position and time.

**A. OUTLINE OF THE COURSE**

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

**B. DETAILED SYLLABUS**

Unit	Unit Details
1.	<b>Simple Harmonic Motion</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Simple harmonic motion, examples-spring mass system, mass on a spring, torsional oscillator,</li> <li>• LC circuit, energy of the oscillator</li> <li>• Differential equation of simple harmonic motion and its general solution</li> <li>• Damped harmonic oscillator, Mathematical formulation of damped harmonic oscillator,</li> <li>• Energy of damped oscillator,</li> <li>• Power dissipation, Relaxation time, Quality factor of damped harmonic oscillator</li> <li>• Conclusion &amp; Real life applications</li> </ul>
2.	<b>Driven Harmonic Oscillator</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Driven harmonic oscillator</li> <li>• Mathematical formulation of driven harmonic oscillator</li> <li>• Frequency response on amplitude and phase</li> <li>• Quality factor of driven oscillator</li> <li>• Resonance</li> <li>• Sharpness of resonance</li> <li>• Power absorption by forced oscillator</li> <li>• Series and parallel LCR circuit</li> <li>• Conclusion &amp; Real life applications</li> </ul>

<b>3.</b>	<b>Coupled Oscillator</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Equation of motion of two coupled simple harmonic oscillators</li> <li>• Normal modes</li> <li>• Energy transfer between modes</li> </ul>
	<ul style="list-style-type: none"> <li>• Electrically coupled circuits (capacitive and inductive)</li> <li>• Effect of coupling and resistive load</li> <li>• Conclusion &amp; Real life applications</li> </ul>
<b>4.</b>	<b>Wave Motion</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Plane and Spherical Waves</li> <li>• Longitudinal and Transverse Waves</li> <li>• Plane Progressive (Travelling) Waves</li> <li>• Particle and Wave Velocities</li> <li>• Transverse wave in a stretched string</li> <li>• Velocity of transverse vibrations of stretched strings</li> <li>• Newton's formula for velocity of sound</li> <li>• Laplace's correction</li> <li>• Conclusion &amp; Real life applications</li> </ul>
<b>5.</b>	<b>Waves in the Bounded Medium</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Standing (Stationary) waves in a string: Fixed and free ends</li> <li>• Normal modes of stretched strings</li> <li>• Longitudinal standing waves and normal modes</li> <li>• Open and closed pipes</li> <li>• Flow of energy in stationary waves</li> <li>• Phase and group velocities</li> <li>• Conclusion &amp; Real life applications</li> </ul>

**C. RECOMMENDED STUDY MATERIAL:**

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

**COURSE OUTCOMES:** Students will be able to:

CO1: Distinguish between aromatic and antiaromatic compounds by comparing their structures along with their electrophilic aromatic substitution reactions.

CO2: Explain basic principles of stereochemistry as well as differentiate configuration and conformation, Flying wedge and Fischer projection formula

CO3: Categorize Nucleophilic Substitution ( $S_N^1$ ,  $S_N^2$  and  $S_N^i$ ) reactions with energy profile diagram.

CO4: Explain the addition-elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reaction, relative reactivities of alkyl, allyl, vinyl and aryl halides.

CO5: Classify and prepare 1°, 2° and 3° alcohols and demonstrate their reaction.

#### A. OUTLINE OF THE COURSE

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

#### B. DETAILED SYLLABUS

Unit	Unit Details
1.	<b>Aromaticity</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Aromaticity: Nomenclature of benzene derivatives. The aryl group, aromatic nucleus and side chain.</li> <li>• Structure of benzene: Kekule structure.</li> <li>• Resonance theory and Molecular orbital theory</li> <li>• Stability and carbon-carbon bond lengths of benzene, resonance structure, MO diagram</li> <li>• Hückel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples</li> <li>• Electrophilic aromatic substitution: mechanism, role of sigma and pi-complexes.</li> <li>• Halogenation, sulphonation, mercuration, Friedel-Crafts reactions and Mechanism of nitration, chloromethylation.</li> <li>• Energy profile diagrams. Activating and deactivating substituents.</li> <li>• Directive influence - orientation and ortho/para ratio.</li> <li>• Side chain reactions of benzene derivatives. Birch Reduction.</li> <li>• Conclusion &amp; Real life applications</li> </ul>
2.	<b>Stereochemistry</b>



	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Concept of isomerism</li> <li>• Types of isomerism</li> </ul>
	<ul style="list-style-type: none"> <li>• Difference between configuration and conformation,</li> <li>• Flying wedge and Fischer projection formula</li> <li>• Optical isomerism- Elements of symmetry, molecular chirality, stereogenic centre, optical activity</li> <li>• Properties of enantiomers, chiral and achiral molecules with two stereogeniccentre</li> <li>• Diastereomers, threo and erythro isomers</li> <li>• Mesocompounds</li> <li>• Resolution of enantiomers</li> <li>• Inversion, retention and racemization.</li> <li>• Relative and absolute configuration, sequence rules ,D and L and R/S system of nomenclature.</li> <li>• Geometric isomerism-Determination of configuration of geometrical isomers, ; <i>cis-trans</i> and E / Z nomenclature</li> <li>• Geometric isomerism in oximes and alicyclic compounds</li> <li>• Conformational isomerism-Newman projection and saw house formula</li> <li>• Conformational analysis of ethane, n butane and cyclo hexane</li> <li>• Conclusion &amp; Real life applications</li> </ul>
<b>3.</b>	<b>Alkyl Halides</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• (Upto 5 Carbons) Nomenclature</li> <li>• Preparation: from alkenes <i>and</i> alcohols, methods of formation of alkyl halides.</li> <li>• Reactions: hydrolysis, nitrite &amp; nitro formation, nitrile &amp; isonitrile formation. Williamson's ether synthesis: Elimination versus substitution</li> <li>• Types of Nucleophilic Substitution (SN1, SN2 and SNi) reactions with energy profile diagram</li> <li>• Polyhalogen compounds: Chloroform, carbon tetrachloride, DDT, BHC</li> <li>• Conclusion &amp; Real life applications</li> </ul>
<b>4.</b>	<b>Aryl Halides</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Aryl Halides Preparation:(Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer &amp; Gattermann reactions</li> <li>• Methods of formation of aryl halides, nuclear and side chain reactions. The addition-elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl, allyl, vinyl and aryl halides</li> <li>• Reactions (Chlorobenzene): Aromatic nucleophilic substitution (replacement by –OH group) and effect of nitro substituent. Benzyne Mechanism: KNH<sub>2</sub>/NH<sub>3</sub> (or NaNH<sub>2</sub>/NH<sub>3</sub>).</li> <li>• Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides</li> <li>• Conclusion &amp; Real life applications</li> </ul>
<b>5.</b>	<b>Alcohols</b>

	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Alcohols:</li> <li>• Classification and Nomenclature.</li> <li>• Monohydric Alcohols-Preparation: Preparation of 1°, 2° and 3° alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters, Hydrogen bonding, Acidic Nature</li> </ul>
	<ul style="list-style-type: none"> <li>• Reactions: With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk. KMnO<sub>4</sub>, acidic dichromate, conc. HNO<sub>3</sub>), Oppeneauer oxidation</li> <li>• Dihydric Alcohols: (Upto 6 Carbons) Methods of Formation, Chemical Reactions of Vicinal Glycols, oxidation of diols, Pinacol-Pinacolone, rearrangement.</li> <li>• Trihydric Alcohols : Methods of Formation, Chemical Reactions of Glycerols.</li> <li>• Conclusion &amp; Real life applications</li> </ul>

### C. RECOMMENDED STUDY MATERIAL:

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

**COURSE OUTCOMES:**

Students will be able to:

CO1: Determine structure of compounds by X ray diffraction methods and compare the chemical behavior and physical properties of common substances.

CO2: Apply the concept of liquid crystals in applications of advanced technologies

CO3: Differentiate real gases from ideal gases at different temperature and pressure and explain methods of liquefaction of gases.

CO4: Interpret the stability regions using Phase diagrams of one component and two component system and compounds with congruent and incongruent melting point.

CO5: Explain fundamental principle of thermodynamic and thermo chemistry

**A. OUTLINE OF THE COURSE**

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

**B. DETAILED SYLLABUS**

Unit	Unit Details
1	<b>Solid State</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Solid state: Definition of space lattice, Unit cell.</li> <li>• Laws of crystallography (i) law of constancy of interfacial angles (ii) law of rationality of indices (iii) law of symmetry.</li> <li>• Symmetry elements in crystals. X ray diffraction by crystals</li> <li>• Derivation of Braggs equation</li> <li>• Determination of crystal structure of NaCl, KCl and CsCl (Laue's method and powder method).</li> <li>• Conclusion &amp; Real life applications</li> </ul>
2	<b>Liquid State</b>

	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Liquid State: Surface tension of liquids, capillary action, surface tension and temperature, interfacial tension, surface active agents, the Parachor and chemical constitution (atomic and structural parachors).</li> <li>• Viscosity of liquids, experimental determination of viscosity coefficient, its variation with temperature.</li> <li>• Intermolecular forces, structure of liquids (a qualitative description).</li> <li>• Structural difference between solid, liquid and gases</li> <li>• Liquid crystals: Difference between liquid crystal, solid and liquid. Classification, structure of nematic and cholestric phases. Thermography and seven-segment cell.</li> <li>• Conclusion &amp; Real life applications</li> </ul>
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<b>3</b>	<b>Gaseous State</b>
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	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Gaseous State :Kinetic theory of gases, ideal gas laws</li> <li>• Behavior of real gases - the Vander Waal's equation</li> <li>• Critical phenomena - critical constants of a gas and their determination</li> <li>• PV isotherms of real gases, continuity of state, Vander Waals equation and critical state</li> <li>• Principle of corresponding states, reduced equation of state</li> <li>• Molecular velocities- Root mean square, average and most probable velocities</li> <li>• Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter</li> <li>• Liquefaction of gases (based on Joule-Thomson effect)</li> <li>• Conclusion &amp; Real life applications</li> </ul>
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<b>4</b>	<b>Phase Equilibrium</b>
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	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Phase Equilibrium:Phases, components and degrees of freedom of a system,</li> <li>• Gibbs Phase Rule and its thermodynamic derivation</li> <li>• Phase diagrams of one-component systems (water and sulphur) and two component systems involving eutectics,</li> <li>• Bi-Cd system, Pb- Ag system, desilverisation of Pb</li> <li>• Solid Solutions-congruent and incongruent melting points</li> <li>• Solid solutions-Compound formation with congruent melting point of Mg-Zn and incongruent melting point of NaCl –H<sub>2</sub>O system</li> <li>• Freezing Mixtures</li> <li>• Conclusion &amp; Real life applications</li> </ul>
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<b>5</b>	<b>Thermodynamics</b>
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- Introduction to the Unit
- **Thermodynamics terms:** systems, surroundings etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamics process. Concept of heat and work
- First law of thermodynamics: statement, definition of internal energy and enthalpy. Heat capacity. Heat capacities at constant volume and pressure and their relationship.
- Joule law-Joule Thomson co-efficient and inversion temperature.
- Thermochemistry: Standard state, standard enthalpy of formation, Hess's law of heat summation and its applications. Heat of reaction at constant pressure and at constant volume.
- **Second law of thermodynamics:** Carnot cycle and its efficiency. Carnot theorem. Thermodynamic scale of temperature.
- Concept of entropy: Entropy as a state function, entropy as a function of Volume and temperature, entropy as a function of pressure and temperature, entropy change in physical change.
- **Third law of thermodynamics:** Statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions: Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities,
- Conclusion & Real life applications

### C. RECOMMENDED STUDY MATERIAL:

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

**COURSE OUTCOMES:**

Students will be able to:

CO1: Solve equal and unequal intervals for Interpolation problem.

CO2: Apply numerical methods to obtain approximate solutions to mathematical problems.

CO3: Solve the linear simultaneous equations using numerical methods

CO4: Solve the transcendental and algebraic equations using Secant, RegulaFalsi, Successive iteration method, Newton-Raphson etc.

CO5: Analyze the numerical methods to solve differential equations.

**A OUTLINE OF THE COURSE**

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

**B. DETAILED SYLLABUS**

Unit	Unit Details
1	<b>Interpolation</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Interpolation: Differences, relation between differences and derivatives.</li> <li>• Newton's formulae for forward and backward interpolation,</li> <li>• Sterling's formula, Divided difference, Newton's divided difference,</li> <li>• Lagrange's interpolation formula</li> <li>• Conclusion &amp; Real life applications</li> </ul>
2	<b>Numerical Differentiation and Integration:</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Numerical differentiation simple methods,</li> <li>• Numerical integration: Derivation of General Quadrature formulas,</li> <li>• Trapezoidal rule, Simpson's one third and Simpson's three eighth rule,</li> <li>• Gauss Quadrature Formulae</li> <li>• Conclusion &amp; Real life applications</li> </ul>
3	<b>Numerical Solution of Linear Simultaneous Equations</b>

	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Solution of linear simultaneous equations:</li> <li>• Direct methods - Gauss elimination</li> <li>• Gauss-Jordan</li> <li>• LU decomposition</li> <li>• Gauss-Seidel method</li> <li>• Conclusion &amp; Real life applications</li> </ul>
<b>4</b>	<b>Numerical Solution of Algebraic and Transcendental Equations:</b>

	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Solution of algebraic and transcendental equations using</li> <li>• Bisection method</li> <li>• Secant method</li> <li>• Regula Falsi method</li> <li>• Successive iteration method,</li> <li>• Newton-Raphson method</li> <li>• Conclusion &amp; Real life applications</li> </ul>
<b>5</b>	<b>Numerical Solution of Ordinary Differential Equations</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Solution of ordinary differential equations of first order with initial condition using</li> <li>• Picard's method</li> <li>• Euler's and Modified Euler's methods</li> <li>• Runge-Kutta method of fourth order</li> <li>• Milne Predictor Corrector method</li> <li>• Conclusion &amp; Real life applications</li> </ul>

### C. RECOMMENDED STUDY MATERIAL

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

**COURSE OUTCOME:**

Students would be able to:

CO1: Identify the type of a given differential equation, select, and apply the appropriate analytical technique for finding the solution.

CO2: Solve the first order and higher degree differential equations solvable for  $x$ ,  $y$ ,  $p$ , *Clairaut's* form and orthogonal trajectories.

CO3: Solve linear differential equations with constant coefficients, linear simultaneous differential equations and Cauchy-Euler equation.

CO4: Determine the complete solutions to the linear equations of second order

CO5: Explain the order and degree of partial differential equations and their solutions

**A. OUTLINE OF THE COURSE**

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

**B. DETAILED SYLLABUS**

Unit	Unit Details
1	<b>First order and First Degree Differential Equations</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Degree and order of Differential equation</li> <li>• Variable separation, Homogeneous,</li> <li>• Linear equations and equations reducible to linear form.</li> <li>• Exact Differential equation and reducible to exact</li> <li>• Conclusion &amp; Real life applications</li> </ul>
2	<b>First Order and Higher Degree Differential Equations</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• First order and higher degree equations solvable for <math>x</math>, <math>y</math>, <math>p</math>.</li> <li>• Clairaut's form and singular solutions.</li> <li>• Orthogonal trajectories.</li> <li>• Conclusion &amp; Real life applications</li> </ul>
3	<b>Higher Order and Simultaneous Linear Differential Equations</b>



	<input type="checkbox"/> Introduction of the Unit <input type="checkbox"/> Higher order linear differential equation with constant coefficients <input type="checkbox"/> Linear simultaneous differential equations <input type="checkbox"/> Conclusion & Real life applications
<b>4</b>	<b>Second Order Linear Differential Equation with Variable Coefficients</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Linear differential equation of second order:</li> <li>• Homogeneous equation, Exact equation</li> <li>• Change of dependent variable and independent variable method</li> <li>• Method of variation of parameters</li> <li>• Conclusion &amp; Real life applications</li> </ul>
<b>5</b>	<b>Partial Differential Equations</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Order and degree of a partial differential equation</li> <li>• Linear partial differential equation of first order: Lagrange's method</li> <li>• Standard forms and Charpit's method</li> <li>• Classification of second order partial differential equations into elliptic, parabolic and hyperbolic (simple concept only)</li> <li>• Conclusion &amp; Real life applications</li> </ul>

### C. RECOMMENDED STUDY MATERIAL

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

**COURSE OUTCOMES:**

Students will be able to:

CO1: Identify the physical and chemical properties of common organic functional groups.CO2:

Learn the concept of separating the mixture

CO3: Become familiar with instrumental analysis techniques in chemistry.CO4:

Understand the concept of surface tension and viscosity

CO5: Understand the states of matter.

**LIST OF EXPERIMENTS**

<b>Organic Chemistry</b>	
1	To determine the functional group and identify the given organic compound.
2	To determine the functional group and identify the given organic compound.
3	To determine the functional group and identify the given organic compound.
4	To crystallize s acetanilide from hot water
5	To purify the given organic mixture by Sublimation
6	To separate the mixture (1 solid+1 liquid) by distillation.
<b>Physical Chemistry</b>	
7	To determine the surface tension of the pure liquid (alcohol etc.) with the help of Stalagmometer.
8	To determine the viscosity of the given liquid with the help of viscometer.
9	To determine critical solution temperature and composition of phenol water system.
10	To determine the percentage composition of a given mixture (non-interacting system) by viscosity method/ surface tension method.
11	Estimation of Fe(II) with $K_2Cr_2O_7$ using internal indicator (diphenylamine, N-phenylanthranilic acid) and discussion of external indicator.
12	Estimation of sodium carbonate using standardized HCl.

**COURSE OUTCOMES:**

Students will be able to:

CO1: Learn the concept of interference by the help of Newton's ring & Michelson Interferometer

CO2: Learn the phenomenon of polarisation and diffraction through biquartz polarimeter & Grating respectively

CO3: Learn the dispersive power of the material of the prism & resolving power of the telescope

CO4: Learn the concept of De-Sauty Bridge, phenomenon of charging & discharging & Lissajous figures.

CO5: Understand the characteristics of LR circuit with the source of constant emf and AC power source.

**LIST OF EXPERIMENTS:**

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

**COURSE OUTCOMES:****Students will be able to:**

CO1: Understand the importance of human values and learn from others' experiences to become the conscious practitioners of the same.

CO2: Enhance their self-esteem, confidence and assertive behaviour to handle difficult situations with grace, style, and professionalism

CO3: Distinguish among various levels of professional ethics while developing an understanding of them as a process in an organization.

CO4: Implement emotional intelligence to achieve set targets and excel in interpersonal as well as intrapersonal

CO5: Demonstrate knowledge of personal beliefs and values and a commitment to continuing personal reflection and reassessment.

**A. OUTLINE OF THE COURSE**

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1	Introduction to Human Values	6
2	Study of Self	6
3	Introduction to Professional Ethics	8
4	Emotional Intelligence	2
5	Life Skills & Value Education	2

**B. DETAILED SYLLABUS****LIST OF LABS**

1.	Human Values: Love & Compassion
2.	Truth, Non-Violence, Righteousness
3.	Peace, Service, Renunciation (Sacrifice)
4.	Self-Esteem: Do's and Don'ts to develop positive self-esteem
5.	Self-Assertiveness: Development of Assertive Personality
6.	Ambition & Desire: Self & Body (concepts & differences )
7.	Professional Ethics: Personal & Professional Ethics
8.	Emotional Intelligence: Skill Building for Strengthening the Elements of Self-awareness, Self-regulation, Internal motivation, Empathy, Social skills
9.	Governing Ethics & Ethics Dilemma
10.	Profession, Professionalism & Professional Risks
11.	Professional Accountabilities & Professional Success
12.	Life Skills & Value Education

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

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

**COURSE OUTCOMES:** Students will be able to:

CO1: Apply the concepts of power supply and different network systems and apply them in electronics circuits practically.

CO2: Understand the basics of semiconductor Physics and PN junction diode and apply them in electronics.

CO3: Compare the configuration of transistors like CE, CC, CB and implement them into electronics.

CO4: Point out the construction and working principle of Field effect transistor and MOSFET's.

CO5: Explain the construction, operation and characteristics of different types of power amplifier and their efficiencies.

**A. OUTLINE OF THE COURSE**

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

**B. DETAILED SYLLABUS**

Unit	Unit Details
<b>1.</b>	<b>Circuit Analysis</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Important definitions of circuits</li> <li>• Voltage Sources</li> <li>• Voltage and Current divider rules</li> <li>• Kirchhoff's Laws</li> <li>• Four Terminal Network</li> <li>• Reduction of complicated network</li> <li>• Network Theorems</li> <li>• Conclusion of the Unit</li> </ul>
<b>2.</b>	<b>Semiconductor and Rectification</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Classification of Semiconductors: Intrinsic and Extrinsic</li> <li>• Mass Action Law</li> <li>• Fermi level in an Extrinsic Semiconductor and effect of temperature on Fermi Level</li> <li>• P-N Junction Diode</li> <li>• Characteristic of P-N junction diode</li> <li>• Rectification</li> <li>• Ripple factor and efficiency</li> <li>• Filters: Series Inductor, Shunt capacitor, L and <math>\pi</math> section</li> <li>• Zener diode and Voltage Regulation</li> <li>• Conclusion of the Unit</li> </ul>
<b>3.</b>	<b>Bipolar Junction Transistor (BJT)</b>

	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• PNP and NPN transistors</li> <li>• Transistor - CB, CE and CC configurations: Input and Output characteristics</li> <li>• Current gains and their relationship.</li> <li>• Relationship between <math>\alpha</math> and <math>\beta</math></li> <li>• Transistor as an amplifier</li> <li>• Transistor load line</li> <li>• Transistor as a diode</li> <li>• Transistor Biasing</li> <li>• Selection of Operating Point</li> <li>• Bias Stabilization</li> <li>• Conclusion of the Unit</li> </ul>
<b>4.</b>	<b>Field Effect Transistors (JFET and MOSFETs)</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Junction Field Effect Transistors (JFET)</li> <li>• Characteristics of JFETs</li> <li>• FET Configurations</li> <li>• DC load line and bias point</li> <li>• FET biasing</li> <li>• FET small signal models</li> <li>• MOSFET: Construction and working, I-V characteristics</li> <li>• Enhancement and depletion modes</li> <li>• Comparison of JFETs and MOSFETs</li> <li>• Conclusion of the Unit</li> </ul>
<b>5.</b>	<b>Power Amplifiers</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Need of power amplifiers</li> <li>• Classification of power amplifiers, Class A, Class B and Class C power amplifiers</li> <li>• Efficiencies</li> <li>• Harmonic distortion in power amplifier</li> <li>• Variation of output power in Transformer coupled power amplifier</li> <li>• Introduction of Push-Pull Amplifier</li> <li>• Introduction of Tuned amplifiers</li> <li>• Conclusion of the Unit</li> </ul>

**C. RECOMMENDED STUDY MATERIAL:**

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

**COURSE OUTCOMES:** The students will be able to:

CO1: Describe the electronic configuration, atomic radii, ionic radii, oxidation state of lanthanides and their separation.

CO2: Differentiate between Lanthanides and Actinides and learn the separation techniques of trans-uranium elements.

CO3: Demonstrate the preparation, structure and industrial applications of inorganic polymers.

CO4: Interpret the chemistry of coordination compounds on the basis of Werner's Theory and its industrial applications.

CO5: Examine the basic principle of crystallization, distillation, solvent extraction, TLC and column chromatography.

### A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Lanthanides	8
2.	Actinides	7
3.	Inorganic Polymer	7
4.	Coordination Compounds	8
5.	Separation Techniques and chromatography	6

### B. DETAILED SYLLABUS

Unit	Unit Details
1.	<b>Lanthanides</b>
	<ul style="list-style-type: none"> <li>Introduction to the Unit</li> <li><b>Lanthanides:</b> Comparative study of lanthanide elements with respect to electronic configuration, atomic and ionic radii, oxidation state and complex formation.</li> <li>Lanthanide contraction. Occurrence and principles of separation of lanthanides.</li> <li>General features and chemistry of Lanthanides</li> <li>Conclusion &amp; real life application</li> </ul>
2.	<b>Actinides</b>
	<ul style="list-style-type: none"> <li>Introduction to the Unit</li> <li><b>Actinides:</b> Comparative study of actinide elements with respect to electronic configuration, atomic and ionic radii, oxidation states and complex formation;</li> <li>Occurrence and principles of separation.</li> <li>General features and chemistry of actinides, principles of separation of Np, Pu and Am from U. Trans-Uranium elements</li> <li>Comparison of Lanthanides and Actinides</li> <li>Conclusion &amp; real life application</li> </ul>
3.	<b>Inorganic Polymer</b>
□	<ul style="list-style-type: none"> <li>Introduction to the Unit</li> </ul>



	<ul style="list-style-type: none"> <li>• <b>Inorganic Polymer:</b> Classification, Preparation and Structure of silicones, silicon resin, silicon rubber, silicon fluid, industrial application of silicones</li> <li>• Preparation, properties, substitution reaction and structure of phosphazenes</li> <li>• Conclusion &amp; real life application.</li> </ul>
<b>4.</b>	<b>Coordination Compounds</b>
□	<ul style="list-style-type: none"> <li>• Introduction to the Unit</li> <li>• <b>Coordination Compounds:</b> Werner's theory, nomenclature, chelates, stereo-chemistry of coordination numbers 4, 5 and 6.</li> <li>• Nomenclature and isomerism in coordination complexes.</li> <li>• Important applications of coordination compounds.</li> <li>• Theories of metal-ligand bonding in transition metal complexes- Sidgwick effective atomic number concept,</li> <li>• valence bond theory of coordination compounds</li> <li>• Conclusion &amp; real life application</li> </ul>
<b>5.</b>	<b>Separation Techniques and chromatography</b>
	<ul style="list-style-type: none"> <li>• Introduction to the Unit</li> <li>• <b>Separation Techniques:</b> Principles and process of solvent extraction</li> <li>• the distribution law and partition coefficient, batch extraction, continuous extraction and counter current distribution</li> <li>• Gravimetric methods, theory of precipitation, co-precipitation, post precipitation, theory of purifying the precipitates</li> <li>• <b>Chromatography:</b> Classification of chromatographic methods, general principle and application of adsorption, Partition chromatography, Ion-exchange, thin layer and paper chromatography</li> <li>• Conclusion &amp; real life application</li> </ul>

### C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	A New Concise Inorganic Chemistry	J. D. Lee	5th Edition	Chapman & Hall, London
2.	Modern Inorganic Chemistry	R. C. Aggarwal	1st Edition	KitabMahal, Allahabad
3.	Basic Inorganic Chemistry	F. A. Cotton, G. Wilkinson, and Paul L. Gaus	3rd Edition	John Wiley & Sons, New York

**COURSE OUTCOMES:** Students will be able to:

CO1: Apply Raoult's law on colligative properties, abnormal molar mass, degree of dissociation/association

CO2: Derive integrated rate expressions for studying kinetics of zero order first order To derive integrated rate expressions for studying kinetics of zero order, first order, second order and third order reaction by differential and integration method and solve numerical problems.

CO3: Identify the order of reaction using conductometric, potentiometric, optical, plarimetry and spectrophotometer method and explain Arrhenius equation, Simple collision theory and Transition state theory.

CO4: Interpret the equilibrium constant using Le Chatelier's principle, Clapeyron equation and Clausius-Clapeyron equation

CO5: Apply the effect of common ion on solubility equilibria in practical assignments and calculate hydrolysis constant, degree of hydrolysis and pH for different salts.

### A. OUTLINE OF THE COURSE

		(Hours)
1.	Solutions	7
2.	Chemical Kinetics I	7
3.	Chemical Kinetics II	7
4.	Chemical Equilibrium	7
5.	Ionic Equilibrium	8

### B. DETAILED SYLLABUS

Un	Unit Details
1.	<b>Solutions</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Ideal and non ideal solutions</li> <li>• Methods of expressing concentrations, activity and activity coefficients</li> <li>• Dilute solutions-colligative properties, Raoult's law</li> <li>• Relative lowering of vapour pressure, Molecular weight determination</li> <li>• Osmosis, Law of osmotic pressure and its determination, determination of molecular weight from osmotic pressure</li> <li>• Elevation of boiling point and depression in freezing point</li> <li>• Abnormal molar mass, degree of dissociation and association of molecules</li> <li>• Conclusion of the Unit</li> </ul>
2.	<b>Chemical Kinetics I</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> </ul>

	<ul style="list-style-type: none"> <li>• <b>Chemical kinetics and its scope</b>, rate of a reaction, factors influencing the rate of a reaction- concentrations, temperature, pressure, solvent, light, catalyst, concentration dependence of rates</li> <li>• Mathematical characteristics of simple chemical reaction- zero order, first order, second order, pseudo order, half-life and mean life.</li> <li>• Determinations of the order of reaction- differential method, method of integration, method of half-life period and isolation method</li> <li>• Radioactive decay as a first order phenomenon</li> <li>• Conclusion of the Unit</li> </ul>
<b>3.</b>	<b>Chemical Kinetics II</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• <b>Experimental methods of chemical kinetics</b>: conductometric, potentiometric, optical methods, polarimetry and spectrophotometry.</li> <li>• Theories of chemical kinetics, Effect of temperature on rate of reaction,</li> <li>• Arrhenius Equation, concepts of activation energy</li> <li>• Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis)</li> <li>• Expression for the rate constant based on equilibrium constant and thermodynamic aspects</li> <li>• Conclusion of the Unit</li> </ul>
<b>4.</b>	<b>Chemical Equilibrium</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• <b>Chemical Equilibrium</b>: Equilibrium constant and Free energy change</li> <li>• Thermodynamic derivation of the law of mass action</li> <li>• Le Chatelier's principle</li> <li>• Reaction isotherm and reaction isochore</li> <li>• Clapeyron equation and Clausius-Clapeyron equation</li> <li>• Applications</li> <li>• Conclusion of the Unit</li> </ul>
<b>5.</b>	<b>Ionic Equilibrium</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• <b>Ionic Equilibrium</b>: Strong, moderate and weak electrolytes</li> <li>• degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water</li> <li>• Ionization of weak acids and bases, pH scale, common ion effect</li> <li>• Salt hydrolysis- calculation of hydrolysis constant, degree of hydrolysis and pH for different salts, Buffer solutions</li> <li>• Solubility and solubility product of sparingly soluble salts – applications of solubility product principle</li> <li>• Conclusion of the Unit</li> </ul>

**C. RECOMMENDED STUDY MATERIAL:**

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

**COURSE OUTCOMES**

Students will be able to:

CO1: Analyze the characteristics and properties of planes.

CO2: Develop mathematical arguments about geometric relationships of straight lines.

CO3: Demonstrate working knowledge of three-dimensional structure of sphere.

CO4: Explain the 3-D geometry using cone and cylinder.

CO5: Visualize and represent geometric figures and classify central conicoid geometric solids

**A. OUTLINE OF THE COURSE**

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

**B. DETAILED SYLLABUS**

Unit	Unit Details
1	<b>Plane</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• System of Coordinates, Direction Cosines, Direction Ratios and Projections,</li> <li>• Angle between two lines, Condition of Perpendicularity and parallelism,</li> <li>• Equation of plane in various forms, Angle between two planes, Distance of a point from a plane, plane through intersection of two planes</li> <li>• Planes bisecting the angle between two planes, Equation of Pair of Planes</li> <li>• Conclusion of the Unit.</li> </ul>
2	<b>Straight Line</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Equation of Straight line, Symmetrical Form, General Form,</li> <li>• Perpendicular distance of a point from a line, angle between plane and line,</li> <li>• General Equation of Plane containing Line,</li> <li>• Conclusion of the Unit</li> </ul>
3	<b>Sphere</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Equation of the sphere in general and standard forms</li> <li>• Equation of a sphere with given ends of a diameter.</li> <li>• Plane section of a sphere. Sphere through a given circle.</li> <li>• Intersection of two spheres, Orthogonality of spheres Tangent Plane,</li> </ul>

	<ul style="list-style-type: none"> <li>• Conclusion of the Unit</li> </ul>
<b>4</b>	<b>Cone and Cylinder</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Cone, Enveloping Cone, Tangent plane of a cone, Condition of Tangency, Reciprocal cone, condition of three mutually perpendiculars, Right Circular Cone, Cylinder, Enveloping cylinder, Right Circular Cylinder.</li> <li>• Conclusion of the Unit</li> </ul>
<b>5</b>	<b>Central Conicoids</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Central Conicoids, Standard Equation,</li> <li>• Ellipsoid, Hyperboloid of one and two sheet,</li> <li>• Intersection of line with Conicoid,</li> <li>• Tangent lines and Tangent Planes,</li> <li>• Conclusion of the Unit</li> </ul>

### C. RECOMMENDED STUDY MATERIAL:

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

**COURSE OUTCOMES:**

Students will be able to:

CO1: Understand chemical and molecular processes that take place in inorganic chemical reactions in synthesis.

CO2: Analyze and present experimental results and draw sound conclusions based on experimental evidence.

CO3: Acquire the ability to understand, explain and use instrumental techniques for chemical analysis

CO4 Applying subject knowledge and skill to solve complex problems with defined solutions

CO5: Understand the different factors that contribute to the adsorption.

**LIST OF EXPERIMENTS**

<b>Inorganic Chemistry</b>	
1	Preparation of sodium trioxalatoferrate(III).
2	Estimation of Nickel complex
3	Preparation of copper tetraammine complex.
4	Separation and estimation of Mg(II) and Zn(II)
5	Preparation of Potassium dioxalatodiaquachromate(III).
6	Colorimetric determination of metal ions. $\text{Fe}^{3+}$ ,
<b>Physical Chemistry</b>	
7	To determine the relative strength of two acids(HCl& $\text{H}_2\text{SO}_4$ )
8	To verify Beer Lamberts law $\text{KMnO}_4/\text{K}_2\text{Cr}_2\text{O}_7$ and determine the concentration of the given solution.
9	To determine the strength of Na and K in a given sample by flame photometer.
10	To titrate potentiometrically the given ferrous ammonium sulphate solution using $\text{K}_2\text{Cr}_2\text{O}_7$ and calculate the redox potential of $\text{Fe}^{+2}/\text{Fe}^{+3}$ system
11	To determine the dissociation constant of a weak acid Conductometrically and verify ostwalds dilution law.
12	Adsorption of acetic acid on charcoal

**COURSE OUTCOMES:**

Students will be able to:

CO1: Develop a general understanding of different electrical and electronic devices and their characteristics.

CO2: Develop an understanding and assessment of PN junction diode and transistor characteristics

CO3: Understand and apply the phenomenon of bridge rectifier and CRO

CO4: Apply the principle of Seeback effect and study the variation of Thermo-Emf of a Thermocouple

CO5: Understand and operate various electrical and thermal components and verification of physical laws

**LIST OF EXPERIMENTS:**

1	Identification, testing and application of Resistors, Inductors, Capacitors, PN-Diode, Zener Diode, LED, LCD, BJT, Photo Diode, Photo Transistor, Analog/Digital Multi- Metres and Function/Signal Generator.
2	Study of characteristics of a P-N junction diode.
3	Study of characteristics of a zener diode.
4	Voltage regulation using zener diode
5	Measure the frequency, voltage, current with the help of CRO.
6	Study half wave rectifier and effects of filters on wave. Also calculate ripple factor.
7	Study bridge rectifier and measure the effect of filter network on D.C. voltage output & ripple factor.
8	To study the variation of Thermo-Emf of a Thermocouple with Difference of Temperature of its Two Junctions.
9	Study the BJT amplifier in common emitter configuration. Measure voltage gain plot gain frequency response and calculate its bandwidth.
10	Experimental verification of first law of thermodynamics by discharging of condenser.
11	Study of variation of total thermal radiation with temperature.
12	Plot drain current - drain voltage and drain current – gate bias characteristics of field effect transistor and measure of $I_{dss}$ & $V_p$



**Code: BSAESA3101 THERMODYNAMICS AND STATISTICAL PHYSICS 3.0 Credits [LTP: 3-0-0]**

**COURSE OUTCOMES:** Students will be able to:

CO1: Apply the basic concept of thermodynamics and acquire working knowledge of the zero and first law of thermodynamics.

CO2: Produce the statistical nature of concepts and laws in thermodynamics, in particular: entropy, temperature, chemical potential, Free energies, and partition functions.

CO3: Acquire working knowledge of the mechanism of production of low temperature and its applications.

CO4: Point out the distribution of molecular velocities and experimental verification of Maxwell velocity distribution.

CO5: Use the statistical physics methods, such as Boltzmann distribution, Gibbs distribution, and Fermi-Dirac and Bose-Einstein distributions to solve problems in some physical systems.

#### A. OUTLINE OF THE COURSE

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

#### B. DETAILED SYLLABUS

Unit	Unit Details
1.	<b>Thermal Interaction</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Zeroth law of thermodynamics</li> <li>• Various indicator diagrams (P-V diagram)</li> <li>• First law of thermodynamics,</li> <li>• Reversible and irreversible processes</li> <li>• Carnot's engine,</li> <li>• Carnot's cycle and efficiency of Carnot's engine,</li> <li>• Reversibility of Carnot's engine, Carnot's theorem.</li> <li>• Second law of thermodynamics (different statements and their equivalence)</li> <li>• Entropy, Principle of increase of entropy, Thermodynamic scale of temperature,</li> <li>• Thermodynamic scale an absolute scale,</li> <li>• Third law of thermodynamics as</li> <li>• Conclusion of the Unit</li> </ul>
2.	<b>Thermodynamic Relation</b>

	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Maxwell's thermodynamic relations</li> <li>• Triple point</li> <li>• ClausiusClapyron latent heat equation (Derivation)</li> <li>• Effect of pressure on boiling point of liquids</li> <li>• Helmholtz free energy</li> <li>• Enthalpy and Gibbs function, Internal energy</li> <li>• Thermodynamic potentials</li> <li>• Deduction of Maxwell's relations from thermodynamic potentials.</li> <li>• Conclusion of the Unit</li> </ul>
<b>3.</b>	<b>Production of low temperatures and applications</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Joule Thomson expansion and JT coefficient for ideal as well as Vander Waals gas</li> <li>• Porous plug experiment</li> <li>• Temperature of inversion</li> <li>• Regenerative cooling</li> <li>• Cooling by adiabatic expansion and demagnetization</li> <li>• Nernst heat theorem. (Derivation)</li> <li>• Conclusion of the Unit</li> </ul>
<b>4.</b>	<b>Distribution Law of Molecular Velocities</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Distribution law of molecular velocities,</li> <li>• Most probable, Average and RMS velocities,</li> <li>• Energy distribution function (Derivation)</li> <li>• Experimental verification of Maxwell velocity distribution</li> <li>• Principle of equipartition of energy.</li> <li>• Mean free path and collision cross section</li> <li>• Distribution of mean free path (Derivation)</li> <li>• Transport of mass,</li> <li>• Conclusion of the Unit</li> </ul>
<b>5.</b>	<b>Classical and Quantum Statistics</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Phase space</li> <li>• Micro and macro states</li> <li>• Thermodynamic probability</li> <li>• Relation between entropy and thermodynamic probability</li> <li>• Monatomic ideal gas</li> <li>• Specific heat capacity of diatomic gas and specific heat of solids</li> <li>• Postulates of quantum statistics,</li> <li>• Bose Einstein statistics and its distribution function (Derivation)</li> <li>• Planck's distribution function and radiation formula (Derivation)</li> <li>• Fermi Dirac statistics and its distribution function. (Derivation)</li> <li>• Conclusion of the Unit</li> </ul>

**C. RECOMMENDED STUDY MATERIAL:**

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

**COURSEOUTCOMES:**

Students will be able to-

**CO1** Study theory and applications of Electronics Devices.

**CO2** Apply concepts of Transistor Amplifier and Operational Amplifier and their applications in engineering and technology.

**CO3 Develop** Feedback and oscillator Circuits in electrical and electronics engineering field.

**CO4** Define Number System and Boolean algebra

**CO5** Design Combinational Logics.

**A. OUTLINE OF THE COURSE**

Unit No.	Title of the unit	Time required for the Unit(Hours)
1.	Electronics Devices	8
2.	Transistor Amplifier and Operational Amplifier	9
3.	Feedback and oscillator Circuits	9
4.	Number System and Boolean Algebra	9
5.	Analysis & design of Combinational Logic	9

**B. DETAILED SYLLABUS**

Unit	Unit Details
1.	<b>Electronics Devices</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit]</li> <li>• P-N Junctions: Diode theory, Bipolar Junction Transistors (BJT): Transistor fundamentals, transistor Analog Electronics configurations, DC operating point, BJT characteristics &amp; parameters, fixed bias, emitter bias with and without emitter resistance, analysis of above circuits and their design, variation of operating point and its stability.</li> <li>• Field-Effect Transistors (FET): JFET-current-voltage characteristics, effects in real devices, high-frequency and high-speed issues.</li> <li>• Conclusion and Summary of Unit]</li> </ul>
2.	<b>Transistor Amplifier and Operational Amplifier</b>

	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Transistors Amplifier: Small Signal BJT amplifiers: AC equivalent circuit, hybrid, re model and their use in a mp l i f i er design. Multistage amplifiers, frequency response of basic &amp; compound configuration, Power amplifiers: Class A, B, AB, C and D stages, IC output stages.</li> <li>• Operational Amplifiers: Op-AmpBasics,practicalOp-Ampcircuits,differentialandcommonmodeoperation,Inverting &amp; Non Inverting Amplifier, differential and cascade amplifier, Op-Amp applications .</li> </ul>
	<p>Mode operation, Inverting &amp; Non Inverting Amplifier, differential and cascade amplifier, Op-Amp applications.</p> <ul style="list-style-type: none"> <li>• Conclusion and Summary of Unit □</li> </ul>
<b>3.</b>	<b>Feedback and oscillator Circuits</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Feedback &amp; Oscillator Circuits Effect of positive and negative feedbacks, feedbacks, basic feedback topologies &amp; their properties, properties, Analysis of practical feedback amplifiers, Sinusoidal Oscillators (RC, LC and Crystal), Multi-vibrators, The 555timer.</li> <li>• Conclusion and Summary of Unit</li> </ul>
<b>4.</b>	<b>Number System and Boolean Algebra</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• NumberSystems:Decimal,binary,octal,hexadecimalnumbersystemandconversion,binaryweigh tedcodes,signed numbers, 1s and 2s complement codes, Binary arithmetic</li> <li>• BooleanAlgebra:Binarylogicfunctions,Booleanalaws,truthtables,associativeanddistributivep roperties,De-Morgans theorems, realization of switching functions using logic gates</li> <li>• Conclusion and Summary of Unit</li> </ul>
<b>5.</b>	<b>Analysis &amp; design of Combinational Logic</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Combinational Logic: Switching equations, canonical logic forms, sum of product &amp; product of sums, Karnaugh maps, two, three and four variable Karnaugh maps, simplification of expressions, Quine-Mc Cluskey minimization technique, mixed logic combinational circuits, multiple output functions.</li> <li>• Analysis &amp; design of Combinational Logic: Introduction to combinational circuits, code conversions, decoder, encoder, priority encoder, multiplexers as function generators, binary adder, subs tractor, BCD adder, Binary comparator, arithmetic logic units</li> <li>• Sequential Logic, Sequential Circuits, Programmable Logic, Digital integrated circuits.</li> <li>• Conclusion and Summary of Unit</li> </ul>

**C. RECOMMENDED STUDY MATERIAL:**

<b>Sr. No</b>	<b>Reference Book</b>	<b>Author</b>	<b>Editio</b>	<b>Publication</b>
1.	Microelectronics Circuits	A.S. Sedra & K.C.Smith	Latest	Oxford University Press
2.	Electronic Principles	A.P.Malvino	Latest	TMH
3.	Electronic Devices & Circuit	RobertL.Boylestad&LouisNashelsky	Latest	Pearson
4.	Electronic devices and circuits	JacobMillman,andC.C.Halkias	Latest	TMH
5.	Digital Electronics	WilliamKleitz	Latest	PHI

**COURSE OUTCOMES:**

Students will be able to-

- CO1** Analyze the Energy Auditing Techniques, methods of conducting energy audit and energy audit report.
- CO2** Apply the concept of Basic Electrical Systems, Bill Analysis, Lighting Systems and Transformers and Electric Distribution  
Study of Electric Motors with Motor characteristic, Motor Efficiency, losses in induction motors, factor affecting motor performance. And Compressed Air Systems
- CO3** Understand Environment pollution, global warming and climate change: Air pollution (local, regional and global); Water pollution problems; Land pollution and food chain contaminations.
- CO4** Create the chart natural resources, Agricultural, industrial systems and environment, Energy technologies and environment.
- CO5**

**A. OUTLINE OF THE COURSE:**

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Energy Auditing Techniques	8
2.	Basic Electrical Systems	8
3.	Electric Motors: ECO	8
4.	Environment pollution, global warming and climate	8
5.	Energy technologies and environment	8

**B. DETAILED SYLLABUS:**

Uni	Unit Details
1	<p><b>Energy Auditing Techniques</b></p> <ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Energy Auditing Techniques: Definition, Energy audit-need, Types of energy audit, Energy management (audit) approach- understanding energy costs, Bench marking, Energy performance, Matching energy use to Requirement, Maximizing system efficiencies, optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments. ,</li> <li>• Methodologies of Conducting Energy Audit: Preliminary &amp; Detailed Energy Audit Methodology: Preliminary Questionnaire, Review of Previous Records, Introductory Meeting, Walk through Tour, Flow Chart Construction for Detail Energy Audit, Identification of Required Audit Instruments, Finalization of Audit Schedule with the Company, Getting Detailed Data.</li> <li>• Energy Audit Report: Outlines of Energy Audit Report Format, Identification and Techno economic</li> <li>• Analysis of Energy Conservation Measures, Classification of Energy Conservation Measures</li> <li>• Conclusion and Summary of Unit</li> </ul>
2.	<b>Basic Electrical Systems</b>

	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Basic Electrical Systems: Basis of Energy and its various forms: Electrical Basis-DC&amp;AC, currents active power, reactive power and apparent power, star, delta connection.</li> <li>• Bill Analysis: ECO (Energy Conservation Opportunities) Electricity tariff and components, load Management &amp; Demand Side Control, power factor improvement &amp; its benefit, selection and location of capacitors, Performance Assessment of capacitors &amp; Capacitor Bank.</li> <li>• Lighting Systems: Light source, Choice of Lighting, Luminance requirements, Energy conservation avenues.</li> <li>• Transformers and Electric Distribution: Types of transformers, Transformer losses, Energy efficient transformers, Factor affecting the performance of transformers and Energy Conservation Opportunities, Cables, Switch Gears, Distribution Losses, and energy conservation opportunities in-house electrical distribution system.</li> <li>• Conclusion and Summary of Unit</li> </ul>
<b>3.</b>	<b>Electric Motors: ECO</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Electric Motors: ECO Introduction, Types, Motor characteristic, Motor Efficiency, losses in induction motors, factor affecting motor performance, Motor Load Survey: Methodology, Rewinding motor and replacement issues, Energy Saving Opportunities in Motors, Motor Selection, Energy Efficient Motors, Speed Control of AC Induction Motors, Soft starter with energy savers, Variable Speed Drives (VFD).</li> <li>• Compressed Air Systems: ECO Introduction, Types of air compressors, compressor efficiency, efficient compressor operation, compressed air systems components, capacity assessment, and leakage test, factors affecting the performance and Efficiency, energy savings opportunities.</li> <li>• Conclusion and Summary of Unit</li> </ul>
<b>4</b>	<b>Environment pollution, global warming and climate change</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Environment pollution, global warming and climate change: Air pollution (local, regional and global); Water pollution problems; Land pollution and food chain contaminations; Carbon cycle, greenhouse gases and global warming; Climate change–causes and consequences; Carbon footprint; Management of greenhouse gases at the source and at the sinks Ecology,</li> <li>• Structureandfunctioningofnaturalecosystems:Ecology,ecosystemsandtheirstructure,functionin ganddynamics; Energy flow in ecosystems; Biogeochemical cycles and climate; Population and communities</li> <li>• Conclusion and Summary of Unit</li> </ul>
<b>5.</b>	<b>Energy technologies and environment</b>



<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Natural resources: Human settlements and resource consumption; Biological, mineral and energy resources; Land, water and air; Natural resources vis-à-vis human resources and technological resources; Concept of sustainability; Sustainable use of natural resources</li> <li>• Agricultural, industrial systems and environment: Agricultural and industrial systems vis-à-vis natural eco systems; Agricultural systems, and environment and natural resources; Industrial systems and environment</li> <li>• Energy technologies and environment: Electrical energy and steam energy; Fossil fuels, hydro power and nuclear energy; Solar energy, wind energy and biofuels; Wave, ocean thermal, tidal energy and ocean currents; Geothermal energy; Future energy sources; Hydrogen fuels; Sustainable energy</li> <li>• Conclusion and Summary of Unit</li> </ul>
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### C. RECOMMENDED STUDY MATERIAL

Sr.No	Reference Book	Author	Edition	Publication
1.	Bharucha, E., Textbook of Environmental	Bharucha	2 <sup>nd</sup>	Universities Press
2.	Ecology-Principles and Application	Chapman, J.L. and Reiss, M.J	1 <sup>st</sup>	Cambridge University Press(LPE)
3.	Environmental Studies	Joseph, B	1 <sup>st</sup>	Tata Mc Graw-Hill
4.	D.R. Energy Efficiency for Engineers and Technologists	Eastop, T.P. and Croft	2 <sup>nd</sup>	Longman and Harow
5.	Environmental Science	Miller, G.T	2 <sup>nd</sup>	Thomson
6.	Energy Management	O'Callagan	3 <sup>rd</sup>	Mc Graw Hill Book Co. Ltd
7.	Generation Of Electrical Energy Edition 2005	B.R. Gupta	1 <sup>st</sup>	Eurasia Publishing House(PVT.) LTD.

**COURSE OUTCOMES:** Students will be able to:

CO1: Demonstrate depth of understanding, observing complexity, improve insight and develop independent thought and persuasiveness.

CO2: Determine the main ideas of the text by using key details and compare & contrast the most important points with the help of their perspective.

CO3: Practice the qualities of writing style by applying the concepts of sentence conciseness, accuracy, readability, coherence and by avoiding wordiness or ambiguity.

CO4: Distinguish words and phrases as per their intonation patterns and interpret the audios based on different situations

CO5: Demonstrate the understanding of impactful conversational skills, presentation skills & telephonic conversation by considering the need of the audience.

#### A. OUTLINE OF THE COURSE

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

#### B. DETAILED SYLLABUS

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

**COURSE OUTCOME:** Students will be able to:

CO1: Understand the concepts of hardware and software components of computers.

CO2: Acquire the knowledge of basics of computer and data representation

CO3: Create ms-word document and use of different key in that document.

CO4: Understand the use of mathematical tool and hyperlink.

CO5: Create a mail id and write an e-mail.

**LIST OF EXPERIMENTS:**

1.	Prepare a document about any tourist destination of your choice with appropriate pictures and editing features.
2.	Prepare a News Paper Layout. Insert appropriate pictures wherever necessary. Use the following Features: Three Column and Four Column setting Set One or Two Advertisements. Use Bullets and Numbering
3.	Create a Document consisting of Bio-data. It includes A table giving your qualification and/or experience of work. Table should be Bordered and Shaded. A Multilevel list giving your areas of interest and further areas of interest. The subareas should be numbered as „a“, „b“, etc while the areas should be numbered as „1“, „2“, etc. The information should be divided in “General” and “Academic” sections. The header should contain “BIO-DATA” while the footer should have page numbers in the format Page 1 of 10. Assign a password for the document to protect it from unauthorized access.
4.	Assume that you are coordinating a seminar in your organization. Write a letter to 10 different IT companies asking them to participate in the seminar using mail merge facility.
5.	Prepare a document which contains template of marks card of students. Assume that there are 10 students. The footer for the document should be „Poornima University Jaipur
6.	Prepare a document about any topic In mathematics which uses mathematical symbols. (At least 5 mathematical symbols should be used). Assign a password for the document to protect it from unauthorized access. Demonstrate the use of Hyperlink Option. Set margins to your document, a font of size and double spaced document.
7.	Open a new workbook, save it as JavaCoffeeBar.xls. In sheet1 write following sales data for Java Coffee bar to show their First 6 months sales. Select cell B4:D4 and change the horizontal alignment to center and text to 90 degree. All titles should be in bold Format all cells numbers to currency style and adjust width as necessary. Add border to data. Select the cell range A1:H1, merge and center these cells. Apply same format to A2:H2. Give border, shading and pattern to data in sheet Apply different font settings for all titles in sheet Apply green color and bold setting to sales above 10000 (use conditional formatting) Rename current worksheet as First Half Sales
8.	Prepare a worksheet to maintain student information. The work sheet should contain Roll Number, Name and marks in 5 subjects. (Max Marks is 100). Validate the marks. Calculate the total marks. Assign the grade according to the following. Poornima University, Jaipur Assign grade „A“ if the total marks is above 450. From 401 to 449 assign the grade as “B”. From 351 to 400 assign the Grade as C. From 300 to 350 the grade to be assigned is „D“. For the total marks less than 300 No grade is

	assigned. A student eligible to get a grade only when he gets 40 and above in all the subjects. In suchcases the grade is “FAIL”. (Assume that there are 10 students).
9.	Prepare a pay-bill using a worksheet. The work sheet should contain Employee Id, Name, Designation, Experience and Basic Salary and Job ID. If Job Id is 1 then DA is 40% of the basic salary. HRA is Rs. 4500. If Job Id is 2 then DA is 35% of the basic salary. HRA is Rs. 3500. If Job Id is 3 then DA is 30% of the basic salary.HRA is Rs. 2500. If Job Id is 4 then DA is 25% of the basic salary and HRA isRS.2500. For all the other Job ids DA is 20% of the basic salary and HRA is Rs.1500. For all the above Job ids PF to be deducted is 4%. For the job ids between 1-4Rs. 100 to be deducted as Professional Tax. Find the net pay.
10.	For the above employee worksheet perform the following operations 1. Use filter to display the details of employees whose salary is greater than 10,000. 2. Sort the employees on the basis of their net pay 3. Use advance filter to display the details of employees whose designation is “Programmer” and Net Pay is greater than 20,000 with experience greater than 2 yrs.
11	Using Excel project the Product sales for any five products for five years.Compute the total sales of each product in the five years.Compute the total sales of all the products in five year.Compute the total sales of all products for each year.Represent annual sale of all the products using Pie-Chart.Represent annual sales of all products using Bar Chart.Represent sale of a product for five years using Pie-Chart.Label and format the graphs
12	Assume that you are going to give a presentation about Information Technology. (Choose some latest technologies). The presentation should have minimum 10slides. Insert appropriate images wherever necessary. Use proper formattingDiagrams and tables. Show the usage of action buttons, hyperlinks, and animations.

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

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

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

**COURSE OUTCOMES:** Students will be able to:

CO1: Demonstrate different Acid Base theories and Solvent system concept.

CO2: Analyze metal ligand bonding in transition metal complexes with the help of Valence Bond Theory and Crystal field Theory.

CO3: Outline magnetic & spectral properties, thermodynamic and kinetic aspects of metal complexes.

CO4: Summarize synthesis, properties and applications of organometallic compounds.

CO5: Evaluate redox potential, redox cycle and disproportionation using Frost, Latemar and Roubaix diagram.

### A. OUTLINE OF THE COURSE

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

### B. DETAILED SYLLABUS

Unit	Unit Details
1.	<b>Acids &amp; Bases and Non-aqueous Solvents</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• <b>Acids and bases:</b> Theories of Arrhenius, Bronsted-Lowry, Lux-Flood</li> <li>• Solvent system concept and Lewis concept of acids and bases</li> <li>• Hard and Soft Acids and Bases (HSAB): Classification of acids and bases as hard and soft.</li> <li>• Pearson's HSAB concept, acid-base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness</li> <li>• <b>Non-aqueous solvents</b> : Physical properties of solvent, types of solvent and their general characteristics</li> <li>• reactions in non-aqueous solvents with reference to liq. NH<sub>3</sub> and liq. SO<sub>2</sub>, HF</li> <li>• Conclusion of the Unit</li> </ul>
2.	<b>Metal Ligand bonding in Transition Metal Complexes</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• <b>Transition Metals:</b> Characteristic properties transition elements – ionic radii, oxidation states, complexation tendency, magnetic behavior and electronic spectral properties.</li> <li>• Metal ligands bonding in transition metal complexes</li> <li>• Limitation of VBT, Elementary idea of CFT, Crystal field splitting in Octahedral, Tetrahedral and Square planer complexes, Factors affecting the crystal field parameter</li> <li>• Conclusion of the Unit</li> </ul>
3.	<b>Magnetic and Spectral properties of Transition Metal Complexes</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> </ul>

	<ul style="list-style-type: none"> <li>• <b>Magnetic Properties of Transition Metal Complexes:</b> Types of magnetic behavior, methods of determining magnetic susceptibility, L-S and J-J coupling, orbital contribution to magnetic moments. Correlation of magnetic moment data and stereochemistry of Co (II) and Ni (II) complexes; anomalous magnetic moments</li> <li>• <b>Spectral properties of transition metal complexes:</b> Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states and Spectroscopic terms (L-S Coupling) , spectrochemical series, Orgel energy level diagram for <math>d^1</math> and <math>d^9</math> states, the electronic spectrum of <math>[\text{Ti}(\text{H}_2\text{O})_6]^{+3}</math> complex ion.</li> <li>• Thermodynamic and Kinetic Aspects of Metal Complexes: A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes</li> <li>• Conclusion of the Unit</li> </ul>
<b>4.</b>	<b>Organometallic Chemistry</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• <b>Organometallic chemistry:</b> Definition, nomenclature and classification of organometallic compounds,</li> <li>• Preparation, properties, bonding and applications of alkyls and aryls of Li, Al, Hg, Sn and Ti, a brief account of metal – ethylenic complexes and homogenous hydrogenation, mononuclear carbonyls and the nature of bonding in metal carbonyls.</li> <li>• Conclusion of the Unit</li> </ul>
<b>5.</b>	<b>Oxidation &amp; Reduction</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Use of Redox potential data</li> <li>• Analysis of redox cycle</li> <li>• Redox stability in water</li> <li>• Disproportionation</li> <li>• Diagrammatical presentation of potential data-Frost, Latimer and Pourbaix diagram</li> <li>• Principle involved in the extraction of elements</li> <li>• Conclusion of the Unit</li> </ul>

### C. RECOMMENDED STUDY MATERIAL:

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

**COURSE OUTCOMES:** Students will be able to:

CO1: Describe the nomenclature, structure, bonding and characteristic reactions of Phenols and Ethers

CO2: Analyze chemical behavior of aldehyde and ketones and discuss name reactions of synthesis.

CO3: Explain physical and chemical properties of Carboxylic acids.

CO4: Compare physical and chemical properties of carboxylic acid derivatives.

CO5: Discuss chemical behavior and nucleophilic substitution reactions of amines and diazonium salts.

#### A. OUTLINE OF THE COURSE

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

#### B. DETAILED SYLLABUS

Un	Unit Details
1	<b>Phenols and Ethers</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit.</li> <li>• <b>Phenols:</b> (Phenol case) Nomenclature, Structure and Bonding, Preparation: Cumenehydroperoxide method, from diazonium salts.</li> <li>• Physical Properties and acidic character. Comparative acidic Strengths of Alcohols and Phenols. resonance stabilization of phenoxide ion.</li> <li>• Reactions: Electrophilic substitution: Nitration, halogenation and sulphonation. Reimer-Tiemann Reaction, Gattermann-Koch Reaction, Houben-Hoesch Condensation, Schotten – Baumann Reaction, Fries Rearrangement, Claisen Rearrangement, Lederer- Manasse Reaction</li> <li>• <b>Ethers (aliphatic and aromatic):</b> Cleavage of ethers with HI.</li> <li>• Nomenclature of Ethers, Method of Formation, Chemical Reactions – Cleavage and autooxidation, Ziesel's Method.</li> <li>• Synthesis of epoxide, Acid and base-catalyzed ring opening of Epoxide, orientation of epoxide, reactions of Grignard and organolithium reagents with epoxides</li> <li>• Conclusion of the Unit</li> </ul>
2	<b>Aldehydes and Ketones</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit.</li> <li>• Nomenclature and Structure of Carbonyl Group.</li> </ul>



	<ul style="list-style-type: none"> <li>• <b>Aldehydes and ketones (aliphatic and aromatic):</b> (Formaldehyde, acetaldehyde, acetone and benzaldehyde)</li> <li>• Preparation: from acid chlorides and from nitriles.</li> <li>• Reactions – Reaction with HCN, ROH, NaHSO<sub>3</sub>, NH<sub>2</sub>-G derivatives. Iodoform test. Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation. Clemmensen reduction and Wolff Kishner reduction. Meerwein-Ponndorf-Verley reduction, Perkin and Knoevenagel Condensation, Mannich Reaction.</li> <li>• synthesis of aldehydes and ketones using 1,3-dithianes. syntheses of ketones from carboxylic acids, Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction, MPV (Meerwein-Ponndorf-Verley), Clemmensen, Wolff-Kishner, LiAlH<sub>4</sub> and NaBH<sub>4</sub> reductions, Use of acetals and 1,3-dithiane as protecting group.</li> <li>• Conclusion of the Unit</li> </ul>
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<b>3</b>	<b>Carboxylic acids</b>
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	<ul style="list-style-type: none"> <li>• Introduction of the Unit.</li> <li>• <b>Carboxylic acids</b> (aliphatic and aromatic), Nomenclature.</li> <li>• Carboxylic Acids Structure and bonding, physical properties. acidity of carboxylic acids, effects of substituents on acid strength., mechanism of decarboxylation. Methods of formation and chemical reactions of halo acids. Hydroxy acids - malic, tartaric and citric acids.</li> <li>• <i>Reactions:</i> Hell – Vohlard–Zelinsky, reaction, Synthesis of acid chlorides, esters, amides,</li> <li>• <i>Preparation:</i> Acidic and Alkaline hydrolysis of esters.</li> <li>• Methods of Formation of alpha, beta unsaturated monocarboxylic acid.</li> <li>• Dicarboxylic acid- Method Formation and effect of heat and dehydrating agents, succinic, glutaric acid and adipic acid.</li> <li>• Conclusion of the Unit</li> </ul>
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<b>4</b>	<b>Carboxylic acid derivatives</b>
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	<ul style="list-style-type: none"> <li>• Introduction of the Unit.</li> <li>• <b>Carboxylic acid derivatives (aliphatic):</b> (Upto 5 carbons)</li> <li>• Preparation: Acid chlorides, Anhydrides, Esters and Amides from acids and their interconversion.</li> <li>• Reactions: Comparative study of nucleophilicity of acyl derivatives. Reformatsky Reaction, Perkin condensation.</li> <li>• Carboxylic Acid Derivatives: nomenclature Relative stability of acyl derivatives.. Preparation of carboxylic acid derivatives. chemical reactions, mechanisms of esterification and hydrolysis (acidic and basic)</li> <li>• Conclusion of the Unit</li> </ul>
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<b>5</b>	<b>Amines and Diazonium Salts</b>
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	<ul style="list-style-type: none"> <li>• Introduction of the Unit.</li> <li>• Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media. Picric acid. separation of 1<sup>o</sup>, 2<sup>o</sup>, 3<sup>o</sup>.</li> <li>• <b>Amines:</b> Amines (Aliphatic and Aromatic): (Upto 5 carbons)</li> </ul>
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- Preparation: from alkyl halides, Gabriel's Phthalimide synthesis, HofmannBromamide reaction.
- Reactions: Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, with HNO<sub>2</sub>, Schotten – Baumann Reaction. Electrophilic substitution (case aniline): nitration, bromination, sulphonation
- Reactions: conversion to benzene, phenol, dyes
- Amines: Structure. nomenclature and preparation of alkyl, and aryl amines (reduction of nitro compounds. nitrites), reductive amination of aldehydic and ketonic compounds.. Structural features effecting basicity of amines. Amine salts as phase-transfer catalysts. Hoffmann bromamide reaction with mechanism. Diazotisation and mechanism. transformations of aryl diazonium salts, azo coupling and its applications
- **Diazonium salts:** *Preparation:* from aromatic amines
- Conclusion of the Unit

### C. RECOMMENDED STUDY MATERIAL:

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

**COURSE OUTCOMES:** Students will be able to:

CO1: Explain and represent to the various form of data using statistics.

CO2: Evaluate the statistical data using measures of central tendency and dispersion.

CO3: Analyze the correlation and regression.

CO4: Explain the basic concepts of probability and their properties.

CO5: Determine the probability distribution for discrete and continuous random variable.

**A OUTLINE OF THE COURSE**

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

**B DETAILED SYLLABUS**

Unit	Unit details
<b>1</b>	<b>Statistics</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit.</li> <li>• Introduction of Statistics, Scope of Statistics,</li> <li>• Types of data, Collection, classification and tabulation of data.</li> <li>• Presentation of data: Frequency polygon, frequency curve, Ogive, Bar diagram, Histogram and Pie chart.</li> <li>• Conclusion of the Unit</li> </ul>
<b>2</b>	<b>Central Tendency &amp;Dispersion</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit.</li> <li>• Measures of Central Tendency: Mean, median, mode,</li> <li>• Quartile deviation, mean deviation, standard deviation ( <math>\sigma</math> ),</li> <li>• Coefficient of variation.</li> <li>• Conclusion of the Unit</li> </ul>
<b>3</b>	<b>Correlation and Regression</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit.</li> <li>• Correlation, Types of correlation,</li> <li>• Karl Pearson Coefficient (r) of correlation, Properties,</li> <li>• Rank correlation coefficient, Regression,</li> <li>• Lines of Regression, Properties of regression coefficients</li> <li>• Conclusion of the Unit</li> </ul>
<b>4</b>	<b>Probability Theory</b>
<input type="checkbox"/>	<ul style="list-style-type: none"> <li>• Introduction of the Unit.</li> <li>• Random Experiment: Trial, Events and their types</li> <li>• Definition of Probability, Sample Point and Sample space.</li> <li>• Axiomatic Approach of probability and its properties.</li> </ul>

	<ul style="list-style-type: none"> <li>• Addition and multiplication theorems of probability. Conditional probability. Bayes theorem and its applications (Simple problems only)</li> <li>• Conclusion of the Unit</li> </ul>
<b>5</b>	<b>Probability Distribution</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit.</li> <li>• Random variable and its types</li> <li>• Distribution function, Probability mass function and Probability density function</li> <li>• Discrete probability distribution: Binomial and Poisson's distribution</li> <li>• Continuous probability distribution: Normal distribution</li> <li>• Conclusion of the Unit</li> </ul>

**C RECOMMENDED STUDY MATERIAL:**

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

**Code: BSACSA4104****ABSTRACT ALGEBRA****3.0 Credits [LTP: 3-0-0]****COURSE OUTCOMES:** Students will be able to:

CO1: Demonstrate insight into algebraic structure with their axiomatic.

CO2: Identify subgroups of a given group and their properties.

CO3: Explain the fundamental concepts of normal subgroups, homomorphisms and isomorphism.

CO4: Demonstrate knowledge of rings and their properties.

CO5: Demonstrate knowledge of fields and their properties.

**A. OUTLINE OF THE COURSE**

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

**B DETAILED SYLLABUS**

Unit	Unit details
<b>1</b>	<b>Group</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit.</li> <li>• Binary operation, Algebraic Structure, Groups,</li> <li>• Abelian Group, Cyclic Group, order of element,</li> <li>• Generator of Cyclic Group, Cyclic permutation</li> <li>• Conclusion of the Unit</li> </ul>
<b>2</b>	<b>Subgroup</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit.</li> <li>• Subgroup, center of a group,</li> <li>• Group <math>Z_n</math> of integers under addition modulo <math>n</math> and the</li> <li>• Group <math>U(n)</math> of units under multiplication modulo <math>n</math>,</li> <li>• Conclusion of the Unit</li> </ul>
<b>3</b>	<b>Group Morphism</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit.</li> <li>• Morphism of groups, Cayley's theorem</li> <li>• Normal subgroups and Quotient groups</li> <li>• Fundamental theorem of Isomorphism.</li> <li>• Conclusion of the Unit</li> </ul>
<b>4</b>	<b>Rings and Sub-rings</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit.</li> <li>• Definition and simple properties of rings</li> <li>• Commutative and non-commutative rings</li> <li>• Sub-rings, Morphism of Rings</li> <li>• Embedding of a Ring</li> <li>• Conclusion of the Unit</li> </ul>

<b>5</b>	<b>Fields</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit.</li> <li>• Integral domains and Fields</li> <li>• Characteristics of a Ring and Field</li> <li>• Prime fields</li> <li>• Definition of Vector Spaces, liner combination, liner dependence and liner independent of vectors</li> <li>• Conclusion of the Unit</li> </ul>

**C RECOMMENDED STUDY MATERIAL:**

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

**COURSE OUTCOMES:** Students will be able to:

- CO1: Have an idea of estimation technique of various ions present in a mixture.  
CO2: Recognize the basic practical skills for the synthesis and analysis of organic compounds.  
CO3: Purify and separate compounds with special techniques.  
CO4: Analyze and present experimental results and draw sound conclusions based on experimental evidence.  
CO5: Exposed to the different processes used in industries and their applications

### LIST OF EXPERIMENTS

<b>Inorganic Chemistry</b>	
1	Estimation of sodium carbonate and sodium hydroxide present in a mixture.
2	Estimation of acetic acid in commercial vinegar using NaOH
3	Estimation of water of crystallization in Mohr's salt by titrating with $\text{KMnO}_4$ .
4	Estimation of Ferrous and Ferric by dichromate method
5	Estimation of Cu as copper thiocyanate
6	Preparation of Ni- DMG complex
<b>Organic Chemistry</b>	
7	To separate and identify the organic mixture containing two solid components using water and prepare their suitable derivatives.
8	To separate and identify the organic mixture containing two solid components using NaOH.
9	To prepare Iodoform from ethanol and acetone
10	Estimation of glucose by Fehling's solution.
11	Isolation of caffeine from tea leaves.
12	Synthesis of methyl orange

**COURSE OUTCOMES: Students will be able to:**

CO1: Understand the operation and perform the various integrated circuits

CO2: Verify and analyze the truth table of various logic gates and designing a counter using flip-flop.

CO3: Analyze and apply the concept of converter from A to D and D to A types of circuits.

CO4: Understand the concept of various multivibrator

CO5: Understand and analyze the frequency of various oscillators

**LIST OF EXPERIMENTS:**

1.	To study and perform the following experiments. (a) Operation of digital multiplexer and demultiplexer. (b) Binary to decimal encoder. (c) Characteristics of CMOS integrated circuits.
2.	To study and perform experiment- Compound logic functions and various combinational circuits based on AND/NAND and OR/NOR Logic blocks.
3.	To study and perform experiment - Digital to analog and analog to digital converters.
4.	To study and perform experiment- Various types of counters and shift registers.
5.	To study and perform experiment - Interfacing of CMOS to TTL and TTL to CMOS ICs.
6.	To study and perform experiment- BCD to binary conversion on digital IC trainer.
7.	To study and perform experiment - (a) Astable (b) Monostable (c) Bistable Multivibrators and the frequency variation with different parameters, observe voltage waveforms at different points of transistor.
8.	To study and perform experiment -Voltage comparator circuit using IC-710.
9.	To study and perform experiment- Schmitt transistor binary circuit.
10.	Design 2 bit binary up/down binary counter on bread board.
11.	Study of operation of Colpitt's Oscillator and Hartley Oscillator
12.	Study transistor phase shift oscillator and observe the effect of variation in R & C on oscillator frequency and compare with theoretical value.



**COURSE OUTCOMES:** Students will be able to:

CO1: Acquire knowledge of the different types of number systems and De-Morgan Theorem.

CO2: Point out the mechanism of the combinational circuits and flip-flop.

CO3: Judge the concepts and potential applications of feedback systems and their frequency responses.

CO4: Identify the configuration of different types of sinusoidal oscillators.

CO5: Understand the mechanism of operational amplifier and its different applications.

**A. OUTLINE OF THE COURSE**

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

**B. DETAILED SYLLABUS**

Unit	Unit Details
1.	<b>Number System &amp; Boolean Algebra</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Decimal and Binary number system</li> <li>• <b>Octal</b> and Hexadecimal number system</li> <li>• Inter conversion</li> <li>• Character codes</li> <li>• ASCII, BCD, Gray code</li> <li>• Logical operations</li> <li>• Boolean algebra</li> <li>• Simplification of boolean expression,</li> <li>• Gates: NOT, AND, OR, NAND, NOR and XOR gates</li> <li>• De-Morgans theorems</li> <li>• Universal gates</li> <li>• Logic circuits for boolean expressions</li> <li>• Conclusion of the Unit</li> </ul>
2.	<b>Sequential &amp; Combinational logic circuits</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Half adder</li> <li>• Full adder</li> <li>• Parallel adder</li> <li>• Half subtractor</li> <li>• Full subtractor</li> <li>• Parallel subtractor,</li> <li>• Flipflops; RS, D, JK</li> <li>• Clocked and edge triggered</li> </ul>

	<ul style="list-style-type: none"> <li>• PRESET and CLEAR</li> <li>• Counters: Synchronous and Asynchronous counter</li> <li>• Conclusion of the Unit</li> </ul>
<b>3.</b>	<b>Feedback Amplifier</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Feedback concept</li> <li>• Positive and negative feedbacks and their properties</li> <li>• Sampling and mixing</li> <li>• Feedback topology: Voltage series, Voltage shunt, Current series, Current shunt</li> <li>• Effect of positive and negative feedback on gain of amplifier</li> <li>• Frequency response</li> <li>• Gain-stability</li> <li>• Noise, Distortions</li> <li>• Effect of negative feedback on input and output impedances of an amplifier</li> <li>• CE amplifier with current series feedback</li> <li>• Conclusion of the Unit</li> </ul>
<b>4.</b>	<b>Sinusoidal &amp; Non sinusoidal Oscillators</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Operation of oscillator</li> <li>• Classification of oscillators</li> <li>• Barkhausen criterion for sustained oscillations</li> <li>• L-C oscillator</li> <li>• R-C Phase shift oscillator</li> <li>• Hartley oscillator</li> <li>• Colpitt's oscillators.</li> <li>• Non Sinusoidal Oscillators: Transistor as a switch</li> <li>• Introduction of multivibrator</li> <li>• Conclusion of the Unit</li> </ul>
<b>5.</b>	<b>OPAMP and its Basic Applications</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• OPAMP and its Basic Applications</li> <li>• Differential Amplifier: Common mode and difference mode signals and their gains</li> <li>• CMRR, Emitter- Coupled differential amplifier</li> <li>• Basic Operational Amplifier (Op-Amp)</li> <li>• Ideal operational amplifier</li> <li>• Concept of virtual ground</li> <li>• Inverting and non-inverting OPAMP</li> <li>• Applications of Op-Amp</li> <li>• Inverting Op-Amp as constant multiplier</li> <li>• Sign-Changer</li> <li>• Adder or summing amplifier</li> <li>• Integrator</li> <li>• Differentiator</li> <li>• Conclusion of the Unit</li> </ul>

<b>Sr.No</b>	<b>Reference Book</b>	<b>Author</b>	<b>Edition</b>	<b>Publication</b>
1.	Principles of Electronics	<b>V.K. Mehta and R. Mehta</b>	2005	S. Chand and Company
2.	Electronic Devices and Circuits	<b>Allen Mottershead</b>	2002	Prentice-Hall of India
3.	Basic Electronics and Linear Circuits	<b>N.N. Bhargava, D.C. Kulshrestha and S.C. Gupta</b>	1984	Tata McGraw-Hill Publishing Company Ltd., New Delhi

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**COURSE OUTCOMES:**

After Successful completion of the course students will be able-

<b>CO1</b>	Understand concept of Operating System.
<b>CO2</b>	Analyze Process Management
<b>CO3</b>	Apply Process Management
<b>CO4</b>	Analyze the Storage Management.
<b>CO5</b>	Design Protection and Security technologies.

**A. OUTLINE OF THE COURSE**

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to Operating System	8
2.	Process Management – Processes and Threads	8
3.	Process Management – Synchronization and Deadlocks	8
4.	Storage Management	8
5.	Protection and Security	8

**B. DETAILED SYLLABUS**

Unit	Unit Details
<b>1.</b>	<b>Introduction to Operating System</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Objectives and Functions OS</li> <li>• Evolution of OS, OS Structures, OS Components, OS Services</li> <li>• System calls, System programs, Virtual Machines.</li> <li>• Conclusion and Summary of Unit</li> </ul>
<b>2.</b>	<b>Process Management – Processes and Threads</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Processes: Process concept, Process scheduling, Co-operating processes, Operations on Processes, Inter process communication, Communication in client-server systems.</li> <li>• Threads: Introduction to Threads, Single and Multi-threaded processes and its benefits, User And Kernel threads, Multithreading models, threading issues.</li> <li>• CPU Scheduling: Basic concepts, Scheduling criteria, Scheduling Algorithms, Multiple Processor Scheduling, Real-time Scheduling, Algorithm Evaluation, Process Scheduling Models.</li> <li>• Conclusion and Summary of Unit</li> </ul>
<b>3.</b>	<b>Process Management – Synchronization and Deadlocks</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Process Synchronization: Mutual Exclusion, Critical – section problem, Synchronization hardware, Semaphores, Classic problems of synchronization, Critical Regions, Monitors, OS Synchronization, Atomic Transactions.</li> <li>• Deadlocks: System Model, Deadlock characterization, Methods for handling Deadlocks,</li> <li>• Deadlock prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.</li> <li>• Conclusion and Summary of Unit</li> </ul>

<b>4.</b>	<b>Storage Management</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Memory Management: Logical and physical Address Space, Swapping, Contiguous Memory Allocation, Paging, Segmentation with Paging.</li> <li>• Virtual Management: Demand paging, Process creation, Page Replacement Algorithms, Allocation of Frames, Thrashing, Operating System Examples, Page size and other considerations, Demand segmentation</li> <li>• File-System Interface: File concept, Access Methods, Directory structure, File-system Mounting, File sharing, Protection and consistency semantics.</li> <li>• File-System Implementation: File-System structure, File-System Implementations, Directory Implementation, Allocation Methods, Free-space Management, Efficiency and Performance Recovery.</li> <li>• Disk Management: Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management, Disk Attachment, stable-storage Implementation</li> <li>• Conclusion and Summary of Unit</li> </ul>
<b>5.</b>	<b>Protection and Security</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Protection: Goals of Protection, Domain of Protection, Access Matrix, Implementation of Access Matrix, Revocation of Access Rights, Capability- Based Systems, Language – Based Protection</li> <li>• Security: Security Problem, User Authentication, One– Time Password, Program Threats, System Threats, Cryptography, Computer – Security Classifications</li> <li>• Conclusion and Summary of Unit</li> </ul>

**C. RECOMMENDED STUDY MATERIAL:**

Sr.No	Reference Book	Author	Edition	Publication
1.	Operating System Concepts and Design	Milan Milonkovic	Latest	II Edition, McGraw Hill 1992.
2.	Operation System Concepts	Tanenbaum	Latest	2 nd Edition, Pearson Education
3.	Operating System	Silberschatz /Galvin/Gagne	Latest	6th Edition, WSE(WILEY P ublication)
4.	Operating System	William Stallings	Latest	4 th Edition, Pearson Education.

**COURSE OUTCOMES:**

Students will be able to:

CO1: Develop the ability to identify difficult sounds, words and phrases to strengthen listening and applying these improved skills in spoken communication.

CO2: Cultivating knack for reading and writing by understanding the nuances of sentence structure and presentation style.

CO3: Understand negotiation and Identify steps for proper negotiation preparation & learn bargaining techniques and strategies of inventing options for mutual gain and move negotiations from bargaining to closing.

CO4: Develop a heightened awareness of the potential of digital communication and apply their knowledge in creating documents considering the needs of the netizens.

CO5: Propose their outlook through exposure to new and different experiences and ideas and enrich their understanding of the issues under discussion.

**A. OUTLINE OF THE COURSE**

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

**B. DETAILED SYLLABUS**

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

**CODE: BSACCE4201**

**COMPUTER HARDWARE AND  
TROUBLESHOOTING LABORATORY**

**1 Credit {0-0-2}**

**COURSE OUTCOMES:** Students will be able to:

CO1: understand the components on the motherboard.

CO2: perform system administration tasks.

CO3: understand different storage media and manage network connection.

CO4: install, upgrade and configure operating system.

CO5: understand system related problems and methods of troubleshooting.

**LIST OF EXPERIMENTS:**

1.	Study and identification of standard desktop personal computer.
2.	Understanding of Motherboard and its interfacing components
3.	Install and configure computer drivers and system components.
4.	Disk formatting, partitioning and Disk operating system commands
5.	Install,upgrade and configure Windows operating systems.
6.	Remote desktop connections and file sharing.
7.	Identify, install and manage network connections Configuring IP address and Domain name system
8.	Install, upgrade and configure Linux operating systems.
9.	Installation Antivirus and configure the antivirus.
10.	Installation of printer and scanner software.
11.	Disassembly and Reassembly of hardware.
12.	Troubleshooting and Managing System.

**COURSE OUTCOMES:**

Students will be able to:

CO1: Identify literature for review and research methods.

CO2: Apply knowledge and understanding in relation to the agreed area of study.

CO3: Communicate in written form by integrating, analyzing and applying key texts and practices.

CO4: Develop responses on the basis of the evaluation and analysis undertake.

CO5: Demonstrate advanced critical research skills in relation to career development or work-related learning studies.

**A. OUTLINE OF THE COURSE**

1	Dissertation consist of finalization of thesis based on literature review carried out during semester break of third year.
2	Objective finalization & presentation
3	Design & experimentation/survey details
4	Thesis preparation and submission
5	Final presentation



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

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

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

**COURSE OUTCOMES:** Student will be able to:

CO1: Point out the basic terms of the nucleus, Rutherford scattering and Rutherford's scattering formula.

CO2: Apply the basic mechanism of nuclear fusion and fission.

CO3: Classify the classification of elementary particles.

CO4: Understand the need for accelerators and different types of accelerators.

CO5: Compare the different types of nuclear radiation detectors.

### A. OUTLINE OF THE COURSE

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

### B. DETAILED SYLLABUS

Unit	Unit Details
1.	<b>Structure of Nuclei</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Basic Properties of Nuclei: (1) Mass, (2) Radii, (3) Charge, (4) Angular Momentum, (5) Spin, (5) Magnetic Moment (<math>\mu</math>), (6) Stability</li> <li>• Rutherford scattering and Rutherford's scattering formula</li> <li>• Constituents of nucleus</li> <li>• Magnetic dipole moment of nuclei</li> <li>• Basic idea about quadruple moment of nucleus</li> <li>• Nuclear spin and parity</li> <li>• Orbital angular momentum</li> <li>• Nuclear mass, Mass Defect and Binding energy</li> <li>• Theory of Nuclear forces.</li> <li>• Packing fraction and binding energy of nucleus</li> <li>• Liquid drop model of nucleus</li> <li>• Semi-empirical mass formula (Volume, Surface, Coulomb, Asymmetry and Pairing energy terms)</li> <li>• Conclusion &amp; real life application</li> </ul>
2.	<b>Nuclear Fission and Fusion</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• The Discovery of Nuclear Fission</li> <li>• The Energy Release in Fission</li> <li>• Fission cross Section and threshold, Neutron emission in fission</li> </ul>

	<ul style="list-style-type: none"> <li>• The prompt neutron and delayed neutrons</li> <li>• Mechanism for the emission of delayed neutrons</li> <li>• Energy of fission Neutrons</li> <li>• Barrier Penetration-Theory of Spontaneous fission</li> <li>• Nuclear Energy Sources</li> <li>• Nuclear Fission as a source of Energy</li> <li>• The Nuclear Chain Reaction</li> <li>• Condition of controlled chain Reaction, Nuclear Reactors</li> <li>• Energy release in fusion</li> <li>• Fusion reactions in stars: carbon and pp cycle.</li> <li>• Conclusion &amp; real life application</li> </ul>
<b>3.</b>	<b>Particle Physics</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Classification of elementary particles</li> <li>• Properties of particles.</li> <li>• Fundamental interactions,</li> <li>• <b>Conservation laws</b> : Energy ,momentum, angular momentum, charge, lepton number, Baryon number, isospin, strangeness, Invariance under charge, parity, C.P., time and C.P.T.,(Qualitative discussion).</li> <li>• <b>Cosmic rays:</b> Properties of cosmic rays ,properties of secondary radiation, electronic showers ,geomagnetic effects, cosmic ray stars, the origin of cosmic rays</li> <li>• Conclusion &amp; real life application</li> </ul>
<b>4.</b>	<b>A Accelerators</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Need for accelerators</li> <li>• Ion sources, Van De graff generator</li> <li>• Drift tube</li> <li>• Linear accelerator</li> <li>• Wave guide accelerator</li> <li>• Cyclotron ,synchrocyclotron</li> <li>• Electron synchrotron, Proton synchrotron</li> <li>• Conclusion &amp; real life application</li> </ul>
<b>5.</b>	<b>Radiation Detectors</b>
	<ul style="list-style-type: none"> <li>• Introduction of various methods used in detection of nuclear radiation</li> <li>• Principle and working of (i) Ionization chamber (ii) Proportional counter (iii) Geiger- Muller counter; Dead time, Recovery time and paralysis time</li> <li>• Scintillation counter</li> <li>• Cloud chamber</li> <li>• Bubble chamber</li> <li>• Spark chamber</li> <li>• Solid state detectors</li> <li>• Basic components of mass spectroscope</li> <li>• Conclusion &amp; real life application</li> </ul>

### C. RECOMMENDED STUDY MATERIAL:

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

**Code: BSACSAS5102 ATOMIC AND MOLECULAR SPECTROSCOPY 3.0 Credits [LTP: 3-0-0]**

**COURSE OUTCOMES:** Student will be able to:

CO1: Review the basic theory of atomic and molecular spectra.

CO2: Role-play the concept of vector model of atom and Stern Gerlach experiment. CO3:

Learn and realize the effect of magnetic and electric field on spectral lines.

CO4: Point out the theory of energy levels, molecular distance, Raman Effect and its characteristics. CO5:

Judge the origin and characteristics of X-rays.

### A. OUTLINE OF THE COURSE

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

### B. DETAILED SYLLABUS

Unit	Unit Details
1.	<b>Bohr's Theory of Spectra</b>
	<ul style="list-style-type: none"> <li>• Introduction to the Unit</li> <li>• Bohr's theory of spectra of hydrogen like atoms</li> <li>• Origin of spectral series</li> <li>• Ritz combination rule</li> <li>• Effect of finite mass of the nucleus on the spectrum</li> <li>• Bohr's correspondence principle</li> <li>• Wilson-Sommerfield's quantum condition</li> <li>• Sommerfield's theory of elliptic orbit (qualitative idea)</li> <li>• Relativistic correction</li> <li>• Frank and Hertz principle</li> <li>• Limitations of Bohr's theory</li> <li>• Conclusion &amp; real life application</li> </ul>
2.	<b>Vector Model of Atom and Stern-Gerlach Experiment</b>
	<ul style="list-style-type: none"> <li>• Introduction to the Unit</li> <li>• Angular momentum of electron</li> <li>• Stern-Gerlach experiment and its consequence</li> <li>• Space quantization</li> <li>• Spin orbit interaction energy</li> <li>• Total angular momentum</li> <li>• Coupling schemes</li> <li>• Fine structure of a spectral line</li> <li>• Selection rules, Spectral term and their notations</li> <li>• Conclusion &amp; real life application</li> </ul>
3.	<b>Effect of Magnetic and Electric Field on Spectral Lines</b>
	<ul style="list-style-type: none"> <li>• Introduction to the Unit</li> <li>• Angular momentum and magnetic moment</li> </ul>

	<ul style="list-style-type: none"> <li>• Zeeman Effect: Normal Zeeman effect and its selection rules</li> <li>• Anomalous Zeeman effect and its selection rules</li> <li>• Paschen back effect and selection rules</li> <li>• Stark effect: Linear Stark effect</li> <li>• Conclusion &amp; real life application</li> </ul>
<b>4.</b>	<b>Molecular Spectra</b>
	<ul style="list-style-type: none"> <li>• Introduction to the Unit</li> <li>• Rotational Energy levels</li> <li>• Selection Rules and Pure Rotational Spectra of a Molecule</li> <li>• Vibrational Energy Levels</li> <li>• Selection Rules and Vibration Spectra</li> <li>• Rotation- Vibration Energy Levels</li> <li>• Selection Rules and Rotation-Vibration Spectra</li> <li>• Determination of Internuclear Distance</li> <li>• Quantum Theory of Raman Effect</li> <li>• Characteristics of Raman Lines. Stoke's and Anti-Stoke's Lines</li> <li>• Complimentary Character of Raman and infrared Spectra</li> <li>• Conclusion &amp; real life application</li> </ul>
<b>5.</b>	<b>X-rays</b>
	<ul style="list-style-type: none"> <li>• Introduction to the Unit</li> <li>• Origin of continuous and characteristic X-Rays</li> <li>• Absorption and emission spectrum</li> <li>• Energy levels and Moseley's law</li> <li>• Fine structure of X-ray levels</li> <li>• Auger effect</li> <li>• Comparison of optical and X-ray spectra</li> <li>• Classification of molecular spectra,</li> <li>• Rotational spectra and Rotational-Vibrational spectra and selection rules</li> <li>• Conclusion &amp; real life application</li> </ul>

**C. RECOMMENDED STUDY MATERIAL:**

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

**COURSE OUTCOMES:** Student will be able to:

CO1: Familiarize basic concepts of structure elucidation of organic compounds using UV, IR and NMR spectroscopy.

CO2: Demonstrate comprehensive knowledge about Nuclear Magnetic Resonance spectroscopy and PMR spectra of organic compounds.

CO3: Apply mechanism of action of heterocyclic compounds in pharmaceuticals/drugs.

CO4: Categories carbohydrates and structure determination of carbohydrates with conversion.

CO5: Explain the chemical nature of Amino Acids, Peptides and Proteins.

#### A. OUTLINE OF THE COURSE

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

#### B. DETAILED SYLLABUS

Unit	Unit Details
1	<b>Electromagnetic Spectrum</b>
	<ul style="list-style-type: none"> <li>• Introduction to the Unit</li> <li>• <b>Electromagnetic Radiation</b></li> <li>• Origin of organic spectra, Types of energy changes, Types of molecular spectra, General instrumentation, absorbance and transmittance, line width.</li> <li>• <b>Ultraviolet Absorption Spectroscopy</b>- absorption laws (Beer-Lambert Law) molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions,</li> <li>• Effect of solvents on transitions, effect of conjugation, concept of chromophore and auxochrome, bathochromic, hypsochromic and hyperchromic and hypochromic shifts</li> <li>• UV spectra of conjugated enes and enones.</li> <li>• <b>Infrared Absorption Spectroscopy</b> – Theory-Absorption of infra radiation Molecular vibrations, Hookes law, selection rules, intensity and position of IR bands measurement of IR spectrum, finger print region, characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds.</li> <li>• Conclusion &amp; real life application.</li> </ul>
2	<b>Nuclear Magnetic Resonance (NMR) spectroscopy</b>
	<ul style="list-style-type: none"> <li>• Introduction to the Unit.</li> <li>• <b>Nuclear Magnetic Resonance (NMR) spectroscopy:</b> Principles of NMR spectroscopy, Larmor precession, chemical shift and low resolution spectra different scales, spin-spin coupling and high resolution spectra, interpretation of PMR spectra of organic molecules</li> </ul>

	<ul style="list-style-type: none"> <li>Proton magnetic resonance (<math>^1\text{H-NMR}</math>) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals. Interpretation of NMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromoethane, ethyl acetate, toluene and acetophenone.</li> <li>Conclusion &amp; real life application</li> </ul>
<b>3</b>	<b>Heterocyclic Compounds</b>
	<ul style="list-style-type: none"> <li>Introduction to the Unit.</li> <li><b>Heterocyclic Compounds</b> : Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine</li> <li>Methods of synthesis and chemical reactions, with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives.</li> <li>Comparison of basicity of pyridine, piperidine and pyrrole</li> <li>Introduction to condensed five and six-membered heterocyclic compounds</li> <li>Preparation and reactions of indole, quauinoline and isoquinoline</li> <li>Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline</li> <li>Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fisher-indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis.</li> <li>Conclusion &amp; real life application.</li> </ul>
<b>4</b>	<b>Carbohydrates</b>
	<ul style="list-style-type: none"> <li>Introduction to the Unit</li> <li><b>Carbohydrates</b>: Classification, and General Properties</li> <li>Glucose and Fructose (open chain and cyclic structure)</li> <li>Determination of configuration of monosaccharides, absolute configuration of Glucose and Fructose, Mutarotation, ascending and descending in monosaccharides</li> <li>Structure of disacharrides (sucrose, cellobiose, maltose, lactose) and polysaccharides (starch and cellulose) excluding their structure elucidation</li> <li>Mechanism of osazone formation. Epimers, anomers. Interconversion of glucose and fructose, chain lengthening and chain, shortening of aldoses. Erythro and threodiastereomers. Conversion of glucose into mannose.. Determination of ring size of monosaccharides. Formation of glycosides, ethers and esters. Cyclic structure of D (+)-glucose and fructose. Structures of ribose and deoxyribose.</li> <li>Conclusion &amp; real life application.</li> </ul>
<b>5</b>	<b>Amino Acids, Peptides and Proteins</b>
	<ul style="list-style-type: none"> <li>Introduction to the Unit</li> <li><b>Amino Acids: Preparation</b> by Strecker synthesis using Gabriel's phthalimide synthesis. Zwitterion, Isoelectric point and Electrophoresis</li> <li>Reactions of Amino acids: ester of <math>-\text{COOH}</math> group, acetylation of <math>-\text{NH}_2</math> group, complexation with <math>\text{Cu}^{2+}</math> ions, ninhydrin test</li> <li>Overview of Primary, Secondary, Tertiary and Quaternary Structure of proteins.</li> </ul>



- Determination of Primary structure of Peptides by degradation- Edmann degradation (N terminal and C terminal ) thiohydantoin and with carboxy peptidase enzyme
- Synthesis of simple peptides (upto dipeptides) by N-protection (t- butyloxycarbonyl and phthaloyl) & C activating groups and Merrifield solid-phase synthesis
- Amino Acids, Peptides, Proteins and its classification, structure and stereochemistry of amino acids. acid-basebehaviour, isoelectric point and electrophoresis. Preparation and reactions of alpha-amino acids.
- Nucleic acids — Introduction, constituents of nucleic acids - nucleosides and nucleotides
- Conclusion & real life application.

### C. RECOMMENDED STUDY MATERIAL:

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

**COURSE OUTCOMES:** Students will be able to:

CO1: Develop mathematical arguments for Linear Programming.

CO2: Evaluate Linear Programming problem using simplex method.

CO3: Analyze the Linear Programming problem using two Phase method, Duality and Transportation Problem, Modified distribution method for finding the optimum solution.

CO4: Analyze the Assignment Problem, Crew assignment and travelling salesman problem.

CO5: Solve the problems of competitive situations between two competitors using Game theory.

### A OUTLINE OF THE COURSE

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

### B DETAILED SYLLABUS

Unit	Unit details
1	<b>Linear Programming</b>
	<ul style="list-style-type: none"> <li>• Introduction to Unit</li> <li>• Concept of optimization,</li> <li>• Linear Programming: Introduction, Formulation of a Linear Programming Problem (LPP),</li> <li>• Requirements for an LPP, Advantages and limitations of LP.</li> <li>• Graphical solution, Multiple, unbounded and infeasible solutions.</li> <li>• Conclusion &amp; real life application</li> </ul>
2	<b>Simplex Method</b>
	<ul style="list-style-type: none"> <li>• Introduction to Unit</li> <li>• Principle of simplex method: standard form, basic solution, basic feasible solution.</li> <li>• Computational Aspect of Simplex Method: Cases of unique feasible solution, no feasible solution,</li> <li>• Multiple solution and unbounded solution and degeneracy</li> <li>• Two Phase method, Duality in LPP, primal-dual relationship</li> <li>• Conclusion &amp; real life application</li> </ul>
3	<b>Transportation Problem</b>
	<ul style="list-style-type: none"> <li>• Introduction to Unit</li> <li>• Transportation Problem: Methods for finding basic feasible solution of a transportation problem</li> <li>• Modified distribution method for finding the optimum solution</li> <li>• Unbalanced and degenerate transportation problems</li> </ul>

	<ul style="list-style-type: none"> <li>• Conclusion &amp; real life application</li> </ul>
<b>4</b>	<b>Assignment Problem</b>
	<ul style="list-style-type: none"> <li>• Introduction to Unit</li> <li>• Assignment Problem: Solution by Hungarian method,</li> <li>• Unbalanced assignment problem, maximization in an assignment problem,</li> <li>• travelling salesman problem.</li> <li>• Conclusion &amp; real life application</li> </ul>
<b>5</b>	<b>Game Theory</b>
	<ul style="list-style-type: none"> <li>• Introduction to Unit</li> <li>• Game Theory: Two Person zero sum game</li> <li>• Game with saddle points, the rule of dominance</li> <li>• Algebraic, graphical and linear programming methods for solving mixed strategy games</li> <li>• Conclusion &amp; real life application</li> </ul>

### C RECOMMENDED STUDY MATERIAL:

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

**COURSE OUTCOMES:** Students will be able to:

CO1: Understand chemical and molecular processes that take place in organic chemical reactions in synthesis.

CO2: Explain the principles of the chromatographic techniques.

CO3: Acquire the ability to understand, explain and use instrumental techniques for chemical analysis

CO4: Prepare water quality assessment report

CO5: Apply subject knowledge and skill to solve complex problems with defined solutions

**LIST OF EXPERIMENTS:**

1	Synthesis of p bromoacetalide
2	Synthesis of p-nitroacetalide
3	Benzoylation of Aniline
4	Paper chromatographic separation of compounds in Spinach plant
5	To separate a mixture of sugar by paper chromatography
6	Synthesis of Aspirin
<b>Physical Chemistry</b>	
7	To determine the heat of neutralization for strong acid and strong base
8	Potentiometric measurements-Strong acid with strong base.
9	To study the saponification of ethyl acetate conductmetrically
10	Study the variation of surface tension with different concentration of detergent solutions. Determine CMC.
11	To separate mixture of organic compounds by solvent extraction.
12	Determination of conductivity, molar conductivity, degree of dissociation and dissociation constant of a weak acid.

**COURSE OUTCOMES:**

Students will be able to:

CO1: Learn the concept of RC and LC transmission lines at various frequencies. CO2:

Learn the concept of inverse square law and characteristics of GM counter CO3: Learn the concept of Planck's and Stefan's constant using solar and photo cell

CO4: Learn the concept of LCR meter and determine the velocity of sound by standing wave method

CO5: Learn the concept of the magnetic susceptibility of solids and Hall coefficients of semiconductor

**LIST OF EXPERIMENTS:**

1.	Study of a R-C transmission line at 50 Hz.
2.	Study of a L-C transmission line (i) at fixed frequency (ii) at variable frequency.
3.	Study the characteristics of a GM counter and verification of inverse square law for the same strength of a radioactive source.
4.	Study of $\beta$ - absorption in Al foil using GM counter.
5.	Determination of Planck constant using solar cell.
6.	Determination of Stefan's constant using photocell.
7.	Determination of e/m by helical method.
8.	Determination of velocity of sound in air by standing wave method using speaker, microphone and CRO.
9.	Study of electromagnetic damping in LCR circuit using metal plate.
10.	Study the Iodine spectrum with the help of grating, spectrometer and ordinary bulb.
11.	To measure the Magnetic susceptibility of Solids.
12.	To determine the Hall coefficient of a semiconductor sample.

**COURSE OUTCOMES:** Students will be able to:

CO1: Fundamental definitions of sets, Axioms, Real number, complete ordered field, Interval, Neighborhood of a point.

CO2: Explain the Boundedness, supremum, Infimum of sequence, various types of sequence, limits, Cauchy's theorem.

CO3: Evaluate the limits & Continuity of functions, Heine's definition of continuity, Types of Discontinuity, Boundedness theorem, Intermediate Value theorem.

CO4: Analyze the derivative, Darboux's Theorem, Rolles's Theorem, Lagranges mean value theorem, Cauchy mean value theorem, Taylor's Theorem, Maclaurin's theorem.

CO5: Evaluate the upper and Lower Darboux sums, Riemann Integral, Properties of R-Integrable function, Mean value theorem of Integral Calculus, Fundamental theorem of Integral Calculus.

#### A OUTLINE OF THE COURSE

		(Hours)
1	Real Field	9
2	Real Sequences	6
3	Limit and Continuity of Function	6
4	Mean value theorem	8
5	Riemann Integration	7

#### B DETAILED SYLLABUS

Unit	Unit details
1	<b>Real Field</b>
	<ul style="list-style-type: none"> <li>• Introduction to the Unit</li> <li>• Introduction-ordered sets, The Field Axioms, Order axioms</li> <li>• Completeness axioms, Real number as a complete ordered field</li> <li>• Interval, neighborhood of a point</li> <li>• Heine Borel Theorem</li> <li>• Conclusion &amp; real life application</li> </ul>
2	<b>Real Sequences</b>
	<ul style="list-style-type: none"> <li>• Introduction to the Unit</li> <li>• Boundedness, supremum, Infimum of sequence, Limit of sequence, Convergent sequences</li> <li>• Divergent sequence, Theorems on convergent sequence and limits</li> <li>• Cauchy's first theorem on limits, Subsequences, Cauchy sequence, Cauchy's general principle</li> <li>• Cauchy Convergence test, Ratio Comparison test, Hyperharmonic series test, Raabe's Test, Logarithmic ratio test, De Morgan's test</li> <li>• Conclusion &amp; real life application</li> </ul>
3	<b>Limit and Continuity of Function</b>
	<ul style="list-style-type: none"> <li>• Introduction to the Unit</li> <li>• Limits of functions, Continuity</li> <li>• Heine's definition of continuity, Discontinuity</li> </ul>

	<ul style="list-style-type: none"> <li>• Types of Discontinuity</li> <li>• Intermediate Value theorem, Uniform continuity</li> <li>• Conclusion &amp; real life application</li> </ul>
<b>4</b>	<b>Mean value theorem</b>
	<ul style="list-style-type: none"> <li>• Introduction to the Unit</li> <li>• Derivative, necessary condition, Properties of derivatives</li> <li>• Darboux's Theorem, Rolles's Theorem</li> <li>• Lagranges mean value theorem, Cauchy mean value theorem</li> <li>• Taylor's Theorem, Maclaurin's theorem</li> <li>• Conclusion &amp; real life application</li> </ul>
<b>5</b>	<b>Riemann Integration</b>
	<ul style="list-style-type: none"> <li>• Introduction to the Unit</li> <li>• Upper and Lower Darboux sums, Upper and Lower Riemann Integral</li> <li>• Necessary and sufficiency condition of R- Integrability, Properties of R- Integrable function</li> <li>• Conclusion &amp; real life application</li> </ul>

#### C RECOMMENDED STUDY MATERIAL:

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

**Code: BSAESA5102****Data Structure****3 Credit [LTP: 3-0-0]****COURSE OUTCOMES:** Students will be able to:

- CO1** Define the concepts of array, Linked List and Interpreting their applications.  
**CO2** Apply the concepts of Trees with the help of example.  
**CO3** Differentiate between the sorting and has thing with their applications  
**CO4** Analyze the role of algorithms in computing with example.  
**CO5** Apply the Elementary Graph Algorithms with example in real problems.

**A. OUTLINE OF THE COURSE**

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction And Basic Data Structures	7
2.	Advanced Data structures	9
3.	Sorting And hashing	10
4.	Algorithm design techniques	9
5.	Graphs algorithms	9

**B. DETAILED SYLLABUS**

Unit	Unit Details
<b>1.</b>	<b>Introduction And Basic Data Structures</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Problem solving techniques and examples</li> <li>• Abstract Data Type (ADT)-The list ADT Arrays- Stacks and Queues: Implementation and Application, Circular Queues.</li> <li>• Conclusion and Summary of Unit</li> </ul>
<b>2.</b>	<b>Advanced Data structures</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Trees: Preliminaries-Binary Tree- Tree traversals-Binary search Trees-AVL Trees.</li> <li>• Conclusion and Summary of Unit</li> </ul>
<b>3.</b>	<b>Sorting And hashing</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Sorting by Selection- Sorting by Insertion- Sorting by Exchange- Sorting by Diminishing Increment-Heap</li> <li>• Sort- Heaps Maintaining the Heap Property-Building a Heap- Heap sort Algorithm-Quick sort-</li> <li>• Description-Performance of quick sort-Analysis of Quick Sort. Hashing - General idea-Hash functions-</li> <li>• Separate Chaining-Open Addressing-Rehashing-Extendible Hashing.</li> <li>• Conclusion and Summary of Unit</li> </ul>
<b>4.</b>	<b>Algorithm design techniques</b>



	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• The role of algorithms in computing-Getting Started-Growth of functions. Divide and conquer dynamic</li> <li>• programming-Greedy Algorithm –Backtracking</li> <li>• Conclusion and Summary of Unit</li> </ul>
<b>5.</b>	<b>Graphs algorithms</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Elementary Graph Algorithms-Minimum Spanning Trees-Single-source shortest paths-</li> <li>• All pairs shortest paths.</li> <li>• Conclusion and Summary of Unit</li> </ul>

### C. RECOMMENDED STUDYMATERIAL:

Sr. No	Reference Book	Author	Edition	Publication
1	Havowitz & Sawhni	Data structures in C & C++	2nd	BPB Publication
2	Data structures in Pascal	Havowitz &Sawn	2nd	BPB Publication
3	Data structures in C	Tannenbaum	3rd	PHI
4	Data Structures and Algorithms	PAI	3rd	TMH
5	Introduction to Data Structures with Applications	TREMBLAY	2nd	TMH

**COURSE OUTCOMES:** Students will be able to:

CO1: Compare the professional and personal approach towards any task and demonstrate their understanding by displaying professional attitude in the assigned tasks.

CO2: Recognize, explain, and use the formal elements of specific genres of organizational communication: reports, proposals, memorandums, web pages, wikis, blogs, business letters, and promotional documents etc..

CO3: Prepare and deliver a clear and fluent demonstrative, informative, and persuasive presentation and enlarge their vocabulary by keeping a vocabulary journal.

CO4: Demonstrate preparedness for any type of interview from classic one-on-one interview to panel interviews, Phone/Skype interviews, Behavioral/Situational etc. along with sharpening the ability to critically analyze a given piece of information and collectively work in a group to arrive at a solution or develop a perspective.

CO5: Understand negotiation and time management to identify steps for proper negotiation preparation & learn bargaining techniques and strategies of inventing options for mutual gain and move negotiations from bargaining to closing.

#### A. OUTLINE OF THE COURSE

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

#### B. DETAILED SYLLABUS

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

**COURSE OUTCOMES:** Students will be able to:

CO1: Develop advanced and lifelong learning skills.

CO2: Extend the boundaries of knowledge through research and development.

CO3: Write formatted report for explaining the work during industrial training and describing the experience.

CO4: Understand basis of professional practice, administrative functions and company culture.

CO5: Develop greater clarity about academic & career goals and explore options in career plans.

**A. OUTLINE OF THE COURSE**

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

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

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

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

**COURSE OUTCOMES:** Students will be able to:

CO1: Apply the basic concepts of Quantum Mechanics and Heisenberg uncertainty principle.

CO2: Point out the mechanism and importance of Schrodinger equation in Quantum Mechanics.

CO3: Role-plays of Operators in Quantum Mechanics and their Applications

CO4: Compare the theory of potential barrier and apply this in the decay of alpha particle from the nucleus.

CO5: Solve the concept of simple harmonic oscillator at atomic level.

### A. OUTLINE OF THE COURSE

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

### B. DETAILED SYLLABUS

Un	Unit Details
1.	<b>Development of Quantum Mechanics</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Black body radiation spectrum</li> <li>• Classical theory and its failure</li> <li>• Planck quantum hypothesis</li> <li>• Matter Waves: De Broglie hypothesis</li> <li>• Wave packet, Phase velocity and group velocity</li> <li>• Davison Germer experiment.</li> <li>• Heisenberg Uncertainty Principal and its application such as (i) Non existence of electron in nucleus, (ii) Ground state energy of H-atom, (iii) Ground state energy of harmonic oscillator (iv) Natural width of spectral line</li> <li>• Compton effect</li> <li>• Conclusion of the Unit</li> </ul>
2.	<b>Schrodinger Equations</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Wave function and its interpretation,</li> <li>• Schrödinger time dependent and time independent one-dimensional equation,</li> <li>• Three-dimensional Schrödinger wave equation,</li> <li>• Probability current density,</li> <li>• Physical meaning of <math>\psi</math>,</li> <li>• Conditions to be satisfied by <math>\psi</math>.</li> </ul>

	<ul style="list-style-type: none"> <li>• particle in one dimensional box</li> <li>• Eigen function and eigen values</li> <li>• Discrete energy levels</li> <li>• Extension of results for three dimensional case and degeneracy of level.</li> <li>• Conclusion of the Unit</li> </ul>
<b>3.</b>	<b>Operators in Quantum Mechanics and their Applications</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Definition of operator in quantum mechanics</li> <li>• Eigen function</li> <li>• Eigen value and Eigen value equation</li> <li>• Hermitian operator</li> <li>• Parity operator</li> <li>• Exchange operator</li> <li>• Expected value</li> <li>• Normalization of wave function</li> <li>• Orthogonality of wave function</li> <li>• Stationary states</li> <li>• Commutation relations</li> <li>• Ehrenfest's theorem</li> <li>• Bohr's principle of complementarity</li> <li>• principle of superposition</li> <li>• Conclusion of the Unit</li> </ul>
<b>4.</b>	<b>Bound State Problems</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Potential step</li> <li>• Rectangular potential barrier</li> <li>• Calculation of reflection and transmission coefficient</li> <li>• Qualitative discussion of the application to alpha decay (tunnel effect)</li> <li>• square well potential problem,</li> <li>• calculation of transmission coefficient</li> <li>• Resonant scattering</li> <li>• Conclusion of the Unit</li> </ul>
<b>5.</b>	<b>Simple Harmonic Oscillator (1-D Case)</b>
	<ul style="list-style-type: none"> <li>• Introduction of the Unit</li> <li>• Schrödinger equation and its solutions,</li> <li>• Eigen function,</li> <li>• Energy eigen values.</li> <li>• Zero point energy,</li> <li>• Parity,</li> <li>• Symmetric and anti-symmetric wave functions with graphical representation.</li> <li>• <b>Rigid rotator:</b> Schrodinger equation and its solution.</li> <li>• Conclusion of the Unit</li> </ul>

### C. RECOMMENDED STUDY MATERIAL:

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

**COURSE OUTCOMES:** Students will be able to:

CO1: Evaluate photochemical and photophysical processes using Jablonski diagram and their quantum yield expressions.

CO2: Rationalize the selection rules in rotational and vibrational spectra.

CO3: Describe the fundamental concepts of electrochemistry and relate the conductivity of an electrolyte with its concentration.

CO4: Outline the mechanisms of unimolecular and bimolecular reactions at surfaces using Gibbs, Freundlich and Langmuir isotherm.

CO5: Differentiate between classical and quantum mechanics and solve the Schrodinger equation to obtain wave functions for some basic, physically important types of potential in one dimension, and estimate the shape of the wave function.

#### A. OUTLINE OF THE COURSE

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

#### B. DETAILED SYLLABUS

Unit	Unit Details
1.	<b>Photochemistry</b>
	<ul style="list-style-type: none"> <li>• Introduction to the Unit.</li> <li>• <b>Photochemistry:</b> Interaction of radiation with matter, difference between thermal and photochemical processes.</li> <li>• Laws of photochemistry: Grothus-Drapper law, Stark-Einstien law</li> <li>• Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non radiative process ( internal conversion, inter system crossing ) quantum yield, photosensitized reaction-energy transfer process (simple examples)</li> <li>• Conclusion &amp; real life application</li> </ul>
2.	<b>Spectroscopy</b>
	<ul style="list-style-type: none"> <li>• Introduction to the Unit.</li> <li>• <b>Spectroscopy I:</b> Electromagnetic radiation of the spectrum, basic features of different spectrometers, statement of the Born Oppenheimer approximation, degree of freedom.</li> <li>• Rotational spectrum: Diatomic molecules, Energy levels of rigid rotator, (semiclassical principles) selection rules, spectral intensity, distribution using</li> </ul>



	<p>population distribution (Maxwell Boltzmann distribution ), determination of bond length, qualitative description of non-rigid rotator, isotope effect.</p> <ul style="list-style-type: none"> <li>• Vibrational spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant, qualitative relations of force constants and bond energy, effect of anharmonic motion and isotopes on the spectrum, idea of vibrational frequencies of different functional groups.</li> <li>• Conclusion &amp; real life application</li> </ul>
<b>3.</b>	<b>Electrochemistry</b>
	<ul style="list-style-type: none"> <li>• Electrical transport- conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution.</li> <li>• Migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes. Ostwald dilution law its uses and limitations.</li> <li>• Debye Huckel– Onsager`s equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf method and moving boundary method.</li> <li>• Types of reversible electrodes, gas metal ion, metal-metal ion, metal insoluble salt-anion and redox electrodes.</li> <li>• Electrode reactions, Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode, reference electrodes, standard electrode potential, sign convention, electrochemical series and its significance.</li> <li>• EMF of a cell and its measurements. Computation of cells EMF. Calculation of thermodynamic quantities of cell reactions (<math>\Delta G</math>, <math>\Delta H</math> and <math>K</math>),</li> <li>• Conclusion &amp; real life application</li> </ul>
<b>4.</b>	<b>Adsorption</b>
	<ul style="list-style-type: none"> <li>• Introduction to the Unit.</li> <li>• <b>Adsorption:</b> Difference between adsorption, absorption and sorption, Chemisorption, adsorbent and adsorbate, reversible and irreversible adsorption,</li> <li>• Characteristics of adsorption ,adsorption of gases by solids, factors affecting adsorption, types of adsorption</li> <li>• Types of adsorption isotherms;Freundlich and Langmuir adsorption isotherms, Adsorption Techniques, Some important adsorbents used in industries, Application of adsorption.</li> <li>• Conclusion &amp; real life application</li> </ul>
<b>5.</b>	<b>Quantum Mechanics</b>
	<ul style="list-style-type: none"> <li>• Introduction to the Unit</li> <li>• <b>Quantum Mechanics I:</b> Black body radiation, Planck`s radiation law, photoelectric effect, heat capacity of solids, Bohr`s model of hydrogen atom (no derivation) and its defects.</li> <li>• Compton Effect. De Broglie hypothesis, Heisenberg`s uncertainty principle, Sinusoidal wave equation, Hamiltonian operator, Schrodinger wave equation and its</li> </ul>

importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box.

- Schrodinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave functions.
- Conclusion & real life application

### C. RECOMMENDED STUDY MATERIAL:

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

**COURSE OUTCOMES:** Students will be able to:

CO1: Investigate complex functions, concept of limit, continuity and differentiability of complex functions.

CO2: Evaluate the analytic functions using Cauchy-Riemann equations (Cartesian and polar form), sufficient conditions for differentiability, Harmonic Function.

CO3: Evaluate the Complex integration by using Cauchy integral formula, Cauchy theorem and Liouville's theorem

CO4: Analyze the Taylor's Theorem, Laurent's theorem, Power series, Taylor series, Laurent series, Absolute convergence, Abel's theorem, Circle and radius of Convergence.

CO5: Explain the conformal mapping. Bilinear transformation and its properties.

#### A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	Continuity and Differentiability	9
2	Analytic Functions	6
3	Complex Integration	6
4	Taylor's and Laurent's Theorem	8
5	Residues Integration	7

#### B. DETAILED SYLLABUS

Unit	Unit details
1	<p><b>Continuity and Differentiability</b></p> <ul style="list-style-type: none"> <li>• Introduction to the Unit</li> <li>• Complex plane, Connected and Compact sets, Curves and regions in complex plane,</li> <li>• Jordan Curve theorem (Statement only), Complex valued function,</li> <li>• Limits, Limits involving the point at infinity, continuity and differentiability</li> <li>• Conclusion &amp; real life application</li> </ul>
2	<p><b>Analytic Functions</b></p> <ul style="list-style-type: none"> <li>• Introduction to the Unit</li> <li>• Analytic functions, Cauchy-Riemann equations (Cartesian And polar form),</li> <li>• Sufficient conditions for differentiability,</li> <li>• Harmonic Function,</li> <li>• Construction of an analytic function.</li> <li>• Conclusion &amp; real life application</li> </ul>
3	<p><b>Complex Integration</b></p> <ul style="list-style-type: none"> <li>• Introduction to the Unit</li> <li>• Complex integration, Complex line integral,</li> <li>• Cauchy integral theorem,</li> <li>• fundamental theorem of integral calculus for complex functions,</li> <li>• Cauchy integral formula, Liouville's theorem</li> </ul>

	<ul style="list-style-type: none"> <li>• Conclusion &amp; real life application</li> </ul>
<b>4</b>	<b>Taylor's and Laurent's Theorem</b>
	<ul style="list-style-type: none"> <li>• Introduction to the Unit</li> <li>• Taylor's Theorem, Laurent's theorem,</li> <li>• Power series, Taylor series, Laurent series,</li> <li>• Absolute convergence, Abel's theorem, Circle and radius of Convergence,</li> <li>• Conclusion &amp; real life application</li> </ul>
<b>5</b>	<b>Residues Integration</b>
	<ul style="list-style-type: none"> <li>• Introduction to the Unit</li> <li>• Residues theorem,</li> <li>• Singular point, Poles</li> <li>• Application of residues to evaluate real integral</li> <li>• Evaluation of real definite integral by contour integration (Simple problems only)</li> <li>• Conclusion &amp; real life application</li> </ul>

**C. RECOMMENDED STUDY MATERIAL:**

Sr.No	Reference Book	Author	Edition	Publication
1.	Complex Variables and Applications	James Ward Brown and Ruel V. Churchill,	8th Ed.	McGraw – Hill International Edition, 2009.
2.	Complex analysis,	Joseph Bak and Donald J. Newman	2nd Ed	Springer-Verlag New York,
3.	Complex Analysis	Purohit and Goyal	2016	Jaipur Publishing House

**COURSE OUTCOMES:**

Students will be able to:

CO1: Learn how to update and manage the experience, education, and skills & expertise sections on social media & formulate appropriate updates as a means to promote business activities.

CO2: Understand how to leverage grammar and formatting in formal documents & demonstrate how to follow the stages of the writing process

CO3: Evaluate presentation's weak spots and areas for improvement & learn, practice and acquire the skills necessary to deliver effective presentation with clarity and impact.

CO4: Evaluate basic factors such as personal skills & abilities, career fields, willingness to learn and strengthen the chances to get desirable jobs.

CO5: Understand negotiation and team skills dynamics and how to prepare for uncertainty & learn to craft agile strategy and be quick on your feet in changing circumstances.

**A. OUTLINE OF THE COURSE**

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

**LIST OF LABS**

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

**COURSE OUTCOMES:** Students will be able to:

CO1: Identify literature for review and research methods.

CO2: Apply knowledge and understanding in relation to the agreed area of study.

CO3: Communicate in written form by integrating, analysing and applying key texts and practices.

CO4: Develop responses on the basis of the evaluation and analysis undertake.

CO5: Demonstrate advanced critical research skills in relation to career development or work-related learning studies.

#### **A. OUTLINE OF THE COURSE**

1	Dissertation consist of finalization of thesis based on literature review carried out during semester break of third year.
2	Objective finalization & presentation
3	Design & experimentation/survey details
4	Thesis preparation and submission
5	Final presentation

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

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

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