

SCHEME OF EXAMINATION AND DETAILED SYLLABUS

Faculty of Science

**Bachelor of Science
(B.Sc.-Chemistry Hon's)**

(Duration-3 Years)

(For 2019 Batch)



Contact us:

 8252299990

 8404884433



AISECT University, Hazaribag

Matwari Chowk, in front of Gandhi Maidan, Hazaribag (JHARKHAND)-825301

BACHELOR OF SCIENCE (HONOURS)

Duration: 36 Months (3 Years) Eligibility: 12th Pass from Science with Minimum 60%

COURSE STRUCTURE OF CHEMISTRY (HONOURS) SEMESTER Ist													
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional ***		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Theory Group													
3HBHL101H	Ability Enhancement	हिन्दी भाषा संरचना	50	25	08	10	04	15	06	2	-	-	2
3CBCA201H	Ability Enhancement	Basic Information of Computer Technology - I	25	13	04	05	02	07	03	1	-	-	1
3SBCH104H	Core Course - 1	Inorganic & Organic chemistry	100	50	17	20	08	30	12	4	-	-	4
3SBCH106H	Core Course- 2	Polymer Chemistry	100	50	17	20	08	30	12	4	-	-	4
	Generic Elective -1	(Select From Below Given Specialized Subject)*	100	50	17	20	08	30	12	4	-	-	4
Practical Group				Term End Practical Exam		Lab Performance		Sessional					
3SBCH104H	Practical	Inorganic & Organic chemistry	50	25	08	25	08	-	-	-	-	2	2
3SBCH106H	Practical	Polymer Chemistry	50	25	08	25	08	-	-	-	-	2	2
	Practical	(Select From Below Given Specialized Subject)*	50	25	08	25	08	-	-	-	-	2	2
3CBCA201H	Practical	Basic Information Computer Technology - I	25	10	04	15	06	-	-	-	-	1	1
Grand Total			550							15	-	07	22

Minimum Passing Marks are equivalent to Grade C

Major- Term End Theory Exam

Minor- Pre University Test

Sessional weightage – Attendance 50%, Three Class Tests/Assignments 50%

L- Lectures T- Tutorials P- Practical

* Generic Elective Specialization: Opted specialization by student in 1st Semester will remain same in IInd, IIIrd and IVth Semester (See the specialisation subject as mentioned below)*

Generic Elective- 1		
Specialisation	Course Code	Subject
Physics	3SBPH103H	Mechanics, Oscillations and Properties of Matter
Maths	3SBMA105H	Algebra, Trigonometry & Geometry

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Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional ***		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Theory Group													
3HBEL201H	Ability Enhancement	English Language and Indian Culture	50	25	08	10	04	15	06	2	-	-	2
3MBFE101H	Ability Enhancement	Fundamental of Entrepreneurship	50	25	08	10	04	15	06	2	-	-	2
3SBCH204H	Core Course-3	Physical Chemistry	100	50	17	20	08	30	12	4	-	-	4
3SBCH206H	Core Course-4	Application of Computers in Chemistry	100	50	17	20	08	30	12	4	-	-	4
	Generic Elective -2	(Select From Below Given Specialized Subject)*	100	50	17	20	08	30	12	4	-	-	4
Practical Group				Term End Practical Exam		Lab Performance		Sessional					
3SBCH204H	Practical	Physical Chemistry	50	25	08	25	08	-	-	-	-	2	2
3SBCH206H	Practical	Application of Computers in Chemistry	50	25	08	25	08	-	-	-	-	2	2
	Practical	(Select From Below Given Specialized Subject)*	50	25	08	25	08	-	-	-	-	2	2
Skill Courses								Sessional					
	Skill Enhancement	Skill Enhancement Elective Course-I	50	-	-	-	-	50	20	1	-	1	2
Grand Total			600							17	-	07	24

Minimum Passing Marks are equivalent to Grade C

Major- Term End Theory / Practical Exam

Minor- Pre University Test

Sessional weightage – Attendance 50%, Three Class Tests/Assignments 50%

Skill Elective I – Any other course being offered in this semester as per the list given at the end of course structure.

* Generic Elective Specialization: Opted specialization by student in 1st Semester will remain same in IInd, IIIrd and IVth Semester (See the specialisation subject as mentioned below)*

Generic Elective- 2		
Specialisation	Course Code	Subject
Physics	3SBPH203H	Mathematical Background, Electrostatics of Matter
Maths	3SBMA205H	Calculus, Differential Equations& Vector Calculus

L- Lectures T- Tutorials P- Practical

BACHELOR OF SCIENCE (HONOURS)

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COURSE STRUCTURE OF CHEMISTRY (HONOURS) SEMESTER IIIrd													
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional ***		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Theory Group													
3HBHL302H	Ability Enhancement	हिन्दी भाषा सवेधना एवं संचार साधन	50	25	08	10	04	15	06	2	-	-	2
3CBCA502H	Ability Enhancement	Basic Information of Computer Technology – II	25	13	04	05	02	07	03	1	-	-	1
3SBCH304H	Core Course-5	Physical, Inorganic & Inorganic Chemistry	100	50	17	20	08	30	12	4	-	-	4
3SBCH306H	Core Course-6	Analytical methods in chemistry	100	50	17	20	08	30	12	4	-	-	4
	Generic Elective -3	(Select From Below Given Specialized Subject)*	100	50	17	20	08	30	12	4	-	-	4
Practical Group				Term End Practical Exam		Lab Performance		Sessional					
3SBCH304H	Practical	Physical, Inorganic & Inorganic Chemistry	50	25	08	25	08	-	-	-	-	2	2
3SBCH306H	Practical	Analytical methods in chemistry	50	25	08	25	08	-	-	-	-	2	2
	Practical	(Select From Below Given Specialized Subject)*	50	25	08	25	08	-	-	-	-	2	2
3CBCA502H	Practical	Basic Information of Computer Technology – II	25	10	04	15	06	-	-	-	-	1	1
Skill Courses								Sessional					
	Skill Enhancement	Skill Enhancement Elective Course-II	50	-	-	-	-	50	20	1	-	1	2
Grand Total			600							16	-	08	24

Minimum Passing Marks are equivalent to Grade C

Major- Term End Theory / Practical Exam

Minor- Pre University Test

Sessional weightage – Attendance 50%, Three Class Tests/Assignments 50%

Skill Elective II- Any other course being offered in this semester as per the list given at the end of course structure.

L- Lectures T- Tutorials P- Practical

Generic Elective- 3*

Specialisation	Course Code	Subject
Physics	3SBPH303H	Kinetic Theory of Gases, Thermodynamics and Statistical Mechanics
Maths	3SBMA305H	Calculus, Differential Equation and Mechanics

BACHELOR OF SCIENCE (HONOURS)

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COURSE STRUCTURE OF CHEMISTRY (HONOURS) SEMESTER IVth													
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional ***		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Theory Group													
3HBEL402H	Ability Enhancement	English language and scientific temper	50	25	08	10	04	15	06	2	-	-	2
3HBHP401H	Ability Enhancement	Human Values & Ethics	50	25	08	10	04	15	06	2	-	-	2
3SBCH404H	Core Course - 7	Physical, Inorganic & Organic Chemistry	100	50	17	20	08	30	12	4	-	-	4
3SBCH406H	Core Course- 8	Industrial chemical & Environment	100	50	17	20	08	30	12	4	-	-	4
	Generic Elective -4	(Select From Below Given Specialized Subject)*	100	50	17	20	08	30	12	4	-	-	4
Practical Group				Term End Practical Exam		Lab Performance		Sessional					
3SBCH404H	Practical	Physical, Inorganic & Organic Chemistry	50	25	08	25	08	-	-	-	-	2	2
3SBCH406H	Practical	Industrial chemical & Environment	50	25	08	25	08	-	-	-	-	2	2
	Practical	(Select From Below Given Specialized Subject)*	50	25	08	25	08	-	-	-	-	2	2
Grand Total			550							16	-	06	22

Minimum Passing Marks are equivalent to Grade C

L- Lectures T- Tutorials P- Practical

Major- Term End Theory Exam

Minor- Pre University Test

Sessional weightage – Attendance 50%, Three Class Tests/Assignments 50%

Generic Elective- 4*

Specialisation	Course Code	Subject
Physics	3SBPH403H	Group Waves, Acoustics and Optics
Maths	3SBMA405H	Advanced Calculus, Partial Differential Equations, Complex Analysis and Abstract Algebra

BACHELOR OF SCIENCE (HONOURS)

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COURSE STRUCTURE OF CHEMISTRY (HONOURS) SEMESTER Vth													
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional ***		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Theory Group													
3SBCH501H	Core Course-9	Coordination Chemistry	100	50	17	20	08	30	12	4	-	-	4
3SBCH502H	Core Course-10	Industrial Chemistry	100	50	17	20	08	30	12	4	-	-	4
3SBCH503H	Core Course-11	Organic Chemistry & Spectroscopy	100	50	17	20	08	30	12	4	-	-	4
*	Discipline Specific Elective-1	Elective table-I	100	50	17	20	08	30	12	4	-	-	4
**	Discipline Specific Elective -2	Elective table-II	100	50	17	20	08	30	12	4	-	-	4
Practical Group				Term End Practical Exam		Lab Performance		Sessional					
3SBCH501H	Practical-I	Core Course-9	50	25	08	25	08	-	-	-	-	2	2
3SBCH502H	Practical-II	Core Course-10	50	25	08	25	08	-	-	-	-	2	2
3SBCH503H	Practical-III	Core Course-11	50	25	08	25	08	-	-	-	-	2	2
3SBCH504H	Practical-IV	Select from Discipline Specific Elective-1	50	25	08	25	08	-	-	-	-	2	2
3SBCH505H	Practical-V	Select from Discipline Specific Elective-2	50	25	08	25	08	-	-	-	-	2	2
***	Skill Enhancement-VI	Skill Enhancement Elective Course-II	50	25		15	10	1	-	1	2	** *	2
Grand Total			800										32

Minimum Passing Marks are equivalent to Grade C

Major- Term End Theory Exam

Minor- Pre University Test

Sessional weightage – Attendance 50%, Three Class Tests/Assignments 50%

L- Lectures T- Tutorials P- Practical

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COURSE STRUCTURE OF CHEMISTRY (HONOURS) SEMESTER VIth													
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional ***		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Theory Group													
3SBCH601H	Core Course-12	Nano-Chemistry	100	50	17	20	08	30	12	4	-	-	4
3SBCH602H	Core Course-13	INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE	100	50	17	20	08	30	12	4	-	-	4
3SBCH603H	Core Course-14	GREEN CHEMISTRY	100	50	17	20	08	30	12	4	-	-	4
***	Discipline Specific Elective	Elective table-III	100	50	17	20	08	30	12	4	-	-	4
****	Discipline Specific Elective//Project/Dissertation	Elective table-IV / Group B DISSERTATION	150	150	40	-	-	-	-	-	-	6	6
Practical Group				Term End Practical Exam		Lab Performance		Sessional					
	Practical-I	Core Course-12	50	25	08	25	08	-	-	-	-	2	2
	Practical-II	Core Course-13	50	25	08	25	08	-	-	-	-	2	2
	Practical-III	Core Course-14	50	25	08	25	08	-	-	-	-	2	2
	Practical-IV	Discipline Specific Elective -3	50	25	08	25	08	-	-	-	-	2	2
Grand Total			750										30

*** If Project/Dissertation not taken then DSE have same marks/credit as other DSE's.**

Minimum Passing Marks are equivalent to Grade C

Major- Term End Theory Exam

Minor- Pre University Test

Sessional weightage – Attendance 50%, Three Class Tests/Assignments 50%

L- Lectures T- Tutorials P- Practical

DISCIPLINE SPECIFIC ELECTIVE

***Note** - Students need to select any two from below mentioned four papers from Each Group Elective's for Fifth and Sixth semester of **B.Sc. Chemistry (Honours)**.

ELECTIVES FOR SEMESTER 5 TH			ELECTIVES FOR SEMESTER 6 TH		
Course Code	Course Type	List of Electives	Course Code	Course Type	List of Electives
***GROUP ELECTIVE -I			*** GROUP ELECTIVE -III		
3SBCH504H		Bio-Chemistry	3SBCH604H		Chemistry of Natural product
3SBCH505H		Environmental Studies	3SBCH605H		Instrumental Methods of Chemical Analysis
**** GROUP ELECTIVE -II			****GROUP ELECTIVE -IV		
3SBCH506H		Basics of Analytical Chemistry	3SBCH606H		Fundamentals of Spectroscopy
3SBCH507H		Bio molecular Chemistry	3SBCH607H		Some Special aspects of Chemistry

COURSE CODE- 3SBCH608H

Dissertation/Project Guidelines

SKILL ENHANCEMENT ELECTIVE COURSES

Non-Technical			
Elective No.	Department/ Faculty Name		
	Faculty of Information Technology		
I	SCIT 201	Data Entry Operation	2(1+0+1)
II	SCIT 301	Multimedia	2(1+0+1)
III	SCIT 501	Web Designing with HTML	2(1+0+1)
IV	SCMIT 201	Web Development	2(1+0+1)
V	SCMIT 301	LINUX	2(1+0+1)
	Faculty of Management		
I	SMGT 201	Briefing and Presentation Skills	2(1+0+1)
II	SMGT 301	Resolving Conflicts and Negotiation Skills	2(1+0+1)
III	SMGT 802	Entrepreneurship Development	2(1+0+1)
	Faculty of Commerce		
I	SCOM 201	Tally ERP 9	2(1+0+1)
II	SCOM 302	Multimedia	2(1+0+1)
III	SCOM 803	Data Analyst	2(1+0+1)
	Faculty of Humanities		
I	SHBA 301	Pursuing Happiness	2(1+0+1)
II	SHBA302	Communication Skill and Personality Development	2(1+0+1)
III	SHMA301	Tourism in M.P	2(1+0+1)
	Faculty of Science		
I	SSBI 301	Mushroom Cultivation	2(1+0+1)
II	SSPH 301	House Hold Wiring	2(1+0+1)
III	SSPH 301	Basic Instrumentation	2(1+0+1)
IV	SSPH 301	DTP Operator	2(1+0+1)
V	SSCH 301	Graphic Designing	2(1+0+1)
	Faculty of Education		
I	SCBE 403	Understanding of ICTC (Information Communication Technology)	2(1+0+1)
II	SCPE 201	Yoga Education	2(1+0+1)

हिन्दी भाषा और संरचना

पाठ्यक्रम के उद्देश्य:

1. विद्यार्थियों में राष्ट्र प्रेम की भावना का विकास करना।
2. हिन्दी के समृद्ध साहित्य को नयी पीढ़ी तक पहुँचाना।
3. पत्र-लेखन, सार लेखन, भाव पल्लवन एवं साक्षात्कार के कौशल का विकास करना।
4. डायरी, संस्मरण, लेखन, पारिभाषिक, शब्दावली, तत्सम, तद्भव, देशज, विदेशी शब्दों इत्यादि के ज्ञान का परिमार्जन करना।

पाठ्यक्रम

इकाई-1

भारत वंदना) काव्य(
जाग तुझको दूर जाना
स्वतंत्रता पुकारती) काव्य(
हम अनिकेतन) काव्य(
भाषा की महत्ता और उसके विविध रूप
भाषा-कौशल

सूर्यकांत त्रिपाठी निराला
सुश्री महादेवी वर्मा
जयशंकर प्रसाद
बालकृष्ण शर्मा नवीन

इकाई-2

करुणा) निबंध (
समन्वय की प्रक्रिया) निबंध(
बिच्छी बुआ) कहानी(
अनुवाद
हिन्दी की शब्द-संपदा
परिभाषिक शब्दावली

आचार्य रामचन्द्र शुक्ल
रामधारी सिंह दिनकर
डॉ. लक्ष्मण विष्ट बटरोही
परिभाषा प्रकारण महत्व विशेषताएं

इकाई-3

विलायत पहुंच ही गया) आत्मकथांश (
अफसर (व्यंग्य)
तीर्थयात्रा) कहानी(
मकड़ी का जाला) व्यंग्य(
वाक्य- संरचना :तत्सम तद्भव देशज विदेशी

महात्मा गांधी
शरद जोशी
डॉ. मिथिलेश कुमार मिश्र
डॉ. रामप्रकाश सक्सेना

इकाई-4

अप्प दीपो भव) वक्तृत्व कला(
भारत का सामाजिक व्यक्तित्व) प्रस्तावना (
पत्र मैसूर के महाराजा को) पत्र-लेखन (
बनी रहेंगी किताबें) आलेख(
पत्र-लेखन: महत्व और उसके विविध रूप
सड़क पर दौड़ते ईहा मृग) निबंध (

स्वामी श्रद्धानंद
जवाहरलाल नेहरू
स्वामी विवेकानंद
डॉ. सुनीता रानी घोष
डॉ. श्यामसुन्दर दुबे

इकाई-5

योग की शक्ति) डायरी (डॉ. हरिवंश राय बच्चन
कोश के अखाड़े में कोई पहलवान नहीं उतरता) साक्षात्कार (— भाषाविद् डॉ. हरिदेव
बाहरी से प्रो. त्रिभुवननाथ शुक्ल
नीग्रो सैनिक से भेंट) यात्रा-संस्मरण(डॉ. देवेन्द्र सत्यार्थी
यदि बा न होती तो शायद गांधी को यह ऊँचाई न मिलती) साक्षात्कार (कथाकार.
गिरिराज किशोर से सत्येन्द्र शर्मा

सार- लेखनए भाव-पल्लवन साक्षात्कार और कौशल

अपेक्षित परिणाम:

1. विद्यार्थी भारत भूमि से प्रेम व स्नेह के भावों को बढ़ा सकेंगे।
2. विद्यार्थियों की हिन्दी की शब्द संपदा में वृद्धि होगी।
3. पत्र-लेखन ,सार लेखन, भाव पल्लवन साक्षात्कार के कौशल का विकास होगा।
4. डायरी एवं संस्मरण लेखन विद्या का परिमार्जन होगा।
5. हिन्दी के समृद्ध साहित्य कोश से लाभान्वित होंगे।

Chairperson
(Board of Studies)

Dean
(Academic Council)

(Registrar)
Seal

BASIC INFORMATION OF COMPUTER TECHNOLOGY-I

COURSE OBJECTIVE:-

To educate students to analyze, design, integrate & manage information systems using information technology.

Syllabus:

- UNIT – I** Introduction to computer organization History of development of Computer system concepts. Characteristics, Capability and limitations.
Generation of computer. Types of PC's Desktop. Laptop, Notebook. Workstation & their Characteristics.
- इकाई – 1** कम्प्यूटर ऑर्गनाइजेशन का परिचय कम्प्यूटर का इतिहास, कम्प्यूटर सिस्टम विचारधारा, विशेषताएं, योग्यता एवं सीमाएं, कम्प्यूटर की पीढ़ियां, पी.सी. के प्रकार, डेस्कटॉप के प्रकार, लेपटॉप के प्रकार, नोटबुक, वर्क स्टेशन आदि की विशेषताएं।
- UNIT – II** Introduction to computer organization Basic components of a computer system Control Unit, ALU, Input / Output function and Characteristics, memory RAM, ROM, EPROM, PROM.
- इकाई – 2** कम्प्यूटर ऑर्गनाइजेशन का परिचय कम्प्यूटर सिस्टम के आधार उपकरण, कंट्रोल युनिट, ए. एल.यू. इनपुट/आउटपुट फंक्शन और विशेषताएं, मेमोरी रेम, रोम, इपी रोम, पी रोम, और अन्य प्रकार की मेमोरी।
- UNIT – III** Input & output devices Input Devices : Keyboard, Mouse, Trackball. Joystick, Digitizing tablet, Scanners, Digital Camera, MICR, OCR, OMR, Bar-code Reader, Voice Recognition, Light pen, Touch Screen.
Output Devices: Monitors Characteristics and types of monitor, Video Standard VGA, SVGA, XGA, LCD Screen etc. Printer, Daisy wheel, Dot Matrix, Inkjet, Laser, Line Printer. Plotter, Sound Card and Speakers.
- इकाई – 3** इनपुट तथा आउटपुट डिवाइसेस **इनपुट डिवाइस:** कीबोर्ड, माउस, ट्रैकबॉल, जॉयस्टिक, डिजिटाइजिंग टेबलेट, स्कैनर्स, डिजिटल कैमरा, एमआईसीआर, ओसीआर, ओएमआर, बार कोड रीडर, आवाज को पहचानने वाला, लाइटपेन, टच स्क्रीन।
इनपुट डिवाइस: मॉनीटर की विशेषताएं एवं मॉनीटर के प्रकार, वीडियो स्टैंडर्ड VGA, SVGA, XGA, LCD स्क्रीन आदि, प्रिंटर, डेजी व्हील, डॉट मैट्रिक्स, इंकजेट, लेजर, लाइन प्रिंटर, प्लॉटर, साउंड कार्ड्स एवं स्पीकर्स।
- UNIT – IV** Storage Devices Storage fundamental primary Vs Secondary. Various Storage Devices magnetic Tape. Cartridge Tape, Data Drives, Hard Drives, Floppy Disks, CD, VCD, CD-R, CD-RW, Zip Drive, DVD, DVD-RW.
- इकाई – 4** स्टोरेज डिवाइसेस स्टोरेज फंडामेंटल्स प्रथमरी विरुद्ध भिन्न स्टोरेज डिवाइसेस मैग्नेटिक टेप, कार्ट्रिज टेप, डाटा ड्राइव्स, हार्ड डिस्क ड्राइव्स फ्लोपी डिस्कस, सी.डी., वी.सी.डी., सी.डी.-आर.सी.डी.-आर. डब्ल्यू, जीप ड्राइव, डी.वी.डी., डी.वी.डी., -आर. डब्ल्यू।
- UNIT – V** Operating System Introduction to operating systems, its functioning and types. Basic commands of dos & Windows operating System.
- इकाई – 5** ऑपरेटिंग सिस्टम का परिचय ऑपरेटिंग सिस्टम का परिचय, उसके लक्षण एवं प्रकार, डॉस

एवं विन्डोस का मूल कमांड ।

PRACTICALS:-

DOS:

- DOS commands: Internal & External Commands.
- Special batch file: Autoexec, Bar Hard disk setup.

Windows 98:

- Desktop setting: New folder, rename bin operation, briefcase, and function. Control panel utility.
- Display properties: Screen saver, background settings.

MS Word:

- Creating file; save, save as HTML, Save as Text, Template, RTF Format.
- Page setup utility: Margin settings, paper size setting, paper source, layout.
- Editing: Cut, past special, undo, redo, find, replace, go to etc.
- View file: page layout, Normal Outline, master document, ruler header, footer, footline, full screen.
- Insert: break, page number, symbol, date & time, auto text, caption file, object, hyperlink, picture etc.
- Format: font, paragraph, bullets & numbering, border & shading, change case, columns.
- Table: Draw label, insert table, cell handling, table auto format, sort formula.

COURSE OUTCOME:-

Student will be able to use computer system easily and they will get knowledge about how to use different type of operating system.

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INORGANIC & ORGANIC CHEMISTRY**Syllabus:**

- UNIT - I** A. Mathematical Concepts : Logarithmic relations, curves stretching, linear graphs and calculation of slopes, Differentiation of functions like Kx , ex , x^n , $\sin x$, $\log x$; maxima and minima, partial differentiation and reciprocity relations. Integration of some useful/relevant functions; permutations and combinations. Factorials, Probability. B. Gaseous States : Deviation from ideal behaviour, van der Waals equation of state. Critical phenomenon : PV isotherms of ideal gases, continuity of states, the isotherms of van der Waals equations, relationship between critical constants and van der Waals constants, the law of corresponding states, reduced equation of states. C. Molecular Velocities : Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision numbers, mean free path and collision diameter. Liquefaction of gases (based on Joule-Thomson effect).
- UNIT - II** A. Liquid State : Intermolecular forces, structure of liquids (a qualitative description) Liquid crystals: Difference between liquid crystal, solid and liquid. Classification, structure of nematic and cholestric phases. Thermography and seven segment cell. B. Colloidal State : Definition of colloids, classification of colloids. Solids in liquids (sols): properties- kinetic, optical and electrical; stability of colloids, protective action, Hardy-Schulze law, gold number. Liquids in liquids (emulsions) : types of emulsions, preparation. Emulsifier. Liquids in solids (gels): classification, preparation and properties, inhibition, general applications of colloids. C. Solid State : Definition of space lattice, Unit cell, Laws of crystallography - (i) Law of constancy of interfacial angles (ii) Law of rationality of indices (iii) Laws of symmetry, Symmetry elements in crystals. Diffraction : X-ray diffraction by crystals, Derivation of Bragg's equation. Determination of crystal structure of NaCl, KCl and CsCl (Laue's method and powder method).
- UNIT - III** Chemical Kinetics : Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction concentration, temperature, pressure, solvent, light and catalyst. Concentration dependence of rates, mathematical characteristics of simple chemical reactions- zero order, first order, second order, pseudo order, half life and mean life. Determination of the order of reaction - differential method, method of integration, method of half life period and isolation method. Experimental methods of chemical kinetics - conductometric, potentiometric, optical methods- polarimetry and spectrophotometry. Theories of chemical kinetics: effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy. Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis) Expression for the rate constant based on equilibrium constant and thermodynamic aspects.
- UNIT - IV** A. Structure and Bonding : Hybridizations, Bond lengths and bond angles, bond energy : Localized and delocalized chemical bond, van-der Waals interactions, inclusion compounds, clathrates, charge transfer complexes, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding. B. Mechanism of Organic reactions : Curved arrow notations, drawing electron movements with arrows, half-headed and double headed arrows, homolytic and heterolytic bond breaking.

C. Types of Reagents : Electrophiles and nucleophiles. Types of organic reactions. Energy consideration. Reactive intermediates- carbocations, carbanions, free radicals and carbenes. Methods of determination of reaction mechanism.

UNIT - V Stereochemistry : Concept of isomerism, types of isomerism, optical isomerism, elements of symmetry, molecular chirality, enantiomers, stereogenic centres, optical activity, properties of enantiomers, chiral and

achiral molecules with two stereogenic centres, diastereomers, mesocompounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configurations, sequence rule, D & L , R & S systems of nomenclature. E and Z system of Nomenclature geometrical isomerism in alicyclic compounds. Conformation, conformational analysis of ethane and n-butane. Conformations of cyclohexanes, axial and equatorial bonds, Newman projection and Sawhorse formulae, Fischer and Flying wedge formulae. B. Alkanes and Cycloalkanes : IUPAC nomenclature, classification, isomerism in alkanes, sources and methods of preparation (with special reference to Wurtz, Kolbe, Corey-House reactions and decarboxylation of carboxylic acids). Physical properties and chemical reactions of alkanes. Mechanism of free radical halogenation of alkanes Cycloalkanes : nomenclature, methods of preparations, chemical reactions. Baeyer's strain theory and its limitations. ring strain in cyclopropane and cyclobutanes. Theory of strainless rings.

PRACTICAL:-

Physical chemistry

(Any one experiment will be asked in examination form the following)

1. Calibration of thermometer
2. Determination of melting point
3. Determination of boiling point
4. Determination of mixed melting point
5. Preparation of solutions of various concentrations, NaOH, HCl, H₂SO₄.

(Any one experiment will be asked in examination form the following)

1. To determine the velocity constant (specific reaction rate) of hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.
2. To study the effect of acid strength on the hydrolysis of an ester.
3. To compare the strength of HCl and H₂SO₄ by studying the kinetics of hydrolysis of ester.
4. To study kinetically the reaction rate of decomposition of iodide by H₂O₂.
5. Determination of surface tension / percentage composition of given organic mixture using surface tension method.
6. Determination of viscosity / percentage composition of given organic mixture using viscosity method.

Organic chemistry

(Any one experiment will be asked in examination form the following)

1. Distillation
2. Crystallization
3. Decolourisation and crystallization using charcoal
4. Sublimation

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POLYMER CHEMISTRY

Syllabus:

- UNIT - I**
- A.** Atomic Structure : Idea of de Broglie's matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrödinger wave equation, significance of n and l , quantum numbers, radial and angular wave functions and probability distribution curves, effective nuclear charge.
- B.** Periodic Properties : Atomic and ionic radii, ionization energy, electron affinity and electronegativity : definition, method of determination, trends in periodic table and applications.
- C.** Chemical Bonding : Covalent bond- valence bond theory and its limitations, directional characteristic of covalent bond. Hybridization and shapes of simple molecules and ions. Valence Shell Electron Pair Repulsion (VSEPR) theory to NH_3 , SF_4 , ClF_3 , ICl_2 - and H_2O .
- UNIT - II**
- A.** Molecular Orbital theory for homonuclear and heteronuclear (CO and NO) diatomic molecules, multicenter bonding in electron deficient molecules, bond strength and the bond energy, % ionic character from dipole moment and electronegativity difference. Weak interactions, hydrogen bonding, van der Waals forces.
- B.** Ionic Solids : Ionic structures, radius ratio effect and coordination number, limitation of radius ratio rule, Lattice defects, semiconductors, lattice energy and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarizability of ions. Fajan's rule, Metallic bond, free electron, Valence bond and Band theories.
- C.** Noble Gases : Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds.
- UNIT - III**
- A.** s-Block Elements : Comparative study, diagonal relationships, salient features of hydrides, solvation and complexation tendencies including their function in biosystems, an introduction to alkyls and aryls.
- B.** p-Block Elements : Comparative study (including diagonal relationship) of groups 13-17 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13-16.
Hydrides of boron-diborane and higher boranes. Borazine, borohydrides. Fullerenes, carbides, fluorocarbons, silicates (structural principle), tetrasulphur tetranitride, basic properties of halogens, interhalogens.
- UNIT - IV**
- A.** Arenes and Aromaticity : Nomenclature of benzene derivatives. The aryl group, Aromatic nucleus and side chain structure of benzene, molecular formula and Kekule structure. Stability and carbon-carbon bond lengths of benzene, resonance structure. MO picture. Aromaticity the Huckel rule, aromatic ions. Aromatic electrophilic substitution, general pattern of the mechanism, role of s and p complexes. Mechanism of nitration, halogenation, sulphonation, mercuriation and Friedel-Crafts reaction. Energy profile diagrams. Activating and deactivating substituents. orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Birch reduction. Methods of formation and chemical reactions of alkylbenzenes and biphenyl.
- B.** Alkenes : Nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regio-selectivity in alcohol dehydration. The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes, mechanisms

involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration-oxidation, oxymercuration-reduction, Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with KMnO_4 , polymerization of alkenes, Substitution at the allylic and vinylic positions of alkenes, Industrial applications of ethylene and propene.

- UNIT – V**
- A. Cycloalkenes, Dienes and alkynes :** Methods of formation, conformation and chemical reactions of cycloalkenes, nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of allenes and butadiene, methods of formation, polymerization. Chemical reactions - 1,2 and 1,4 additions, Diels-Alder reaction. Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroborationoxidation and polymerization.
- B. Alkyl and Aryl Halides :** Nomenclature and classes of alkyl halides, methods of formation, chemical reactions; mechanisms of nucleophilic substitution reaction of alkyl halides, SN_2 and SN_1 reactions with energy profile diagrams. Polyhalogen compounds: chloroform, carbon tetrachloride. Methods of formation of aryl halides, nuclear and side chain reactions. The addition-elimination and the elimination-addition reactions mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides versus allyl, vinyl and aryl halides. Synthesis and uses of DDT, BHC and Freon.

PRACTICAL:-

Inorganic chemistry:

Inorganic mixture analysis

Macro/Semi-micro Analysis- Cation analysis, separation and identification of ions from group I-VI, anion analysis

Separation of cations by paper chromatography

Preparation of ferrous alum.

Organic Chemistry:

1. Detection of elements (N, S and halogens) 2 elements

2. Functional groups (phenolic, carboxylic, carbonyl, esters, carbohydrates, amines, amides, nitro and aniline) in simple organic compounds.

2 functional groups

Records.

COURSE OUTCOME:-

Upon successful completion of this course, students will understand theories of chemical bonding and determine the molecular geometry of molecules using VSEPR theory. Understand the general and physical properties of matter.

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MECHANICS, OSCILLATIONS AND PROPERTIES OF MATTER

COURSE OBJECTIVE:-

1. To understand applications of Newton's Laws of Classical System.
2. Understands the concepts of elasticity and viscosity
3. Understands the damped and driven oscillators
4. Gains and appreciations of surface phenomena.

Syllabus:

- UNIT – I** Mechanics Laws of motion, centripetal acceleration, Coriolis force and its applications. Kepler's laws. Gravitational law and field,. Gauss & Poisson's Equation of Gravitational self-energy System of particles,, centre, of mass, equation of motion, conservation of linear and angular, momentum, conservation of energy, single stage and multistage rockets, elastic and inelastic collisions.
- UNIT – II** Oscillations differential equation and its solution, kinetic and potential energy, simple harmonic oscillations and its examples, spring and mass system, Vibrations of a magnet, moments of inertia and their products, principal moments and axes, Euler's equations simple and compound pendulum torsional pendulum, Helmholtz resonator, LC circuit.
- UNIT – III** Superposition Of Harmonic Motion Superposition of two simple harmonic motions of the same frequency along the same line, interference, superposition of two mutually perpendicular simple harmonic vibrations of the same frequency, Lissajous figures, damped harmonic oscillators, power dissipation, quality factor and their examples, driven harmonic oscillator;
- UNIT – IV** Properties of matter Elasticity, Hook's Law, elastic constants for an isotropic solid beams supported at both the ends, cantilever, torsion of a cylinder bending moments and shearing forces. Kinematics of moving fluids, equations of continuity Euler's equation, Bernoulli's theorem, viscous fluids, streamline and turbulent flow, Poiseuille's law, Capillary tube flow, Reynolds number, Stokes law Surface tension and surface energy. surface wetting.
- UNIT - V** Motion of charged Particles in Electric and Magnetic Fields E as an accelerating field, electron gun, case of discharge tube, linear accelerator. E as deflecting field- CRO, sensitivity of CRO. Transverse B field; 180° deflection, mass spectrograph. principles of cyclotron. discovery of isotopes, elements of mass spectrographs, principle of magnetic focusing (lenses).

COURSE OUTCOMES:-

1. To study the fundamentals of mechanics and oscillations
2. Gain the knowledge about forces help the student in their daily life
3. The information will teach the students about the rolling concepts

PRACTICAL:-

To determine the acceleration due to gravity (g) at a place with the help of Bar-pendulum.

1. (Compound Pendulum).
2. To determine the acceleration due to gravity (g) at a place with the help of Kater's reversible pendulum.
3. To determine the modulus of rigidity of given wire by Torsional Pendulum.
4. To determine the moment of inertia of a flywheel about its own axis of rotation.
5. To determine the moment of inertia of given body by using inertia table.
6. To determine the moment of inertia of given body by using inertia table with lamp and scale arrangement.
7. To study and prove the perpendicular axis theorem of moment of inertia by using inertia table.
 $I_z = I_x + I_y$
8. To determine the surface tension of a liquid by the capillary rise method.
9. To determine the co-efficient of viscosity of glycerine or castor oil by falling sphere method.
10. To determine the density of liquid by using steel balls and Teflon spheres.
11. To determine the fall time of different size spheres of same material.
12. To determine the Young's Modulus of elasticity of the given sample material by bending.
(Bending of Beam)
13. To study and verify the truth table of Basic, Universal & Compound Logic Gates.

Note:-

- ❖ **One experiment will be asked in the semester practical examination.**

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ALGEBRA, TRIGONOMETRY & GEOMETRY

COURSE OBJECTIVES:-

- Apply the concepts of matrices in solving a system of linear equations.
- Be familiar with the theory of equations.
- Expand trigonometric functions and also find the summation of T-series.
- To have knowledge about Cone and Cylinder with conicoides.
Be familiar with group theory, ring, integral domain, field and make their fundamental strong

Syllabus:

- UNIT – 1** Rank of a matrix. Eigen values, eigen vectors.Characteristic equation of a matrix. Cayley Hamilton theorem and its use in finding inverse of marix. Application of matrix to a system of linear (both homogenous and non - homogenous) equations. Theorems on consistency and inconsistency of a system of linear equations. Solving the linear equations with three unknowns. Relation between the roots and coefficients of a general polynomial equation in one variable. Transformation of equations, Descarte’s rule of signs.
- UNIT – 2** De Moivre’s theorem and its application. Direct and inverse circular and hyperbolic functions, Expansion of trignometrical function. Gregory’s Series, Summation of Series,
- UNIT – 3** Definition and basic properties of group. Order of an element of a group. Subgroups, algebra of subgroups. Cyclic groups and their simple properties. Coset decomposition and related theorems. Lagrange’s theorem and its consequences, Normal sub groups, quotient groups.
- UNIT- 4** Homomorphism and isomorphism of groups, kernel of Homomorphism and fundamental theorem of Homomorphism of groups Permutation groups (even and odd permutations) Alternating groups A_n , Cayley’s theorem. Introduction to rings, subrings, integral domains and fields, simple properties and examples.
- UNIT – 5** General equation of second degree. Tracing of conics. Equation of cone with given base, generators of cone, condition for three mutually perpendicular generators, Right circular cone. Equation of Cylinder and its properties. Right circular cylinder, enveloping cylinder and their properties Central conicoids, Paraboloids. Plane sections of Conicoids.

COURSE OUTCOMES:-

- Understanding the ideas of matrices and ability to solve system of linear equations.
- The student will be able to acquire sound knowledge of matrices and techniques in solving equations with the help of theory of equations
- Fluency in solving equations.
- Understanding the concepts of algebra, trigonometry and geometry

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ENGLISH LANGUAGE AND INDIAN CULTURE

COURSE OBJECTIVES:-

- To Study the basic concept and Language Skills of English Language.
- Comprehensive study of different kinds of vocabulary in English Language.
- To Study the different era in every story and moods in poems.

Syllabus:

UNIT – I

1. Amalkanti: Nirendranath Chakrabarti
2. Sita: Toru Dutt
3. Tryst with Destiny: Jawaharlala Nehru
4. Delhi in 1857: Mirza Ghalib
5. Preface to the Mahabharata: C. Rajagopalachari
6. Where the Mind is Without Fear: Rabindranath Tagore
7. A Song of Kabir: Translated by Tagore
8. Satyagraha: M.K. Gandhi
9. Toasted English: R.K. Narayan
10. The Portrait of a Lady: Khushwant Singh
11. Discovering Babasaheb: Ashok Mahadevan

UNIT – II Comprehension

UNIT – III Composition and Paragraph Writing (Based on expansion of an idea).

UNIT – IV Basic Language Skills : Vocabulary – Synonyms, Antonyms, Word Formation, Prefixes and Suffixes, Words likely to be confused and Misused, Words similar in Meaning or Form, Distinction between Similar Expressions, Speech Skill.

UNIT – V Basic Language Skills : Grammar and usage – The Tense Forms, Propositions, Determiners and Countable/Uncountable Nouns, Verb, Articles, Adverbs.

COURSE OUTCOMES:-

1. Students will be able to understand the basic concept and Language Skills of English Language.
2. Students will be able to understand the different use of vocabulary in their sentences.
3. Students will be able to understand the varieties of stories on different issues and on different format.

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FUNDAMENTALS OF ENTREPRENEURSHIP

COURSE OBJECTIVE:-

Understanding basic concepts of entrepreneurship and key steps in the elaboration of business ideas, Developing personal creativity and entrepreneurial initiative.

Syllabus:

- UNIT – I** Entrepreneurship-Definition, Characteristics and importance, Types and functions of an entrepreneur, merits of a good entrepreneur motivational factors of entrepreneurship.
- UNIT – II** Motivation to achieve targets and establishment of ideas. Setting targets and facing challenges. Resolving problems and creativity. Sequenced planning and guiding capacity, Development of self confidence. Communication skills, Capacity to influence, leadership.
- UNIT – III** Project Report- Evaluation of selected process. Detailed project report - Preparation of main part of project report pointing out necessary and viability.
Selecting the form of Organization: Meaning and characteristics of sole Proprietorship, Partnership and cooperative committees, elements affecting selection of a form of an organization.
Economic management -Role of banks and financial institutions banking, financial plans, working capital-evaluation and management, Cost and Price determination, Calculation of Profits, keeping of accounts.
- UNIT – IV** Production management - Methods of purchase. Management of movable assets/goods. Quality management. Employee management. Packing.
Marketing management Sales and the art of selling. Understanding the market and market policy. Consumer management. Time management.
- UNIT - V** Role of regulatory institutions - district industry centre, pollution control board, food and drug administration, special study of electricity development and municipal corporation.
Role of development organizations, khadi & village Commission/ Board, State Finance Corporation, scheduled banks, MP Women's Economics Development Corporation.
Self-employment-oriented schemes, Prime Minister's Employment schemes, Golden Jubilee Urban environment scheme, Rani Durgavati Self-Employment scheme, Pt. Deendayal Self-employment scheme.
Various grant schemes - Cost-of-Capital grant, interest grant, exemption from entry tax, project report, reimbursement grant, etc.
Special incentives for women entrepreneurs, prospects & possibilities.
Schemes of Tribal Finance Development Corporation, schemes of Antyavasai Corporation, schemes of Backward Class and Minorities Finance Development Corporation.
Special incentives for women entrepreneurs, prospects & possibilities.
Schemes of Tribal Finance Development Corporation, schemes of Antyavasai Corporation, schemes of Backward Class and Minorities Finance Development Corporation.

COURSE OUTCOME:-

Understanding basic concepts in the area of entrepreneurship, understanding the stages of the entrepreneurial process, adopting of the key steps in the elaboration of business ideas, Developing personal creativity and entrepreneurial initiative.

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PHYSICAL CHEMISTRY

- UNIT - I**
- A.** Atomic Structure : Idea of de Broglie's matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrödinger wave equation, significance of n and l , quantum numbers, radial and angular wave functions and probability distribution curves, effective nuclear charge.
- B.** Periodic Properties : Atomic and ionic radii, ionization energy, electron affinity and electronegativity : definition, method of determination, trends in periodic table and applications.
- C.** Chemical Bonding : Covalent bond- valence bond theory and its limitations, directional characteristic of covalent bond. Hybridization and shapes of simple molecules and ions. Valence Shell Electron Pair Repulsion (VSEPR) theory to NH_3 , SF_4 , ClF_3 , ICl_2 - and H_2O .
- UNIT - II**
- A.** Molecular Orbital theory for homonuclear and heteronuclear (CO and NO) diatomic molecules, multicenter bonding in electron deficient molecules, bond strength and the bond energy, % ionic character from dipole moment and electronegativity difference. Weak interactions, hydrogen bonding, van der Waals forces.
- B.** Ionic Solids : Ionic structures, radius ratio effect and coordination number, limitation of radius ratio rule, Lattice defects, semiconductors, lattice energy and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarizability of ions. Fajan's rule, Metallic bond, free electron, Valence bond and Band theories.
- C.** Noble Gases : Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds.
- UNIT - III**
- A.** s-Block Elements : Comparative study, diagonal relationships, salient features of hydrides, solvation and complexation tendencies including their function in biosystems, an introduction to alkyls and aryls.
- B.** p-Block Elements : Comparative study (including diagonal relationship) of groups 13-17 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13-16.
Hydrides of boron-diborane and higher boranes. Borazine, borohydrides. Fullerenes, carbides, fluorocarbons, silicates (structural principle), tetrasulphur tetranitride, basic properties of halogens, interhalogens.
- UNIT - IV**
- A.** Arenes and Aromaticity : Nomenclature of benzene derivatives. The aryl group, Aromatic nucleus and side chain structure of benzene, molecular formula and Kekule structure. Stability and carbon-carbon bond lengths of benzene, resonance structure. MO picture. Aromaticity the Huckel rule, aromatic ions. Aromatic electrophilic substitution, general pattern of the mechanism, role of s and p complexes. Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction. Energy profile diagrams. Activating and

deactivating substituents. orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Birch reduction. Methods of formation and chemical reactions of alkylbenzenes and biphenyl.

B. Alkenes : Nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regio-selectivity in alcohol dehydration. The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes, mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration-oxidation, oxymercuration-reduction, Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with KMnO_4 , polymerization of alkenes, Substitution at the allylic and vinylic positions of alkenes, Industrial applications of ethylene and propene.

UNIT – V **A. Cycloalkenes, Dienes and alkynes :** Methods of formation, conformation and chemical reactions of cycloalkenes, nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of allenes and butadiene, methods of formation, polymerization. Chemical reactions - 1,2 and 1,4 additions, Diels-Alder reaction. Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroborationoxidation and polymerization.

B. Alkyl and Aryl Halides : Nomenclature and classes of alkyl halides, methods of formation, chemical reactions; mechanisms of nucleophilic substitution reaction of alkyl halides, $\text{S}_{\text{N}}2$ and $\text{S}_{\text{N}}1$ reactions with energy profile diagrams.

Polyhalogen compounds: chloroform, carbon tetrachloride. Methods of formation of aryl halides, nuclear and side chain reactions. The addition-elimination and the elimination-addition reactions mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides versus allyl, vinyl and aryl halides. Synthesis and uses of DDT, BHC and Freon.

PRACTICAL:-

Inorganic chemistry

Inorganic mixture analysis

Macro/Semi-micro Analysis- Cation analysis, separation and identification of ions from group I-VI, anion analysis

Separation of cations by paper chromatography. Preparation of ferrous alum

Organic Chemistry

1. Detection of elements (N, S and halogens) 2 elements

2. Functional groups (phenolic, carboxylic, carbonyl, esters, carbohydrates, amines, amides, nitro and aniline) in simple organic compounds.

2 functional groups

COURSE OUTCOME:-

Upon successful completion of this course, students will understand theories of chemical bonding and determine the molecular geometry of molecules using VSEPR theory. Understand the general and physical properties of matter.

APPLICATION OF COMPUTERS IN CHEMISTRY

- UNIT – I** **Basics:** Constants, variables, bits, bytes, binary and ASCII formats, arithmetic expressions, hierarchy of operations, inbuilt functions. Elements of the BASIC language. BASIC keywords and commands. Logical and relative operators. Strings and graphics. Compiled versus interpreted languages. Debugging. Simple programs using these concepts. Matrix addition and multiplication. Statistical analysis.
- UNIT – II** **Numerical methods:** Roots of equations: Numerical methods for roots of equations: Quadratic formula, iterative method, Newton-Raphson method, Binary bisection and Regula-Falsi.
- UNIT – III** Differential calculus: Numerical differentiation.
- UNIT- IV** Integral calculus: Numerical integration (Trapezoidal and Simpson’s rule), probability distributions and mean values. *Simultaneous equations:* Matrix manipulation: addition, multiplication. Gauss - Siedal method. *Interpolation, extrapolation and curve fitting:* Handling of experimental data.
- UNIT – V** Conceptual background of molecular modeling: Potential energy surfaces. Elementary ideas of molecular mechanics and practical MO methods.

Reference Books:

- Harris, D. C. *Quantitative Chemical Analysis*. 6th Ed., Freeman (2007) Chapters 3-5.
- Levie, R. de, *How to use Excel in analytical chemistry and in general scientific data analysis*, Cambridge Univ. Press (2001) 487 pages.
- Noggle, J. H. *Physical chemistry on a Microcomputer*. Little Brown & Co. (1985).
- Venit, S.M. *Programming in BASIC: Problem solving with structure and style*. Jaico Publishing House: Delhi (1996).

PRACTICAL-DSE LAB: APPLICATIONS OF COMPUTERS IN

Chemistry

Computer programs based on numerical methods for :

1. Roots of equations: (e.g. volume of van der Waals gas and comparison with ideal gas, pH of a weak acid).
2. Numerical differentiation (e.g., change in pressure for small change in volume of a van der Waals gas, potentiometric titrations).
3. Numerical integration (e.g. entropy/ enthalpy change from heat capacity data), probability distributions (gas kinetic theory) and mean values.
4. Matrix operations. Application of Gauss-Siedel method in colourimetry.
5. Simple exercises using molecular visualization software.

Reference Books:

- McQuarrie, D. A. *Mathematics for Physical Chemistry* University Science Books (2008).
- Mortimer, R. *Mathematics for Physical Chemistry*. 3rd Ed. Elsevier (2005).
- Steiner, E. *The Chemical Maths Book* Oxford University Press (1996).
- Yates, P. *Chemical Calculations*. 2nd Ed. CRC Press (2007).
- Harris, D. C. *Quantitative Chemical Analysis*. 6th Ed., Freeman (2007) Chapters 3-5.

- Levie, R. de, *How to use Excel in analytical chemistry and in general scientific data analysis*, Cambridge Univ. Press (2001) 487 pages.
- Noggle, J. H. *Physical Chemistry on a Microcomputer*. Little Brown & Co. (1985).
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MATHEMATICAL BACKGROUND, ELECTROSTATICS OF MATTER

COURSE OBJECTIVE:-

1. The main objective of this subject is introducing the basic concepts of Electrostatics to student and help in developing problem solving skills.
2. Student will study basic ideology of Scalar and Vector product, double and triple integral.
3. Introducing the basic concepts of electrostatics to student and help in developing problem solving skills.

Syllabus:

- UNIT - 1** Mathematical Background Scalars and vectors, dot and cross products, triple vector product, flux of a vector field, Gauss's divergence theorem. Green's theorem and Stoke's theorem. Functions of two and three variables, partial derivatives, definition of a double and triple integral, evaluation of double and triple integrals as repeated integrals, change of variables of integration, Jacobian applications.
- UNIT - 2** Electrostatics Coulombs law in vacuum expressed in vector forms, calculations of E for simple distributions of charge at rest, dipole and quadrupole fields. torque on a dipole in a uniform electric field and its energy, flux of the electric field, Gauss's law and its application. Capacitors, electrostatic field energy,. Dielectrics, parallel plate capacitor with a dielectric, dielectric constant, polarization and polarization vector, and displacement vector D, molecular interpretation of Clausius-Mossotti equation.
- UNIT - 3** Electric Currents Steady current, current density J, non-steady currents and continuity equation, Kirchhoff 's laws and analysis of multiloop circuits, rise and decay of current in LR and CR circuits, decay constants, transients in LCR circuits. AC circuits, complex numbers and their applications solving AC circuits Problems, complex impedance and reactance, series and parallel resonance., Q factor, power consumed by an A.C. circuit, power factor,
- UNIT - 4** Magneto-statics Force on a moving charge: Lorentz force equation and definition of B, force on a straight conductor carrying current in a uniform magnetic field, torque on a current loop, magnetic dipole moment, angular momentum and gyromagnetic ratio, Biot and Savart's Law, Ampere's Law, $\vec{\nabla} \times \vec{B} = \mu_0 \vec{J}$, $\vec{\nabla} \cdot \vec{B} = 0$; Field due to a magnetic dipole magnetization current magnetization vector, Half order field, magnetic permeability (linear cases).
- UNIT - 5** Time Varying Fields Electromagnetic induction, Faraday's Laws, electromotive force $e = -\frac{d\phi}{dt}$, integral and differential forms of Faraday's laws. self and mutual inductance9.transformers,. Maxwell's displacement current, Derivations of Maxwell's equations, electromagnetic field energy density., Poynting's vector. The wave equation satisfied by E and B, plane electromagnetic waves in vacuum, polarization by reflection and total internal reflection. Faraday effect, reflection and refraction by the ionosphere.

COURSE OUTCOMES:-

1. To study the basics of Mathematical Background and to introduce concepts of Electrostatics and magnetics.

PRACTICAL:-

1. To plot graphs showing the variation of magnetic field with distance along the axis of circular coil carrying current and to estimate the radius of the coil.
2. To Determine the Dielectric Constant of different materials.
3. To determine the impedance, phase angle & power factor of R, L & C are connecting in series with the help of LCR Impedance circuit.
4. To determine the resistance per unit length of the Carrey-Foster's bridge wire.
5. To study and verify the Coulomb's law.
6. To determine the radius of a current carrying coil by using current carrying coil measurement unit.
7. To determine the magnetic field with the variation of distance along the axis of current carrying coil.

8. Experiment with Ballistic Galvanometer:

- 8.1 To determine the ballistic constant by steady deflection method by using ballistic galvanometer.
- 8.2 To determine the charge sensitivity of a moving coil ballistic galvanometer using a known capacitor.
- 8.3 To study the comparison of the capacitance of two condensers by using ballistic galvanometer.
- 8.4 To determine the logarithmic decrement for a ballistic galvanometer.

9. Electrostatics Measurement Lab:

- 9.1 To study the charge induction in electrostatics.
- 9.2 To study the charge conduction in electrostatics.
- 9.3 To study the pith ball pendulum with the help of Electroscope.
- 9.4 To study the relative charges of different rods with the help of Digital Display in millivolt.
- 9.5 To study the electrostatic charge with the help of Charge Demonstration Tube.
- 9.6 To study the electrostatics charge by the combination of different rods & clothes.

Note:-

- ❖ **One experiment will be asked in the semester practical examination.**

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CALCULUS, DIFFERENTIAL & VECTOR CALCULUS

COURSE OBJECTIVES:-

- To solve problem using expansion of functions.
- Familiar with curve tracing.
- Apply integral calculus in solving problems.
- To make the student acquire sound knowledge of techniques in solving differential equations.
- Familiar with physical interpretation of divergence and curl of a vector.

Syllabus:

- UNIT – 1** Concept of Partial differentiation, Successive differentiation, Leibnitz theorem, Maclaurin and Taylor series expansions, Asymptotes and Curvature, Tests for concavity and convexity, Points of inflexion. Multiple points. Tracing of curves in cartesian and polar co-ordinates
- UNIT – 2** Integration of irrational algebraic functions and transcendental functions. Reduction formulae. Definite Integrals. Quadrature, Rectification, Volumes and Surfaces of solids of revolution of curves.
- UNIT – 3** Linear equations and equations reducible to the linear form, Exact differential equation First order higher degree equations for x, y, p , Clairaut's form and singular solutions. Linear differential equations with constant coefficients.
- UNIT – 4** Homogenous linear ordinary differential equations, linear differential equations of second order. Transformation of the equation by changing the dependent variable and the independent Variable, Method of variation of parameters, Ordinary simultaneous differential equations.
- UNIT – 5** Vector differentiation. Gradient, Divergence and Curl. Vector integration, Theorem of Gauss (without proof) and problems based on it. Theorem of Green (without proof) and problems based on it. Stoke's theorem (without proof) and problems based on it.

COURSE OUTCOMES:-

- Understanding the ideas and concept of calculus and facility in solving standard examples.
- Fluency in integration using standard methods, including the ability to find an appropriate method for a given integral.
- Fluency in solving differential equations and facility in solving standard examples.
- Understanding the ideas of vector calculus and facility in solving standard examples.

ENTREPRENEURSHIP DEVELOPMENT

COURSE OBJECTIVE:-

The content will be multidisciplinary with the view to cover a whole range of issues pertaining to entrepreneurship and small scale industry.

Syllabus:

- UNIT- I Entrepreneur and Entrepreneurship** –Meaning, definition, significance, need, characteristics, qualities, pre- requisites function, types.
- UNIT- II Industries and Business Organization-** Classification of industries, forms of business organization, procedures, lifecycle, motivation, environment factors, problems
- UNIT- III Institutional Assistance-** Infrastructural, information, guidance, training, technical, financial, marketing, quality control
- UNIT- IV Planning and growth-** Project report, feasibility study, factory location, demand analysis, market potential, project cost, working capital requirement, profit and tax planning.
- UNIT- V Govt. support & promotional agencies-** Regulatory institutions, development organization, self- employment- oriented schemes, grant schemes, special incentives for women, and scheme for backward class, govt. & non govt. project

Practicals:

1. To identify a project and conduct market survey of it.
2. Prepare a project report of yours choice.
3. To collect various formats used in industries/departments or institutions working in the field of entrepreneurship.
4. To collect details of various schemes run by the government for self-employment and entrepreneurship.
5. Develop logical and analytical approach of purchasing the raw material/finished goods.
6. Collect information about market rates, quality and quantity of goods of your choice.
7. Collect information about few small-scale industries situated in city, nearby industrial area.
8. Discuss the problems of small-scale industries.
9. To prepare chart to show various factors affecting entrepreneurship.
10. To prepare case study of successful entrepreneurs.

COURSE OUTCOME: -

After completion of this course the students would be able to understand the relevance of entrepreneurship as a means of management practice in the context of a fast changing organizational structure in a global environment.

COURSE CODE: SMT 802

Text Books:

- Udhymita Vikas : U.C Gupta (Kailash Prakashan)
- Udhymita Vikas (H) : Entrepreneurship Development / by Tribhuvannath Shukl Bhopal : Madhya Pradesh Hindi Granth Academy,
- Varshney, G.K. (2010).Fundamental Of Entrepreneurship, SahityaBhawan Publications
- Agrawal and Mishra (2017) Fundamental Of Entrepreneurship, SahityaBhawan Publications.
- Fundamentals of Entrepreneurship by G.K. Varshney Agra Sahitya Bhawan
- Fundamentals of Entrepreneurship (H) by Avnish Kumar Mishra Agra Sahitya Bhawan
- Fundamentals of Entrepreneurship by H. Nandan New Delhi PHI Learning
- Fundamentals of Entrepreneurship and Small Business Management by Vasant Desai Mumbai Himalaya Publishing House
- Fundamentals of Entrepreneurship : Principles, Policies and Programmes by K.K. Patra Mumbai Himalaya Publishing House
- Fundamentals of Entrepreneurship by Sangram Keshari Mohanty New Delhi PHI Learning

Reference Books:

- Entrepreneurial Development: Dr. S.S. Khanka (S. Chand)
- Entrepreneurship Development: D. Acharya (Himalaya Publication House)
- Entrepreneurship: New Venture Creation by David H. Holt New Delhi PHI Learning

हिन्दी भाषा संवेदना एवं संचार साधन

पाठ्यक्रम के उद्देश्य—

- विद्यार्थियों को भारतीय संवेदना, संस्कृति, वैश्विक चेतना से परिचित कराना।
- धर्म, दर्शन, न्याय, नीति, साहित्य की प्राचीन व नवीन मान्यताओं से परिचित करवाना।
- संचार साधनों से परिचित करवाना।

पाठ्यक्रम:

- सिनेमा, रंगमंच, संगीत, चित्रकला इत्यादि से परिचित करवाना।

इकाई -1

1. भारतीय संस्कृति
2. भारतीय समाज व्यवस्था
3. सभ्यता एवं संस्कार
4. वैश्विक चेतना
5. समन्वयीकरण भारतीय एवं अंतर्राष्ट्रीय संदर्भ में

इकाई -2

1. धर्म
2. न्याय
3. दर्शन
4. नीति
5. साहित्य

इकाई -3

1. संचार साधन रू संपर्क के नए क्षितिज
2. समाचार पत्र
3. भारतीय प्रेस परिषद्
4. रेडियो
5. दूरदर्शन

इकाई -4

1. सिनेमा
2. रंगमंच
3. संगीत
4. चित्र, मूर्ति, स्थापत्य कला
5. शिल्प कला

इकाई -5

1. कम्प्यूटर
2. दूरभाष सौगात विज्ञान की
3. मंत्र रू कहानीद्ध प्रेमचंद
4. मातृ भूमिगुप्त मैथिलीशरण रू कविताद्ध
5. साहित्यकार का दायित्व डॉ. भारती प्रेम ष

अपेक्षित परिणाम:

1. विद्यार्थी आधुनिक संचार संसाधनों के प्रयोग में कुशल हो सकेंगे।
2. भारत की धर्म, दर्शन, नीति, संस्कृति, सभ्यता, संस्कारों इत्यादि के प्रति ज्ञान प्राप्त कर कुशल एवं संवेदनशील नागरिक बन सकेंगे।

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BASIC INFORMATION & COMPUTER TECHNOLOGY-II

Course Objective:

To educate students to analyze , design , integrate & manage information systems using information technology.

Syllabus:

UNIT – I: Word Processing: Word

- MS Word: features, Creating, Saving and Operating Multi document windows, Editing Text selecting, Inserting, deleting moving text.
- Previewing documents, Printing document to file page. Reduce the number of pages by one.
- Formatting Documents: paragraph formats, aligning Text and Paragraph, Borders and shading, Headers and Footers, Multiple Columns.

इकाई-1: वर्डप्रोसेसिंग

- वर्डप्रोसेसिंग का परिचय
- एम. एस वर्ड: फीचर्स, क्रीएटिंग, सेविंग एवं ओपनिंग, मल्टी डॉक्यूमेंट विंडोस, एडिटिंग टेक्स्ट सिलेक्टिंग, इंसर्टिंग, डिलीटिंग टेक्स्ट।
- प्रीव्यूविंग डॉक्यूमेंट्स, प्रिंटिंगडॉक्यूमेंट फ्रॉम दि स्टेण्डर्ड टूलबार, प्रिंट डॉक्यूमेंट फ्रॉम दि स्टेण्डर्ड टूलबार, डॉक्यूमेंट को मीनू द्वारा प्रिंट करना, प्रिंटिंग ए डॉक्यूमेंट इन ए फाइल पेज, पेजों को कम करना।
- फॉरमेटिंग डॉक्यूमेंट्स: पैराग्राफ फारमेट, अलाइनिंग टेक्स्ट एंड पैराग्राफ, बार्डर एवं हेडर्स एवं फुटर्स, मल्टीपल कॉलम्स।

UNIT – II: Introduction to Excel& Worksheet

- Worksheet basic.
- Creating worksheet, entering data into worksheet, heading information, data text, dates, alphanumeric, values, saving & quitting worksheet.
- Opening and moving around in an existing worksheet.
- Toolbars and Menus, keyboard shortcuts.
- Working with single and multiple workbook coping, renaming, moving, adding and deleting. coping entries and moving between workbooks.
- Working with formulas & cell referencing.
- Autosum.
- Coping formulas
- Absolute & Relative addressing.

इकाई-2: एक्सेल एवं वर्कशीट का परिचय

- एक्सेल एंड वर्कशीट
- वर्कशीट का आधार, वर्कशीट बनाना, वर्कशीट में डाटा एंटर करना, हेडिंग इंफॉर्मेशन, डाटा टेक्स्ट डेट, अल्फा न्यूमेरिक, वेल्यूज, सेविंग और वर्कशीट छोड़ना।
- पहले बनी हुई वर्कशीट को खोलना तथा चलाना।
- टूलबार मीनू और कीबोर्ड के शॉर्टकट।
- एक एवं अनेक वर्कशीट पर काम करना, कॉपी, रिनेमिंग, मूविंग, एडिंग एंड डिलीटिंग, एन्टीज को कॉपी तथा विभिन्न वर्कशीट में ले जाना।

- फॉर्मूला एवं सेल रिफ्रेशिंग के साथ काम करना।
- ऑटो सम फॉर्मूला को कॉपी करना, एक्सल्यूट एंड रिलेटिव एड्रेसिंग।

UNIT – III: INTRODUCTION TO POWER POINT

- Features and various versions.
- Creating presentation using Slide master and template in various colour scheme.
- Working with slides make new slide move, copy, delete, duplicate, lay outing of slide, zoom in or out of a slide.
- Editing and formatting text: Alignment, editing, inserting, deleting, selecting, formatting of text, find and replace text.

इकाई-3: पॉवरपाइंट का परिचय-1

- फीचर्स एंड विभिन्न वर्जन्स
- प्रजेन्टेशन तैयार करना स्लाइड मास्टर एवं टेम्पलेट इन वेरियस कलर स्कीम।
- पॉवरपाइंट के भिन्न व्यू के साथ काम करना एवं पॉवरपाइंट के मेन्यू।
- स्लाइड के साथ काम करना, नये स्लाइड तैयार करना एवं मूव करना, कॉपी करना, डिलीट करना, डुपलीकेट स्लाइड तैयार करना, ले-आउटिंग करना, जूम इन और आउट करना।
- एडिटिंग एवं फॉर्मेटिंग टेक्स्ट: अलाइनमेंट, एडिटिंग, इनसर्टिंग, डिलीटिंग, सिलेक्टिंग, फॉर्मेटिंग ऑफ टेक्स्ट, फाईन्ड एवं रिप्लेस टेक्स्ट।

UNIT – IV: POWER POINT – II

- Bullets , footer, paragraph formatting, spell checking.
- Printing presentation Print slides, notes, handouts and outlines.
- Inserting objects Drawing and Inserting objects using Clip Arts picture and charts.
- Slide sorter, slide transition effect and animation effects.
- Presenting the show making stand alone presentation, Pack and go wizards.

इकाई-4: पॉवरपाइंट का परिचय-2

- बुलेट्स, फुटर, पैराग्राफ फॉर्मेटिंग, स्पेल चेकिंग।
- प्रिंटिंग प्रजेन्टेशन, प्रिंट स्लाइड्स, नोट्स, हेण्डआउट एवं आउट लाईन्स।
- इंसर्टिंग आब्जेक्ट, ड्राइंग एवं इंसर्टिंग ऑब्जेक्ट्स क्लिपआर्ट पिक्चर्स एवं चार्ट्स का प्रयोग करना।
- स्लाइड्स सोर्टर, स्लाइड ट्रांजिशन के प्रभाव एवं अन्य ऐनिमेशन प्रभाव।
- प्रजेटिंग शो मेकिंग स्टैंड अलोन प्रजेन्टेशन, पके एवं गोविजार्ड।

UNIT – V: INTRODUCTION OF INTERNET

Evolution, Protocol, concept, Internet, Dial-up connectivity, leased line, VSAT, Broad band, URLs, Domain names, Portals. E-mail, Pop & web based Email. Basic of sending and receiving Emails, Email

& Internet Ethics, Computer virus, Antivirus software wage, Web Browsers.

इकाई-5: इंटरनेट का परिचय:

इवोल्यूशन, प्रोटोकॉल, विचारधारा, इंटरनेट, डायल अप कनेक्टिविटी, डीज्डलाइन, वीएसटी, ब्रोडबैंड, यू.आर.एल्स., डोमेननेम्स, पोस्टल्स, ई-मेल, पॉप एवं वेब बेस्डई-मेल, बेसिक्स ऑफ सेडिंग एवं रिसीविंग इमेल्स, ई-मेल एवं इंटरनेट एथिक्स, कम्प्यूटर वायरस, एंटी वायरस सॉफ्टवेयर, वेब ब्राउसर।

PRACTICALS:

MS- Power Point:

Creating new slide, formatting slide layout, slide show & sorter, Inserting new slide, slide no., date, time, chart, formatting slide, tool operation.

List of suggested practical work:

- Under standing of a dial up connection through modern.
- Configuring a computer for an e-mail and using outlook Express or Netscape Messenger.
- Registration an e-mail address.
- Understanding of e-mail drafting.
- Understanding of address book maintenance for e-mail.
- Understanding of different mail program tools.
- Send and receive functions of e-mail.

Course outcome:

Student will be able to use computer system easily and they will get knowledge about how to use different type of operating system.

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PHYSICAL, INORGANIC & ORGANIC CHEMISTRY**Syllabus:****Physical Chemistry**

UNIT – I Thermodynamics-I Definition of thermodynamic terms: System, surrounding, Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic 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's Law: Joule Thomson coefficient and inversion temperature.
 Calculation of w , q , dU and dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process. Thermochemistry: Standard state, standard enthalpy of formation: Hess's Law of heat summation and its application. Heat of reaction at constant pressure and at constant volume. Enthalpy of neutralization. Bond dissociation energy and its calculation from thermochemical data, temperature dependence of enthalpy, Kirchoff's equation.
 Second Law of Thermodynamics- Need for the law, different statements of the law, Carnot cycle and its efficiency. Carnot theorem. Thermodynamic scale of temperature.

UNIT – II Thermodynamics-II (a) Concept of entropy: Entropy as a state function, entropy as a function of P&T, entropy change in physical change, Clausius inequality, entropy as criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases. Third Law of Thermodynamics: Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data, Gibbs and Helmholtz functions, Gibbs function (G) and Helmholtz function(A) as a thermodynamic quantities, A and G as a criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G and A with P, V and T.
 (b) Chemical equilibrium Equilibrium constant and free energy. Thermodynamic derivation of law of mass action. Le Chateliers's principle. Reaction isotherm and reaction isochore: Clapeyron equation and Clausius- Clapeyron equation, applications.
 (c) Buffers: Mechanism of buffer action, Henderson-Hazel equation, Hydrolysis of salts.
 (d) Corrosion: types, theories and methods of combating it.

Inorganic Chemistry

UNIT – III Chemistry of elements of I transition series: Characteristic properties of d-block elements. Properties of the elements of the first transition series, their binary compounds such as carbides, oxides and sulphides. Complexes illustrating relative stability of their oxidation states, coordination number and geometry chemistry of elements of II and III transition series: General characteristics, comparative treatment with their 3d-analogues in respect of ionic radii, oxidation states, magnetic behaviour, spectral properties and stereochemistry

UNIT – IV (a) Coordination Compounds: Werner's coordination theory and its experimental verification, EAN Concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, VBT of transition metal complexes.

(b) Oxidation and Reduction: Use of redox potential data, analysis of redox cycle, redox stability in H₂O: Frost, Latimer and Pourbaix diagram. Principles involved in the extraction of elements.

Organic Chemistry

UNIT – V

(a) Electromagnetic Spectrum: Absorption Spectra; UV absorption spectroscopy: Absorption laws (Beer-Lambert law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation.

Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones. IR absorption spectroscopy; molecular vibrations, Hook's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds.

(b) Alcohols: Classification and nomenclature. Monohydric alcohols: nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding, acidic nature, reactions of alcohols. Dihydric alcohols: nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [Pb(OAc)₄ and HIO₄] and pinacole-pinacolone rearrangement. Trihydric alcohols-nomenclature and methods of formation, chemical reactions of glycerol

(c) Phenols: Nomenclature, structure and bonding. Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols: resonance stabilization of phenoxide ion. Reactions of phenols: electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben-Hoesch reaction, Lederer-Manasse reaction and Riemeier-Tiemann reaction

(d) Ethers and Epoxides Nomenclature of ethers and methods of their formation, physical properties. Chemical reactions: cleavage and auto oxidation. Ziesel's method. Synthesis of epoxides. Acid and base-catalysed ring opening of epoxides, orientation of epoxide ring opening, reaction of Grignard and organolithium reagents with epoxides.

PRACTICAL:-

Time: 6 hours

Inorganic Chemistry 18 marks

Calibration of the fractional weights, pipettes and burettes. Preparation of standard solutions. Dilution of 0.1 M to 0.001 M solutions.

Quantitative analysis -Volumetric analysis.

(a) Determination of acetic acid in commercial vinegar using NaOH.

(b) Determination of alkali content- antacid tablet using HCl.

(c) Estimation of calcium content in chalk as calcium oxalate by permanganometry.

(d) Estimation of hardness of water by EDTA

Gravimetric analysis:

Barium as barium sulphate

Organic Chemistry Laboratory Techniques 18 marks

A. Thin layer chromatography

Determination of R_f values and identification of organic compounds.

(a) Separation of green leaf pigments (spinach leaves may be used).

(b) Preparation and separation of 2,4-dinitrophenylhydrazones of acetone, 2-butanone, hexane-2 and 3-one using toluene and light petroleum (40:6).

(c) Separation of a mixture of dyes using cyclohexane and ethylacetate (8:5:1.5). B. Paper chromatography: Ascending and Circular Determination of R_f values and identification of organic compounds

- (a) Separation of a mixture of phenylalanine and glycine, alanine and aspartic acid, leucine and glutamic acid. Spray reagent ninhydrin.
- (b) Separation of a mixture of DL-alanine, glycine and L-leucine using n-butanol: acetic acid: water (4:1:5). Spray reagent ninhydrin.
- (c) Separation of monosaccharides- a mixture of D-galactose and D-fructose using n-butanol: acetone: water (4:1:5). Spray reagent-aniline hydrogen phthalate.

COURSE OUTCOME:-

Upon successful completion of this course, students will understand kinetics, equilibrium, LeChatelier's principle, acid and base reactions, pH, buffers, colligative properties, and electrochemical applications in an undergraduate laboratory.

Understand the first law of thermodynamics and the role of energy and enthalpy in chemical reactions and perform thermochemical calculations.

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ANALYTICAL METHODS IN CHEMISTRY

- UNIT – I Qualitative and quantitative aspects of analysis:** Sampling, evaluation of analytical data, errors, accuracy and precision, methods of their Expression, normal law of distribution if indeterminate errors, statistical test of data; F, Q and t test, rejection of data, and confidence intervals.
- UNIT – II Optical methods of analysis:** Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law. *UV-Visible Spectrometry:* Basic principles of instrumentation (choice of source, mono chromator and detector) for single and double beam instrument;
- UNIT – III Basic principles of quantitative analysis:** estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers. Determination of composition of metal complexes using Job's method of continuous variation and mole ratio method.
- UNIT – IV Infrared Spectrometry:** Basic principles of instrumentation (choice of source, mono chromator & detector) for single and double beam instrument; sampling techniques. Structural illustration through interpretation of data, Effect and importance of isotope substitution.
- UNIT – V Flame Atomic Absorption and Emission Spectrometry:** Basic principles of instrumentation (choice of source, mono chromator, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples.

Thermal methods of analysis:

Theory of thermo gravimetry (TG), basic principle of instrumentation. Techniques for quantitative estimation of Ca and Mg from their mixture.

Electroanalytical methods:

Classification of electroanalytical methods, basic principle of pH metric, potentiometric and conduct metric titrations. Techniques used for the determination of equivalence points. Techniques used for the determination of pK_a values.

Separation techniques:

Solvent extraction: Classification, principle and efficiency of the technique.

Mechanism of extraction: extraction by solvation and chelation.

Technique of extraction: batch, continuous and counter current extractions.

Qualitative and quantitative aspects of solvent extraction: extraction of metal ions from aqueous solution, extraction of organic species from the aqueous and nonaqueous media.

Chromatography: Classification, principle and efficiency of the technique.

Mechanism of separation: adsorption, partition & ion exchange.

Development of chromatograms: frontal, elution and displacement methods.

Qualitative and quantitative aspects of chromatographic methods of analysis: IC, GLC, GPC, TLC and HPLC.

Stereoisomeric separation and analysis: Measurement of optical rotation, calculation of Enantiomeric excess (ee)/ diastereomeric excess (de) ratios and determination of enantiomeric composition using NMR, Chiral solvents and chiral shift reagents. Chiral chromatographic techniques using chiral columns (GC and HPLC).

Role of computers in instrumental methods of analysis.

Reference Books:

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

PRACTICALS- DSE LAB: ANALYTICAL METHODS IN CHEMISTRY

I. Separation Techniques

1. Chromatography:

(a) Separation of mixtures

(i) Paper chromatographic separation of Fe^{3+} , Al^{3+} , and Cr^{3+} .

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

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

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

II. Solvent Extractions:

(i) To separate a mixture of Ni^{2+} & Fe^{2+} by complexation with DMG and extracting the Ni^{2+} - DMG complex in chloroform, and determine its concentration by spectrophotometry.

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

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

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

5. Analysis of soil:

(i) Determination of pH of soil.

(ii) Total soluble salt

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

6. Ion exchange:

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

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

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

III Spectrophotometry

1. Determination of pK_a values of indicator using spectrophotometry.

2 Structural characterization of compounds by infrared spectroscopy.

3 Determination of dissolved oxygen in water.

4 Determination of chemical oxygen demand (COD).

5 Determination of Biological oxygen demand (BOD).

6 Determine the composition of the Ferric-salicylate/ ferric-thiocyanate complex by Job's method.

Reference Books:

- Mendham, J., *A. I. Vogel's Quantitative Chemical Analysis 6th Ed.*, Pearson, 2009.
- Willard, H.H. *et al.: Instrumental Methods of Analysis*, 7th Ed. Wardsworth Publishing Company, Belmont, California, USA, 1988.
- Christian, G.D. *Analytical Chemistry*, 6th Ed. John Wiley & Sons, New York, 2004.
- Harris, D.C. *Exploring Chemical Analysis*, 9th Ed. New York, W.H. Freeman, 2016.
- Khopkar, S.M. *Basic Concepts of Analytical Chemistry*. New Age International Publisher, 2009.
- Skoog, D.A. Holler F.J. and Nieman, T.A. *Principles of Instrumental Analysis*, Cengage Learning India Edition.
- Mikes, O. & Chalmes, R.A. *Laboratory Handbook of Chromatographic & Allied Methods*, Elles Harwood Ltd. London.
- Ditts, R.V. *Analytical Chemistry: Methods of separation*. Van Nostrand, New York, 1974.

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KINETIC THEORY OF GASES, THERMO-DYNAMICS AND STATISTICAL MACHANICS

COURSE OBJECTIVES:-

1. To express the basic assumption of the kinetic theory of gases.
2. Students learns the different laws of Thermodynamics.
3. To learn Thermodynamically function and their relations.

Syllabus:

- UNIT – 1** Kinetic Theory of Gases: Ideal Gas Kinetic model, deduction of Boyle's law, interpretation of temperature, estimation of rms speeds of molecules. Brownian motion, estimation of the Avogadro number. Law of Equipartition of energy, specific heat of monatomic gas, extension to di- and tri- atomic gases, behavior at low temperatures. Adiabatic expansion of an ideal gas, applications to atmospheric physics. Real Gas: Van der Waals gas, Equation of state, nature of Vander Waals forces, comparison with experimental P-V curves. The critical constants; gas and vapour. Joule expansion of ideal gas and Vander Waals gas, Joule coefficient, estimates of J-T cooling. Liquefaction of gases: Boyle temperature and inversion temperature. Principle of regenerative cooling, liquefaction of hydrogen and helium. Refrigeration cycle, meaning of efficiency.
- UNIT – 2** Thermodynamics The laws of thermodynamics: The Zeroth law, first law of thermodynamics, internal energy as a state function and other applications. Reversible and irreversible changes, Carnot cycle and its efficiency, Carnot theorem and the second law of thermodynamics, Entropy,. The thermodynamic scale of temperature; its identity with the perfect gas scale. Impossibility of attaining the absolute zero; third law of thermodynamics. Thermodynamic relationships: Thermodynamic variables: Maxwell's general relationships, application to Joule – Thomson cooling and adiabatic cooling in a general system, Clausius-Clapeyron Latent heat equation. Cooling due to adiabatic demagnetization, Production and measurement of very low temperatures.
- UNIT – 3** Statistical Physics The statistical basis of thermodynamics: Probability and thermodynamic probability, principle of equal a priori probabilities, probability distribution and its narrowing with increase in number of particles. The expressions for average properties. Constraints, accessible and inaccessible states, distribution of particles with a given total energy into a discrete set of energy states. Some universal laws: The μ space representation, division of μ space into energy states and into phase cells of arbitrary size, applications to one-dimensional harmonic oscillator and free particles. Equilibrium between two systems in thermal contact, bridge with macroscopic physics. Probability and entropy, Boltzmann entropy relation. Statistical interpretation of second law of thermodynamics. Boltzmann canonical distribution law and its applications; Rigorous form of equipartition of energy.
- UNIT - 4** Maxwellian distribution of speeds in an ideal gas Distribution of speeds and velocities, experimental verification, distinction between mean, rms and most probable speed values. Doppler broadening of spectral lines. Black Body Radiation :Pure temperature dependence, Stefan-Boltzmann law, pressure of radiation, Spectral distribution of Black Body radiation. Wien's displacement law, Rayleigh-Jean's law, the ultraviolet catastrophe, Planck's quantum postulates, Planck's law, complete fit with experiment. Interpretation of behaviour of specific heats of gases at low temperature.
- UNIT - 5** Quantum Statistics Transition to quantum statistics; “h” as a natural constant and its implications, cases of particle in a one dimensional box and one-dimensional harmonic oscillator. Indistinguishability of particles and its consequences, Bose- Einstein and Fermi-Dirac conditions; applications to liquid helium,

Free electrons in a metal, and photons in blackbody chamber. Fermi level and Fermi energy. Transport Phenomena : Transport phenomena in gases; Molecular collisions, mean free path and collision cross sections. Estimates of molecular diameter and mean free path. Transport of mass, momentum and energy and interrelationship, dependence on temperature and pressure.

COURSE OUTCOMES:-

1. understand the concept of Thermodynamics and their laws.
2. Describe the Thermodynamics function and their relations.
3. Student learn about the concepts of Quantum Statics.

PRACTICAL:-

1. To determine the mechanical equivalent of heat of the water (J) by using Callendar & Barne's method.
2. To study and verify the Stefan's law by electrical method.
3. To study the temperature dependence of total radiation and hence, to verify the Stefan's law.
4. To determine the grid voltage plate current characteristics of a Triode valve (6C5) and then to find the triode constants.
5. To determine the plate current I_P for different plate voltage V_P when grid voltage V_G remains fixed.
6. To study and plot the plate characteristics for different values of grid voltage V_G .
7. To study and plot the transfer characteristic for different values of plate voltage V_P .
8. To determine the Coefficient of Thermal Conductivity of bad conductors of given material by Lee's Disc method.
9. Study of Brownian motion.

Note:-

- ❖ One experiment will be asked in the semester practical examination.

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CALCULUS, DIFFERENTIAL EQUATION AND MECHANICS

COURSE OBJECTIVES:-

- The goal of this course is for students to gain proficiency in calculus computations..
- To make the student acquire sound knowledge of sequences, series and their convergence.
- To familiarize the student with Laplace and inverse Laplace transforms as well as applications of Laplace transformation in solving linear differential equations.
- To acquaint the student with mechanics.

Syllabus:

- UNIT – 1** Definition of a sequence. Theorems on limits of sequences. Bounded and monotonic sequences. Cauchy's convergence criterion . Series of non-negative terms. Comparison test, Cauchy's integral test, Ratio test. Raabe's test ,logarithmic test. Leibnitz's theorem. Absolute and conditional convergence.
- UNIT – 2** Continuity of functions of one variable , sequential continuity. Properties of continuous functions. Uniform continuity. Chain rule of differentiability. Mean value theorems and their geometrical interpretations. Darboux's intermediate value theorem for derivatives. Limit and continuity of functions of two variables.
- UNIT - 3** Series Solution of Differential Equations-Power series Method, Bessel's Equation Bessel's function and its properties, recurrence and generating relations. Legendre's
- UNIT – 4** Laplace transformations, Linearity of the Laplace transformation, Existence theorem of Laplace transforms, Laplace transforms of derivatives and integrals. Shifting theorem . Differentiation and integration of transforms. Inverse Laplace transforms, Convolution theorem. Applications of Laplace transformation in solving linear differential equations with constant coefficients.
- UNIT - 5** Analytical conditions of equilibrium of Coplanar forces. Catenary. Forces in three dimensions. Velocities and accelerations along Radial and transverse direction.

COURSE OUTCOMES:-

- Understanding the ideas of sequences and series and ability to find their convergence.
- Understanding of the ideas of limit and continuity and an ability to calculate with them and apply them for function of one and two variables.
- Understanding of the ideas of differential equation and facility in solving standard examples.
- Understanding the ideas of Laplace and inverse Laplace transforms facility in solving standard examples and apply them.
- Understanding of the ideas of Mechanics and facility in solving simple standard examples.

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DATA ENTRY OPERATIONS

Course Objective:-

- 1 To understand the basic knowledge of computer
- 2 To understand the assembly-level programming
- 3 To understand the input output devices, storage media, and memory

Syllabus:

Theory :

UNIT-1

Basics of Computer: Computer Organization, Input and Output Devices, System Software and Application Software, Computer Language, Compiler and Assembler.

Operating System: Elements of Windows XP, Desktop Elements, Locating Files and Folders, Changing System Setting, File Management in Windows, Installation of Software and Hardware.

UNIT-2

Basics of Word Processing: Starting Word Program, Word Screen Layout ,Typing Screen Objects, Managing Documents, Protecting and Finding Documents, Printing Documents

Formatting Documents: Working with text, Formatting Text, Formatting Paragraphs, Bulleted and Numbered Lists, Copying and Moving Text, Spelling and Grammar, Page Formatting, Creating Tables, Mail Merge.

UNIT-3

Types of document in Mail merge: Creating data Source, Creating Mailing Labels, Creating Mailing Labels, Merging Data into Main Document.

Basics of Spreadsheet: Selecting, Adding and Renaming Worksheets, Modifying a Worksheet, Resizing Rows and Columns, Workbook Protection.

UNIT-4

Formatting Worksheets: Formatting Toolbar, Formatting Cells, Formatting Rows and Columns, Formatting Worksheets Using Styles, Protect and Unprotect Worksheets.

Formulas, Functions and Charts: Formulas and Functions, Copying a Formula, Types of Functions, Types of Charts, Auto Shapes and Smart art.

UNIT-5

Creating Presentation: Creating Slides, Slide Sorter View, Changing Slide Layouts, Moving Between Slides.

Introduction to Internet: Getting Connected to Internet, Types of Internet Connections, Internet Terminology, Understanding Internet Address, Web Browser and Internet Services.

Course Outcomes:-

After studying this student will be able to know about terms and concepts of Microsoft suite completely.(like MS-word, power-point-excel sheets, outlook express)

Practicals

1. To study the features of MS-Office 2007 such as MS-Word, MS-Excel, MS-Power point and MS-Access
2. To create a document using mail merge in MS-Word.
3. To create a document for type the mathematical equation in MS-Word.
4. To create a employees work detail list using MS-Excel
5. To calculate student mark details using MS-Excel.
6. To Import External Data, Sort and Filter using MS-Excel.
7. To create a database using MS-Access.
8. To generate report using MS-Access.
9. To create a presentation text and images with effects using MS-Power point.
10. To create a presentation with effects using animation and sound effects.
11. To create a document using mail merge in MS-Word.

Reference Books:

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ENGLISH LANGUAGE AND SCIENTIFIC TEMPER

COURSE OBJECTIVES:-

- To Study the basic language skills (speaking, listening, reading, and writing) and grammar.
- Comprehensive study of different kinds of letters and applications.

Syllabus:

UNIT – I

- | | |
|----------------------|--------------------------------------|
| 1. Tina Morris | : Tree |
| 2. Nissim Ezekiel | : Night of the Scorpion |
| 3. C.P. Snow | : Ramanujan |
| 4. Roger Rosenblatt | : The Power of WE |
| 5. George Orwell | : What is Science? |
| 6. C.Rajagopalachari | : Three Questions |
| 7. Desmond Morris | : A short extract from the Naked Ape |
| 8. A.G. Gardiner | : On the rule of the road |

UNIT – II Comprehension of an unseen passage.

UNIT – III Letter Writing : Formal Letters, Informal letters, Applications.

UNIT – IV Report Writing.

UNIT – V Language Skills

Correction of common errors in sentence structure : usage of pronouns, subject/ verb agreement word order, gender; compound nouns, collective nouns, possessives, articles and prepositions. (advanced)

COURSE OUTCOMES:-

- Student will be able to understand correct use of grammar and language skills.
- Student will be familiar with different prose and poetry.
- Student should be able to write analytically in a variety of formats, including essays, report writing and application.

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HUMAN VALUES AND ETHICS

COURSE OBJECTIVES:-

- To help students understand the basic guidelines, content and process of Human value and value crisis in contemporary Indian Society
- To help students understand the meaning of happiness and prosperity for a human being.
- To help students reflect critically on gender violence .
- To facilitate the students to understand harmony at all the levels of human living, and live accordingly.

Syllabus:

UNIT – I: Concept of value and value crisis in contemporary Indian Society.

1. Concept of value
2. Value crisis at- individual level
3. Value crisis at- Cultural level
4. Value crisis at- Societal level
5. The Indian concept of value.
6. Modern Approach to the study of Values.

UNIT – II: Moral and Ethical Human values.

1. Bases for Moral Judgment
2. Some Canons of Ethics
3. Ethics of Duty
4. Ethics of Responsibility
5. Factors to be considered in making Ethical Judgments.
6. Continuous Happiness and Prosperity- A look at basic Human Aspirations.

UNIT – III: Moral Values in Profession.

1. What is Profession?
2. Professional Ethos
3. Code of Professional Ethics
4. Corporate social Responsibility

UNIT – IV: Gender sensitization.

1. Socialization of Women
2. Demographic consequences
3. Domestic Violence
4. Women's work, its politics and economics , fact and fiction ,Unrecognized and unaccounted work

UNIT – V: Co- Curricular Activities and value Education.

1. Games and sports
2. Literary and cultural Activities
3. NSS, NCC activities
4. A New Approach to Human Value Freedom, Creativity Love & Wisdom

COURSE OUTCOMES:-

On completion of this course, the students will be able to: Understand the significance of value inputs in a classroom and start applying them in their life and profession

1. Understand the value of harmonious relationship based on trust and respect in their life and profession.
2. Students will develop a sense of appreciation of women in all walks of life .
3. Understand the role of a human being in ensuring harmony in society and nature.

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PHYSICAL, INORGANIC & ORGANIC CHEMISTRY

Syllabus:

Physical Chemistry

- UNIT – I** Phase equilibrium Statement and the meaning of the terms: phase component and the degree of freedom, derivation of the Gibbs phase rule. Phase equilibria of one component system: water, CO₂ and S system. Phase equilibria of two component system: solid liquid equilibria, simple eutectic: Bi-Cd, Pb-Ag system, desilverisation of lead. Solid solutions: compound formation with congruent melting point (Mg-Zn) and incongruent melting point, (NaCl-H₂O) (FeCl₃-H₂O) and (CuSO₄-H₂O) system. Freezing mixtures, acetone-dry ice. Liquid-liquid mixtures: Ideal liquid mixtures, Raoult's and Henry's law. Non-ideal system azeotropes: HCl-H₂O and ethanol water systems. Partial miscible liquids: Phenol-water, trimethylamine-water and nicotine-water systems. Lower and upper consolute temperature. Effect of impurity on consolute temperature. Immiscible liquids, steam distillation, Nernst distribution law: thermodynamic derivation, applications.
- UNIT – II** Electrochemistry Electrical transport- conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of specific conductance and equivalent conductance with dilution. Migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law, its uses and limitations. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Transport number: Definition and determination by Hittorf method and moving boundary method. Application of conductivity measurements: determination of degree of dissociation, determination of K_a of acids, determination of solubility product of sparingly soluble salt, conductometric titrations. Types of reversible electrodes: gas-metal ion, metal-metal ion, metal- insoluble salt-anion and redox electrodes. Electrode reactions, Nernst equation, derivation of cell E.M.F and single electrode potential, standard hydrogen electrode- reference electrodes-standard electrode potential, sign conventions, electrochemical series and its significance. Electrolytic and Galvanic cells, reversible and irreversible cells. Conventional representation of electrochemical cells. EMF of a cell and its measurements. Computation of cell EMF. Calculation of thermodynamic quantities of cell reaction (G, H and K), polarization, over potential and hydrogen over voltage. Concentration cell with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titration. Definition of pH and pK, determination of pH using hydrogen, quinhydrone and glass electrodes by potentiometric methods.
- UNIT - III** (a) Chemistry of Lanthanides Elements: electronic structure, oxidation states, ionic radii and lanthanide contraction, complex formation, occurrence and isolation of lanthanide compounds.
 (b) Chemistry of Actinides: General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from U, Similarities between the later actinides and later lanthanides.
 (c) Acids and Bases: Arrhenius, Brønsted-Lowry, Lux-Flood, Solvent system and Lewis concepts of acids and bases.
 (d) Non-aqueous Solvents: Types of solvents and their general characteristics, reaction in non-aqueous solvents with reference to liquid NH₃ and liquid SO₂

Organic Chemistry

UNIT – IV

(a) Aldehydes and ketones: Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes and ketones from acid chlorides, synthesis of aldehydes and ketones using 1,3-dithianes, synthesis of ketones from nitriles and from carboxylic acids. Physical properties. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Wittig reaction, Mannich reaction.

Use of acetals as protecting group. Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction. Meerwein-Ponndorf-Verley (MPV), Clemmensen, Wolf-Kishner, LiAlH_4 and NaBH_4 reductions, Halogenation of enolizable ketones. An introduction of alpha, beta unsaturated aldehydes and ketones

(b) Carboxylic Acids: Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids, reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction.

Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids. Mechanism of decarboxylation. Methods of formation and chemical reactions of unsaturated monocarboxylic acids. Dicarboxylic acids: Methods of formation and effect of heat and dehydrating agents. Methods of formation and chemical reactions of halo acids, hydroxy acids, malic, tartaric and citric acids.

Carboxylic acid derivatives Structure and nomenclature of acid chlorides, esters, amides (urea) and acid anhydrides. Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution. Preparation of carboxylic acid derivatives, chemical reactions. Mechanism of esterification and hydrolysis (acidic and basic).

UNIT – V

Organic Compounds of Nitrogen Preparation of nitroalkanes and nitroarenes. Chemical reaction of nitroalkanes. Mechanism of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media, Picric acid.

Halonitroarenes: reactivity, structure and nomenclature. Structure and nomenclature of amines, physical properties and stereochemistry of amines. Separation of mixture of primary, secondary and tertiary amines. Structural features affecting basicity of amines. Amine salt as phase transfer catalysts. Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles), reductive amination of aldehydic and ketonic compounds. Gabriel-Phthalamide reaction, Hoffmann bromamide reaction, Reactions of amines, electrophilic aromatic substitution in aryl amines, reaction of amines with nitrous acid. Synthetic transformation of aryl diazonium salts, azo coupling.

PRACTICAL:-

Organic Chemistry

Qualitative analysis

Identification of an organic compound through the functional group analysis, determination of melting point and preparation of suitable derivatives.

Physical Chemistry

Transition temperature

1. Determination of transition temperature of given substance by thermometric, dilatometric method (e.g.) ($\text{MnCl}_2 \cdot 4\text{H}_2\text{O}$ / $\text{SrBr}_2 \cdot 2\text{H}_2\text{O}$).

Phase equilibrium

1. To study the effect of solute (e.g. NaCl, succinic acid) on the critical solution temperature of two partially miscible liquid (e.g., phenol water system) and to determine the concentration of that soluble in phenol water system.

2. To construct the phase diagram of two component (e.g., diphenyl amine/benzophenone) by cooling curve method.

Thermo chemistry

1. To determine the enthalpy of neutralization of weak acid/weak base versus strong acid/strong base and determine the enthalpy of ionization of the weak acid/ base.

Inorganic chemistry-Quantitative Volumetric Analysis

1. Estimation of ferrous and ferric by dichromate method.
2. Estimation of copper using thiosulphate.

COURSE OUTCOME :-

Upon successful completion of this course students will describe the bonding and properties of transition metal coordination compounds

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INDUSTRIAL CHEMICAL & ENVIRONMENT

UNIT – I Industrial Gases and Inorganic Chemicals *Industrial Gases*: Large scale production, uses, storage and hazards in handling of the following gases: oxygen, nitrogen, argon, neon, helium, hydrogen, acetylene, carbon monoxide, chlorine, fluorine, sulphur dioxide and phosgene.

UNIT – II *Inorganic Chemicals*: Manufacture, application, analysis and hazards in handling the following chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda, common salt, borax, bleaching powder, sodium thiosulphate, hydrogen peroxide, potash alum, chrome alum, potassium dichromate and potassium permanganate.

UNIT – III Industrial Metallurgy Preparation of metals (ferrous and nonferrous) and ultrapure metals for semiconductor technology.

UNIT – IV Environment and its segments Ecosystems. Biogeochemical cycles of carbon, nitrogen and sulphur. Air Pollution: Major regions of atmosphere. Chemical and photochemical reactions in atmosphere. Air pollutants: types, sources, particle size and chemical nature; Photochemical smog: its constituents and photochemistry. Environmental effects of ozone, Major sources of air pollution. Pollution by SO₂, CO₂, CO, NO_x, H₂S and other foul smelling gases. Methods of estimation of CO, NO_x, SO_x and control procedures.

Effects of air pollution on living organisms and vegetation. Greenhouse effect and Global warming, Ozone depletion by oxides of nitrogen, chlorofluorocarbons and Halogens, removal of sulphur from coal. Control of particulates. *Water Pollution*: Hydrological cycle, water resources, aquatic ecosystems, Sources and nature of water pollutants, Techniques for measuring water pollution, Impacts of water pollution on hydrological and ecosystems. Water purification methods. Effluent treatment plants (primary, secondary and tertiary treatment). Industrial effluents from the following industries and their treatment: electroplating, textile, tannery, dairy, petroleum and petrochemicals, agro, fertilizer, etc. Sludge disposal. Industrial waste management, incineration of waste. Water treatment and purification (reverse osmosis, electro dialysis, ion exchange). Water quality parameters for waste water, industrial water and domestic water.

UNIT – V Energy & Environment Sources of energy: Coal, petrol and natural gas. Nuclear Fusion / Fission, Solar energy, Hydrogen, geothermal, Tidal and Hydel, etc. Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its management.

Biocatalysis Introduction to biocatalysis: Importance in “Green Chemistry” and Chemical Industry.

Reference Books:

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

- S. M. Khopkar, *Environmental Pollution Analysis*: Wiley Eastern Ltd, New Delhi.
- S.E. Manahan, *Environmental Chemistry*, CRC Press (2005).
- G.T. Miller, *Environmental Science* 11th edition. Brooks/ Cole (2006).
- A. Mishra, *Environmental Studies*. Selective and Scientific Books, New Delhi (2005).

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GROUP WAVES, ACOUSTICS AND OPTICS

COURSE OBJECTIVE:-

1. To aware the students about various phenomena of Waves, Acoustics and Optics.
2. Describe the phenomena like Interference, Diffraction.

Syllabus:

- UNIT - I** Waves: Waves in Media Speed of transverse waves on a uniform string, speed of longitudinal waves in a fluid, gravity waves and ripples. Group velocity and phase velocity, their measurements. Superposition of waves : Linear homogeneous equations and the superposition principle, Standing waves harmonics and the quality of sound , examples. Chladni's figures and vibrations of a drum. Production and detection of ultrasonic and infrasonic waves and applications.
- UNIT – II** Acoustics Noise and Music , The human ear and its responses , limits of human audibility, intensity and loudness, bel and decibel, the musical scales, temperament and musical instrument. Reflection, refraction and diffraction of sound; Acoustic impedance of a medium, percentage reflection and refraction at a boundary, impedance matching for transducers, diffraction of sound, principle of a sonar system, sound ranging. Applied acoustics: Transducers and their characteristics. Recording and reproduction of sound, various systems, measurements of frequency, waveform, intensity and velocity. The acoustics of halls, reverberation period, Sabine's formula.
- UNIT – III** Geometrical Optics Fermat's Principle of extremum path, the aplanatic points of a sphere and other applications. General theory of image formation: cardinal points of an optical system, general relationships for thick lens and lens combinations,. Optical instruments: Entrance and exit pupils, need for a multiple lens eyepiece, common types of eyepieces.
- UNIT – IV** Interference of light; The principle of superposition, twoslit interference, coherence requirement for the sources, thin films, interference by a film with two non-parallel reflecting surfaces, Newton's rings. Haidinger fringes (Fringes of equal inclination). Michelson interferometer, its application for precision determination of wavelength, Intensity distribution in multiple beam interference, Fabry-Perot interferometer and etalon.
- UNIT – V** Fresnel Diffraction Fresnel half period zones, plates, straight edge, rectilinear propagation. Fraunhofer Diffraction: Diffraction at a slit, phasor diagram and integral calculus methods, the intensity distribution, diffraction at a circular aperture and a circular disc, Rayleigh criterion, resolving power of telescope and microscope. Diffraction & Polarization: Diffraction gratings: Diffraction at N parallel slits, plane diffraction grating, reflection grating and blazed gratings. Concave grating and different mountings. Resolving power of a grating. Double refraction and optical rotation: Refraction in uniaxial crystals. Phase retardation plates.

COURSE OUTCOMES:-

1. Understand the Physics behind various optical phenomena.
2. Understand various natural phenomena which is happening in their surroundings.
3. Explain the relationship in between various optical phenomena.

PRACTICAL:-

1. To determine the frequency of A.C. Mains by using sonometer.
2. To determine the frequency of A.C. Mains by Melde's Experiment in transverse

arrangement.

3. To Study and analysis of human ear (on the basis of physical concepts).
4. To determine the wavelength of sodium light by Newton's rings method.
5. To determine the wavelength of prominent lines of mercury light by plane diffraction grating.
6. To determine the refractive index of the material of the prism using spectrometer.
7. To determine the resolving power of the Telescope.
8. To determine the resolving power of the Prism.
9. To determine the resolving power of the Diffraction Grating.
10. To determine the focal length of the combination of two lenses separated by a distance with the help of a nodal slide and to verify the formula –

$$\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2} - \frac{x}{f_1 f_2}$$

11. ULTRASONIC MEASUREMENT LAB

1. To study the characteristic of ultrasound.
2. To determine of the distance by using ultrasonic sensors.
3. To study the object detection by using ultrasonic sensors.
4. To determine the velocity of ultrasonic waves in a non-electrolytic liquid by ultrasonic interferometer.
5. To determine the compressibility of a non-electrolytic liquid by ultrasonic waves.

Note:-

- ❖ **One experiment will be asked in the semester practical examination.**

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ADVANCED CALCULUS, PARTIAL DIFFERENTIAL EQUATIONS, COMPLEX ANALYSIS AND ABSTRACT ALGEBRA

COURSE OBJECTIVES:-

- The goal of this course is for students to gain proficiency in computations of advanced calculus.
- To make the student acquire sound knowledge of techniques in solving partial differential equations.

Syllabus: • To familiarize the student with complex analysis.

UNIT – I Partial differentiation. Change of variables. Euler's Theorem on homogeneous function, Taylor's theorem for functions of two variables. Jacobians, Envelopes, Evolutes.

UNIT – II Maxima, minima and saddle points of functions of two variables. Beta and Gamma functions. Double and triple integrals. Dirichlet's integrals.

UNIT – III Partial Differential equations of the first order. Lagrange's solution. Some special types of equations which can be solved easily by methods other than general methods. Charpit's general method of solution, Partial differential equations of second and higher orders. Homogeneous and non- Homogeneous equations with constant coefficients. Partial differential equations reducible to equations with constant coefficients.

UNIT – IV Complex numbers as ordered pairs. Geometric representation of Complex numbers, Continuity and differentiability of Complex functions. Analytical function, Cauchy Riemann equation, Harmonic function, Mobius transformations, fixed point, cross ratio.

UNIT – V Group-Automorphisms, inner automorphism. Group of Automorphism, Conjugacy relation and centraliser. Normaliser. Counting principle and the class equation of a finite group. Cauchy's theorem for finite abelian groups and non abelian groups. Ring homomorphism. Ideals and Quotient Rings.

COURSE OUTCOMES:-

- Understanding the ideas of advanced calculus and series and an ability to calculate with them and apply them.
- Understanding of the ideas of partial differential equations and facility in solving standard examples.
- Understanding of the ideas of complex analysis and ability to calculate with them.
- Improved facility in abstract algebra.

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Coordination Chemistry

COURSE CODE: 3SBCH501H
(Core course-9)

Syllabus

UNIT I *Bioinorganic Chemistry - I* Essential and trace elements in biological processes, metalloporphyrins with special reference to haemoglobin and myoglobin, Biological role of alkali and alkaline earth metal ions with special reference to Ca^{2+} . Nitrogen fixation.

Bioinorganic Chemistry - II Role of metal ions in biological process, Na/K pump, metal complexes as therapeutic agents anticancer agents, antiarthritits drugs and chelation therapy.

Hard and Soft Acids and Bases (HSAB)- Classification of acids and bases as hard and soft, Pearson's HSAB concept, acid-base strength and hardness and softness, Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness.

Gravimetric Analysis Principles of gravimetric estimation, supersaturation, co-precipitation, post-precipitation and Ash treatment with respect to the estimation of Ba, Zn and Cu.

Water Analysis- Hardness, types of hardness-Temporary, permanent and total hardness, acidity and alkalinity, BOD, COD and DO.

UNIT II *Organometallic compounds*; Organomagnesium compounds-the Grignard reagents-formation, structure and synthetic applications, organozinc compounds, formation and chemical reactions, Organolithium compounds-formation and chemical reactions. Definition, nomenclature and classification of organometallic compounds. Preparation, properties, bonding and applications of alkyls and aryls of Li, Al, Hg, Sn and Ti. A brief account of metal-ethylene complexes and homogeneous hydrogenation; mononuclear carbonyls and the nature of bonding in metal carbonyls. Transition metal organometallic compounds with bonds to hydrogen and boron. Metal nitrosyls: modes of coordination, nature of bonding and probable applications.

Inorganic polymers Introduction and scope of inorganic polymers, special characteristics, classification, homo and hetero atomic polymers and their applications. Silicones and phosphazenes as examples of inorganic polymers, nature of bonding in triphosphazenes.

UNIT III *Chemistry of elements of I transition series*: Characteristic properties of d-block elements. Properties of the elements of the first transition series, their binary compounds such as carbides, oxides and sulphides. Complexes illustrating relative stability of their oxidation states, coordination number and geometry chemistry of elements of II and III transition series: General characteristics, comparative treatment with their 3d-analogues in respect of ionic radii, oxidation states, magnetic behaviour, spectral properties and stereochemistry

UNIT IV(a) *Coordination Compounds*: Werner's coordination theory and its experimental verification, EAN Concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, VBT of transition metal complexes.

(b) Oxidation and Reduction: Use of redox potential data, analysis of redox cycle, redox stability in H_2O : Frost, Latimer and Pourbaix diagram. Principles involved in the extraction of elements.

UNIT V (a) *Chemistry of Lanthanides Elements*: electronic structure, oxidation states, ionic radii and lanthanide contraction, complex formation, occurrence and isolation of lanthanide compounds.

(b) *Chemistry of Actinides*: General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from U, Similarities between the later actinides and later lanthanides.

(c) *Acids and Bases*: Arrhenius, Brønsted-Lowry, Lux-Flood, Solvent system and Lewis concepts of acids and bases.

(d) Non-aqueous Solvents: Types of solvents and their general characteristics, reaction in non-aqueous solvents with reference to liquid NH₃ and liquid SO₂

PRACTICAL

A. (Complex Compound Preparation)

1. Diaquabis(methyl acetoacetato)nickel(II)
2. Diaquabis(ethyl acetoacetato)cobalt(II)
3. Bis(methyl acetoacetato)copper(II) monohydrate
4. Potassium chlorochromate(IV)
5. Tetraamminecopper(II) sulphate monohydrate
6. Mercury(II) tetrathiocyanatocobaltate(II)
7. Hexaamminenickel(II) chloride

B. Analysis of inorganic mixture containing five radicals with at least one interfering radical (phosphate, borate, oxalate or fluoride).

C. Calibration of the fractional weights, pipettes and burettes. Preparation of standard solutions. Dilution of 0.1 M to 0.001 M solutions.

Quantitative analysis -Volumetric analysis.

- (a) Determination of acetic acid in commercial vinegar using NaOH.
- (b) Determination of alkali content- antacid tablet using HCl.
- (c) Estimation of calcium content in chalk as calcium oxalate by permanganometry.
- (d) Estimation of hardness of water by EDTA

Gravimetric analysis: Barium as barium sulphate

Reference Books

- Concise Coordination Chemistry by R Gopalan and V Ramalingam
- Coordination Chemistry by K Sarn
- Coordination Chemistry by Pimplapure and Jain
- Coordination Chemistry by Ajai Kumar
- Coordination Chemistry (Structure and Bonding) by N W Alcock and T K Chandrashekar
- Physical Inorganic Chemistry: A Coordination Chemistry Approach by S F A Kettle

Industrial Chemistry

COURSE CODE: 3SBCH502H
(Core course-10)

Syllabus

UNIT I *Distillation Introduction,*

batch and continuous distillation, separation of azeotropes, plate columns and packed columns.

Absorption: Introduction, equipments, packed columns, spray columns, bubble columns, mechanically agitated contactors.

UNIT II *Evaporation Introduction,*

equipments, short tube evaporator, forced circulation evaporators, falling film evaporators, wiped (agitated) film evaporators.

Filtration:

Introduction, equipments, plate and frame filter press, Nutch filter, rotary drum filter, sparkler filter, candle filter, Bag filter.

UNIT III *Energy Balance*

Heat capacity of pure gases and gaseous mixtures at constant pressures, sensible heat changes in liquids, Enthalpy changes.

Drying: Introduction, free moisture, bound moisture, drying curve, equipments– tray dryer, rotary dryer, flash dryer, fluid bed dryer, drum dryer, spray dryer.

UNIT IV *Catalysis Introduction,*

Types, Basic principles, mechanisms, factors affecting the performance, introduction to phase transfer catalysis, Enzymes catalyzed reactions- rate model, industrially important reactions.

Renewable Natural resources: Cellulose, Starch: - properties, modification, important industrial chemicals derived from them. Alcohols, oxalic acid and Furfura.

UNIT V *Utilities in Industry Fuel Types of fuels –*

advantages and disadvantages.

Boilers: Types of boilers and their functioning.

Water: Specifications for Industrial use, various water treatments. **Steam:** Generation and use.

Fluid Flow: Fans, Blowers, Compressors, vacuum pumps, Ejectors.

Pumps: Reciprocating pumps, Gear pumps, Centrifugal pumps.

Heat Transfer: Heat exchangers- shell and tube type, finned tube heat exchangers, plate heat exchangers, refrigeration cycles.

CHEMISTRY PRACTICAL

1. Determination of dissolved oxygen in water.
2. Determination of Chemical Oxygen Demand (COD)
3. Determination of Biological Oxygen Demand (BOD)
4. Percentage of available chlorine in bleaching powder.
5. Measurement of chloride, sulphate and salinity of water samples by simple titration method (AgNO₃ and potassium chromate).
6. Estimation of total alkalinity of water samples (CO₃²⁻, HCO₃⁻) using double titration method.
7. Measurement of dissolved CO₂.
8. Study of some of the common bio-indicators of pollution.
9. Estimation of SPM in air samples.
10. Preparation of borax/ boric acid.

Reference Books:

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

Organic Chemistry & Spectroscopy

Syllabus

UNIT I *Spectroscopy – I*

- (a) Electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom.
- (b) Rotational spectrum of diatomic molecules. Energy levels of a rigid rotator (semi classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution), determination of bond length, qualitative description of non-rigid rotator, isotope effect.
- (c) *Raman spectrum*, concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules, application of Raman spectrum.

Spectroscopy - II

- (d) *UV Spectroscopy* : Electronic excitation, elementary idea of instrument used, Applications to structure determination of organic molecules. Woodward-Fieser rule for determining max of , - unsaturated carbonyl compounds.
- (e) *Infrared Spectrum* : Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups.

UNIT II *Spectroscopy – II(Organic Analysis)*

Electromagnetic Spectrum: Absorption Spectra; UV absorption spectroscopy: Absorption laws (Beer-Lambert law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones. IR absorption spectroscopy; molecular vibrations, Hook's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds.

UNIT III *Alcohols:* Classification and nomenclature. Monohydric alcohols: nomenclature, methods of formation by reduction of Aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding, acidic nature, reactions of alcohols. Dihydric alcohols: nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [Pb(OAc)₄ and HIO₄] and pinacole-pinacolone rearrangement. Trihydric alcohols-nomenclature and methods of formation, chemical reactions of glycerol

Phenols: Nomenclature, structure and bonding. Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols: resonance stabilization of phenoxide ion. Reactions of phenols: electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben-Hoesch reaction, Lederer-Manasse reaction and Riemer-Tiemann reaction

UNIT IV *Aldehydes and ketones:* Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes and ketones from acid chlorides, synthesis of aldehydes and ketones using 1,3-dithianes, synthesis of ketones from nitriles and from carboxylic acids. Physical properties. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldolperkin and knovenagel condensations. Condensation with ammonia and its derivatives. Wittig reaction, Mannich reaction. Use of acetals as protecting group. Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction. Meerwein-Ponndorf-Verley (MPV), Clemmensen, Wolf-Kishner, LiAlH₄ and NaBH₄ reductions, Halogenation of enolizable ketones. An introduction of alpha, beta unsaturated aldehydes and ketones

Carboxylic Acids: Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids, reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids. Mechanism of decarboxylation. Carboxylic acid derivatives Structure and nomenclature of acid chlorides, esters, amides (urea) and acid anhydrides. Physical properties, Preparation of carboxylic acid derivatives, chemical reactions. Mechanism of esterification and hydrolysis (acidic and basic).

UNIT V (a) *Ethers and Epoxides* Nomenclature of ethers and methods of their formation, physical properties. Chemical reactions: cleavage and auto oxidation. Ziesel's method. Synthesis of epoxides. Acid and base-catalysed ring opening of epoxides, orientation of epoxide ring opening, reaction of Grignard and organolithium reagents with epoxides.

(b) *Organosulphur compounds* Nomenclature, structural features, method of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides and sulphaguanidine.

(c) *Amino acids Classification*, structure, stereochemistry of amino acids, acid base behaviour, isoelectric point, general methods of preparation and properties of α -amino acids

(d) *Proteins and peptides* Introduction to peptides linkage, synthesis and end group analysis of peptides, solid phase synthesis, classification, properties and structure of proteins (primary, secondary and tertiary).

(e) *Organic Compounds of Nitrogen Preparation of nitroalkanes and nitroarenes*. Chemical reaction of nitroalkanes. Mechanism of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media, Picric acid.

Practical Organic Chemistry

(Qualitative analysis)

- Identification of an organic compound through the functional group analysis, determination of melting point and preparation of suitable derivatives.
- Binary mixture analysis containing two solids: Separation, identification and preparation of derivatives.

(Organic Chemistry Preparation)

- Acetylation
- Benzoylation
- meta-Dinitrobenzene
- Picric acid

Reference Books

- Textbook of Organic Chemistry, Rakesh K. Parashar, V.K. Ahluwalia
- Advanced Organic Chemistry, I Francis A. Carey, Richard A. Sundberg
- Advanced Organic Chemistry, II Francis A. Carey, Richard A. Sundberg
- Physical Inorganic Chemistry: A Coordination Chemistry Approach by S F A Kettle
- Inorganic Chemistry, B.R. Puri (Author), L.R. Sharma
- Principles of Inorganic Chemistry, B.R. Puri, L.R. Sharma, K.C. Kalia
- Principles of Physical Chemistry, B. R. Puri, Madan S. Pathania, L. R. Sharma

Biochemistry

Syllabus

Unit I *Introduction to Biochemistry*, Water as a biological solvent. Carbohydrates: Structure, occurrence and biological importance of monosaccharides and disaccharides Stereoisomerism and optical isomerism of sugars. Ring structure, epimers, anomers and mutarotation. Important reactions of sugars. Important derivatives of monosaccharides. Structure, occurrence and biological importance of oligosaccharides and polysaccharides. e.g. Cellulose, glycogen and starch, chitin, agar. Mucopolysaccharides.

Unit II *Fatty acids*, Classification, structure and properties of saturated and unsaturated fatty acids. Essential fatty acids. Triacylglycerols, properties and characterization of fats – hydrolysis, saponification, halogenation, Acetyl number, Rancidity of fats, Reichert-Meissel number. Reaction of glycerol. Glycerophospholipids (lecithins, cephalins, phosphatidyl serine, phosphatidyl inositol, plasmalogens), sphingomyelins, glycolipids- cerebrosides, sulfolipids, gangliosides. Cholesterol and Bile acids.

Unit III *Amino acids*, Structure and classification of amino acids, stereoisomerism, zwitter ion in aqueous solutions, physical and chemical properties, titration of amino acids, Isoelectric pH, Essential amino acids. Peptides: Peptide bond, Determination of the amino acid sequence of a polypeptide chain, chemical and enzymatic cleavage of a polypeptide chains and separation of peptides. Classification of proteins, behaviour of proteins in solutions, salting in and salting out of proteins, Denaturation and renaturation of proteins.

Unit IV *Protein structure*, Levels of structure in protein architecture, primary structure of proteins, secondary structure of proteins – helix and pleated sheets, tertiary structure of proteins, forces and bonds stabilizing the structure proteins. Structure of fibrous proteins (keratins and collagen), globular proteins (hemoglobin and myoglobin). Composition of DNA and RNA. Features of DNA double helix. Denaturation and annealing of DNA, Secondary and tertiary structure of DNA, Watson Crick model, A, B and Z type of DNA. Different types of RNA and their role, Secondary and tertiary structure of RNA.

Unit V *Important Metalloporphyrins occurring in nature*, Bile pigments- chemical nature and their physiological significance. Hormones: Structure and biological functions of Insulin, Glucagon, Epinephrine, Thyroxine, Structure, properties and role of fat soluble and water soluble vitamins, Coenzyme functions of vitamins.

Practicals

1. Preparations of Different biochemical reagents

a. Ninhydrin Reagent , b. Benedicts Reagent , c. Barfoeds Reagent ,d. Biuret Reagent

2. Qualitative test for amino acid

a. Ninhydrin test for amino acid , b. Millions test c. Sakaguchi test

3. Qualitative test for protein.

a. Precipitation with organic solvent , b. Precipitation with TCA , c. Precipitation with Ammonias sulphate

4. Qualitative test for carbohydrate

a. Molish test b. Iodine test , c. Benedicts test, d. Barfoeds test ,e. Osazone formation

5. Qualitative test for Nucleic acid

a. Orcinol test b. Diphenyl amine test, c. Neumann's test

6. Qualitative test for lipid

a. Iodine test ,b. saponification test, c. emulsification

7. Qualitative Test for Vitamin-

a) Thiamine b) Ascorbic Acid c) Riboflavine

Reference Books

- T.G. Cooper: Tool of Biochemistry.
- Keith Wilson and John Walker: Practical Biochemistry.
- Alan H Gowenlock: Varley's Practical Clinical Biochemistry.
- Thomas M. Devlin: Textbook of Biochemistry.
- Jeremy M. Berg, John L Tymoczko, Lubert Stryer: Biochemistry.
- G. P. Talwar and M Srivastava: Textbook of Biochemistry and Human Biology.
- A.L. Lehninger: Biochemistry.
- O. Mikes, R.A. Chalmers: Laboratory Handbook of Chromatographic Methods.
- Biochemistry : U. Satyanarayana
- Biochemistry :Lubest Stryer
- Textbook of Biochemistry : Jain & Jain
- An Introduction to practical Biochemistry : David Plummer (TMH)
- Hawke's Physiological Chemistry
- Laboratory Manual in Biochemistry : J. Jayaraman

Environmental Studies

Syllabus

UNIT-I Introduction to environmental sciences: NATURAL RESOURCES : Environmental Sciences
- Relevance - Significance - Public awareness - Forest resources - Water resources - Mineral resources
- Food resources - conflicts over resource sharing - Exploitation - Land use pattern - Environmental
impact - fertilizer - Pesticide Problems - case studies.

UNIT-II Ecosystem, biodiversity and its conservation: Ecosystem - concept - structure and function -
producers, consumers and decomposers - Food chain - Food web - Ecological pyramids - Energy flow
- Forest, Grassland, desert and aquatic ecosystem. Biodiversity - Definition - genetic, species and
ecosystem diversity - Values and uses of biodiversity - biodiversity at global, national (India) and
local levels - Hotspots, threats to biodiversity - conservation of biodiversity - Insitu&Exsitu.

UNIT-III Environmental pollution and managementEnvironmental Pollution - Causes - Effects and
control measures of Air, Water, Marine, soil, solid waste, Thermal, Nuclear pollution and Disaster
Management - Floods, Earth quake, Cyclone and Landslides. Role of individuals in prevention of
pollution - pollution case studies.

UNIT-IV Social issues - human populationUrban issues - Energy - water conservation -
Environmental Ethics - Global warming - Resettlement and Rehabilitation issues -
Environmental legislations - Environmental production Act. 1986 - Air, Water, Wildlife and
forest conservation Act - Population growth and Explosion - Human rights and Value
Education - Environmental Health - HIV/AIDS - Role of IT in Environment and Human
Health - Women and child welfare - Public awareness - Case studies.

UNIT-V Field WorkVisit to a local area / local polluted site / local simple ecosystem - Report
submission

Practical

Field Study

Exercise – 1 Study of a simple ecosystem (Suggested habitats: pond, river, estuarine, grassland,
forest and desert) and description of the biotic and abiotic components of the ecosystem.

Exercise - 2 Study of effects of human interaction with natural environment.

Exercise - 3 Survey of vegetation, birds, insects and other animals in an area.

Exercise - 4 Choose five common species of Trees / plants from your NEIGHBORHOOD and list
their common names. Describe each plant in terms of its height and leaves.

Exercise - 5 Describe the environmental problem of your locality and suggest a remedy.

Exercise - 6 Identifying the sources of pollution in water obtained from different sources.

Exercise - 7 To segregate domestic waste into bio-degradable and non-biodegradable components.
3. Lab Exercise

Exercise - 8 To study the quality of a sample of water collected or provided.

Exercise - 9 To determine Texture of various soil samples.

Exercise - 10 To estimate the amount dust (particulate matter) deposition on the leaves of roadside plants.

Exercise - 11 To Study the effect of light intensity on the growth of plants. 4. Creative Exercise

Exercise - 12 To set up an aquarium.

Exercise - 13 To study the biodiversity of birds and insects in your locality.

Exercise - 14 To prepare a list of plants and animals which are used for making meals at home on any one day and to comment on the habit and habitat of each.

Exercise - 15 To make a herbarium sheet.

Exercise - 16 To describe : a) climate of an urban area; b) yearly variation in suspended particulate matter in the same area.

Exercise - 17 To Make an audit of the electrical energy consumption by various household appliances.

Reference Books

- Kumarasamy, K., A.Alagappa Moses AndM.Vasanthi, 2004. Environmental Studies, Bharathidasan University Pub, 1, Trichy
- Rajamannar, 2004, Environmental Studies, Evr College Pub, Trichy
- Kalavathy,S. (Ed.) 2004, Environmental Studies, Bishop Heber College PUB., TRICHY

Basics of Analytical Chemistry

Syllabus

UNIT I Errors and treatment of Analytical Chemistry Errors, Determinant, constant and indeterminate. Accuracy and precision Distribution of random errors. Average derivation and standard derivation, variance and confidence limit. Significance figures and computation rules. Least square method.

UNIT II Chromatographic methods: General principle, classification of chromatographic methods. Nature of partition forces. Chromatographic behavior of solutes. Column efficiency and resolution. Gas Chromatography: detector, optimization of experimental conditions. Ion exchanges chromatography. Thin layer chromatography: coating of materials, preparative TLC. Solvents used and methods of detection Column chromatography. Adsorption and partition methods. Nature of column materials. Preparation of the column. Solvent systems and detection methods.

UNIT III Electroanalytical Techniques Polarography: Introduction, Instrumentation, Ilkovic equation and its verification. Derivation of wave equation, Determination of half wave potential, qualitative and quantitative applications. Amperometry: Basic principles, instrumentation, nature of titration curves, and analytical applications.

UNIT IV Theory of Volumetric and Gravimetric Analysis Standard solutions Indicators, theory of indicators, types of titrations, Acid, base, precipitation, Redox and complexometric titrations, Acid-base titrations in nonaqueous media, solvent characterisation, living effect, applications of non-aqueous titrations.

UNIT V Computer Science: Introduction: History etc. Hardware: Central processor unit. Input devices. Storage devices. Peripherals, Software: Overview of the key elements of basic program structure, loops, arrays, mathematical function. User defined functions, conditional statements, string. Applications. Data representation.

Practicals

- 1. Error analysis & Statistical data analysis,** Error, types of errors, minimization of errors, statistical treatment for error analysis standard deviation, Relative standard, Linear Least Squares.
Calibration of Volumetric apparatus, burettes, pipettes, standard flask, weight box etc.
- 2. Volumetric analysis,** Basic principles. Determination of iodine and saponification values of oil sample Determination of DO, COD, BOD, Hardness of water samples.
- 3. Gravimetric analysis,** Determination of metal ions eg. Ni, Cu etc. by gravimetric methods using organic precipitants such as dimethylglyoxime, 8-hydroxyquinoline, etc.
- 4. Chromatography :-**
Separation of cations and anions by-
(a) Paper chromatography (b) Column Chromatography
- 5. pHmetry / potentiometry :** Determination of strength of acids etc.
- 6. Flame Photometry / AAS/ FIA/ Colorimetry :-**
Determination of cations/anions and metal ions, e.g. Na^+ , K^+ , Ca^{2+} , SO_4^{2-} , NO_2^- , Fe, Mo, Ni, Cu, Zn, etc.

7. Spectrophotometry :-

Verification of Beer-Lambert Law. Molar absorptivity calculation, plotting graph to obtain ϵ_{\max} etc. Effect of pH in aqueous coloured systems. Determination of metal ions, e.g. Fe, Cu, Zn, Pb, etc. using inorganic reagent like SCN and organic chelating agent like dithizone, cupferron 8-hydroxyquinoline, etc. in aqueous/organic phase in the presence of surface active agents.

8. Nephelometry / Turbidimetry :-

Determination of chloride, sulphate, phosphate, turbidity, etc.

Reference Books

- Analytical Chemistry: (J.W) G. D. Christain
- Introduction to chromatography : Bobbit
- Instrumental Methods of analysis (CBS)- H.H . Willard, L.L. Mirrit, J.A. Dean
- Instrumental Methods of Analysis : Chatwal and Anand
- Instrumental Methods of Inorganic Analysis(ELBS) : A.I. Vogel
- Chemical Instrumentation: A Systematic approach- H.A. Strobel
- The principals of ion-selective electrodes and membrane transport: W.E.Morf
- Physical Chemistry – P.W.Atkins
- Principal of Instrumental Analysis- D. Skoog and D.West
- Treatise on Analytical Chemistry: Vol I to VII – I.M. Kolthoff
- Computer, Fundamentals-P.K.Sinha
- Programming in BASIC : E. Balaguruswamy

Bio-molecular Chemistry

Syllabus

Unit I Nucleic Acids-Components of nucleic acids, Nucleosides and nucleotides Structure, synthesis and reactions of: Adenine, Guanine, Cytosine, Uracil and Thymine Structure of polynucleotides.

Unit II Amino Acids, Peptides and Proteins-Amino acids, Peptides and their classification. α -Amino Acids - Synthesis, ionic properties and reactions. Zwitterions, pKa values, isoelectric point and electrophoresis Study of peptides: determination of their primary structures-end group analysis, methods of peptide synthesis. Synthesis of peptides using N-protecting, C-protecting and C-activating groups -Solid-phase synthesis .

Unit III Enzymes- Introduction, classification and characteristics of enzymes. Salient features of active site of enzymes. Mechanism of enzyme action (taking trypsin as example), factors affecting enzyme action, coenzymes and cofactors and their role in biological reactions, specificity of enzyme action (including stereospecificity), enzyme inhibitors and their importance, phenomenon of inhibition (competitive, uncompetitive and non-competitive inhibition including allosteric inhibition).

Unit IV Lipids -Introduction to oils and fats; common fatty acids present in oils and fats, Hydrogenntion of fats and oils, Saponification value, acid value, iodine number. Reversion and rancidity.

Unit V Pharmaceutical Compounds- Structure and Importance Classification, structure and therapeutic uses of antipyretics: Paracetamol (with synthesis), Analgesics: Ibuprofen (with synthesis), Antimalarials: Chloroquine (with synthesis). An elementary treatment of Antibiotics and detailed study of chloramphenicol, Medicinal values of curcumin (haldi), azadirachtin (neem), vitamin C and antacid (ranitidine).

Practicals – Bio-molecular Lab

1. Estimation of glycine by Sorenson's formalin method.
2. Study of the titration curve of glycine.
3. Estimation of proteins by Lowry's method.
4. Study of the action of salivary amylase on starch at optimum conditions.
5. Effect of temperature on the action of salivary amylase.
6. Saponification value of an oil or a fat.
7. Determination of Iodine number of an oil/ fat.
8. Isolation and characterization of DNA from onion/ cauliflower/peas.

Recommended Books

- Berg, J.M., Tymoczko, J.L. and Stryer, L. (2006) Biochemistry. VIth Edition. W.H. Freeman and Co.
- Nelson, D.L., Cox, M.M. and Lehninger, A.L. (2009) Principles of Biochemistry. IV Edition. W.H. Freeman and Co.
- Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2009) Harper's Illustrated Biochemistry. XXVIII edition.Lange Medical Books/ McGraw-Hill.

Communication Skill & Personality Development

Objective: To make the students understand the basics of personality, public speaking, language, Listening, conversation & writing skills, along with the communication process Syllabus

THEORY –

Unit- I:

Basics of Personality, Do's and Dont's in Personality, Salutations and Greetings, Presenting Yourself, Proper Introduction of Oneself.

Unit- II:

Administration- your work style, Overcoming Phobias, Public Speaking, General Etiquettes and Mannerism, Time Management, Attire, Attitude, Self Actualization, Magic of Positive Thinking.

Unit- III :

Tips of Preparing CV, Interviews tips.

Unit-IV:

Language Skill, Writing Skill, Speaking Skill, Listening Skill, Conversation Practice, Mysticism of Body Language, Basics of Grammar.

Unit- V :

Communication- Meaning, Functions, Channels, Process, Barriers and Interpersonal Skills.

PRACTICAL –

1. To present self introduction of yours.
2. Mock interview.
3. Group discussions.
4. SWOT analysis of self.
5. Extempore.
6. Debate.
7. Preparation of CV.
8. Role play.
9. Present a speech.
10. Make a power point presentation of communication.

Reference Books:

1. Business Communication, Universal Pub. Agra – Dr. Ramesh Mangal
 2. English Grammar- Wren & Martin
 3. Putting your best foot forward- Lt. Co. (Dr.) Pramod Deogirikar
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Chairperson

Dean (Academics)

(Board of studies)

(Academic Council)

(Registrar) Seal

Outcome- After the completion of this subject the learners will understand the basics of personality, public speaking, language, Listening, conversation & writing skills, along with the communication process.

Nano-Chemistry

Syllabus

Unit I Background to Nanoscience Definition of Nano, Scientific revolution-Atomic Structure and atomic size, Emergence and challenges of nanoscience and nanotechnology Carbon age-new form of carbon (CNT to Graphene), Size effects and crystals Large surface to volume ration, surface effects on the properties

Unit II Synthesis of Nanomaterial's, Top-down and bottom up approach, Solution chemical methods, Sol-gel processing

Template self-assembly, Spin coating, Gas or vapor based methods of synthesis: CVD, MOCVD and MB, Ball Milling

Unit III Structural Characterization Techniques of Nanomaterials, Diffraction analyses: X-ray diffraction, powder diffraction, Lattice parameters, Structure analyses, strain analyses Phase identification, particle size analyses using -Scherer's formula, Surface Imaging: Scanning Electron Microscope (SEM, Field Emission Scanning Electron Microscope (FESEM), Transmission Electron Microscopy (TEM)

Unit IV Mechanical Processing and Properties of Nanomaterials, Processing of Powders of Metals and Ceramics, Metal/Ceramic Powder synthesis, Compacting and Sintering, Production of Porous and Dense Composite Components, Advanced Composite materials, Structure-Property Relationship

Unit V Applications of Nanomaterials, Nanomaterials in Health Care and Agriculture, Nanomaterials in Energy Conversion and Storage, Nanomaterials in textile, self-cleaning, self-healing, Nanomaterials in Sensors

Practical

1. Synthesis of nanomaterials by combustion method, sol-gel route, co-precipitation technique, hydrothermal method and template assisted route
2. Preparation of porous materials and nano-composites
3. Structural Characterization of synthesized nanomaterials by X-ray Powder Diffraction Method, calculation of particle size and strain using Scherrer formula
4. Characterization of synthesized nanomaterials by SEM, FESEM and TEM

Reference Books

- C. N. R. Rao, A. Muller, A. K. Cheetham (Eds), **The chemistry of nanomaterials: Synthesis, properties and applications**, Wiley VCH Verlag GmbH & Co, Weinheim, 2004.
- G. Cao, **Nanostructures and Nanomaterials: Synthesis, properties and applications**, Imperial College Press, 2004.
- G.A. Ozin, C. Andre, and L. Arsenault, Cademartiri, **Nanochemistry: A chemical Approach to Nanomaterials**, Royal Society of Chemistry, 2005.
- T. Pradeep, **NANO: The Essentials**, Tata-McGraw Hill, New Delhi, 2007.
- K.J. Klabunde, **Nanoscale Materials in Chemistry**, Wiley-Interscience, 2001.
- G. Schmidt, **Nanoparticles: From theory to applications**, Wiley Weinheim 2004.
- □Fahan, **Materials Chemistry**, Springer (2004).

INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE

Syllabus

Unit I Silicate Industries

Glass: Glassy state and its properties, classification (silicate and non-silicate glasses). Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass.

Ceramics: Important clays and feldspar, ceramic, their types and manufacture. High technology ceramics and their applications, superconducting and semiconducting oxides, fullerenes carbon nanotubes and carbon fibre.

Cements: Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements.

Unit II Fertilizers: Different types of fertilizers. Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates; polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate.

Unit III Surface Coatings: Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings. Paints and pigments-formulation, composition and related properties. Oil paint, Vehicle, modified oils, Pigments, toners and lakes pigments, Fillers, Thinners, Enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Dyes, Wax polishing, Water and Oil paints, additives, Metallic coatings (electrolytic and electroless), metal spraying and anodizing.

Unit IV Batteries: Primary and secondary batteries, battery components and their role, Characteristics of Battery. Working of following batteries: Pb acid, Li-Battery, Solid state electrolyte battery. Fuel cells, Solar cell and polymer cell.

Alloys: Classification of alloys, ferrous and non-ferrous alloys, Specific properties of elements in alloys. Manufacture of Steel (removal of silicon decarbonization, demanganization, desulphurization dephosphorisation) and surface treatment (argon treatment, heat treatment, nitriding, carburizing). Composition and properties of different types of steels.

Unit V Catalysis: General principles and properties of catalysts, homogenous catalysis (catalytic steps and examples) and heterogenous catalysis (catalytic steps and examples) and their industrial applications, Deactivation or regeneration of catalysts. Phase transfer catalysts, application of zeolites as catalysts.

Chemical explosives: Origin of explosive properties in organic compounds, preparation and explosive properties of lead azide, PETN, cyclonite (RDX). Introduction to rocket propellants.

PRACTICAL

1. Determination of free acidity in ammonium sulphate fertilizer.
2. Estimation of Calcium in Calcium ammonium nitrate fertilizer.
3. Estimation of phosphoric acid in superphosphate fertilizer.
4. Electroless metallic coatings on ceramic and plastic material.
5. Determination of composition of dolomite (by complexometric titration).
6. Analysis of (Cu, Ni); (Cu, Zn) in alloy or synthetic samples.

7. Analysis of Cement.
8. Preparation of pigment (zinc oxide).

Reference Books:

- E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK.
- R. M. Felder, R. W. Rousseau: *Elementary Principles of Chemical Processes*, Wiley Publishers, New Delhi.
- W. D. Kingery, H. K. Bowen, D. R. Uhlmann: *Introduction to Ceramics*, Wiley Publishers, New Delhi.
- J. A. Kent: *Riegel's Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.
- P. C. Jain, M. Jain: *Engineering Chemistry*, Dhanpat Rai & Sons, Delhi.
- R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry*, Vikas Publications, New Delhi.
- B. K. Sharma: *Engineering Chemistry*, Goel Publishing House, Meerut

GREEN CHEMISTRY

Syllabus

UNIT – I *Introduction to Green Chemistry* What is Green Chemistry? Need for Green Chemistry. Goals of Green Chemistry. Limitations/ Obstacles in the pursuit of the goals of Green Chemistry.

UNIT –II *Principles of Green Chemistry and Designing a Chemical synthesis* Twelve principles of Green Chemistry with their explanations and examples; Designing a Green Synthesis using these principles; Prevention of Waste/ byproducts; maximum incorporation of the materials used in the process into the final products (Atom Economy); prevention/ minimization of hazardous/ toxic products; designing safer chemicals – different basic approaches to do so; selection of appropriate auxiliary substances (solvents, separation agents), green solvents, solventless processes, immobilized solvents and ionic liquids; energy requirements for reactions - use of microwaves, ultrasonic energy; selection of starting materials; avoidance of unnecessary derivatization – careful use of blocking/protecting groups; use of catalytic reagents (wherever possible) in preference to stoichiometric reagents; designing of biodegradable products; prevention of chemical accidents; strengthening/ development of analytical techniques to prevent and minimize the generation of hazardous substances in chemical processes.

UNIT – III *Examples of Green Synthesis* Reactions Green Synthesis of the following compounds: adipic acid, catechol, BHT, methyl methacrylate, urethane, aromatic amines (4-aminodiphenylamine), benzyl bromide, acetaldehyde, disodium iminodiacetate (alternative to Strecker synthesis), citral, ibuprofen, paracetamol, furfural. Microwave assisted reactions in water: Hofmann Elimination, Hydrolysis (of benzyl chloride, benzamide, n-phenyl benzamide, methylbenzoate to benzoic acid), Oxidation (of toluene, alcohols) Microwave assisted reactions in organic solvents: Esterification, Fries rearrangement, Orthoester Claisen Rearrangement, Diels-Alder Reaction, Decarboxylation.

UNIT – IV *Microwave assisted solid state reactions*: Deacetylation, Deprotection. Saponification of esters, Alkylation of reactive methylene compounds, reductions, synthesis of nitriles from aldehydes; anhydrides from dicarboxylic acid; pyrimidine and pyridine derivatives; 1,2-dihydrotriazine derivatives; benzimidazoles. Ultrasound assisted reactions: Esterification, saponification, substitution reactions, Alkylations, oxidation, reduction, coupling reaction, Cannizzaro reaction, Strecker synthesis, Reformatsky reaction. Selective methylation of active methylene group using dimethylcarbonate: Solid-state polymerization of amorphous polymers using diphenylcarbonate; Use of “Clayon”, a nonmetallic oxidative reagent for various reactions; Free Radical Bromination; Role of Tellurium in organic syntheses; Biocatalysis in organic syntheses.

UNIT – V *Future Trends in Green Chemistry* Oxidation reagents and catalysts; Biomimetic, multifunctional reagents; Combinatorial green chemistry; Proliferation of solventless reactions; oncovalent derivatization; Green chemistry in sustainable development.

PRACTICAL

1. Safer starting materials

The Vitamin C clock reaction using Vitamin C tablets, tincture of iodine, hydrogen peroxide and liquid laundry starch.

Effect of concentration on clock reaction

Effect of temperature on clock reaction. (if possible)

2. Using renewable resources

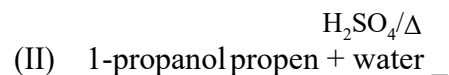
Preparation of biodiesel from vegetable oil.

3. Avoiding waste

Principle of atom economy.

Use of molecular model kit to stimulate the reaction to investigate how the atom economy can illustrate Green Chemistry.

Preparation of propene by two methods can be studied



The other types of reactions, like addition, elimination, substitution and rearrangement should also be studied for the calculation of atom economy.

4. Use of enzymes as catalysts - Benzoin condensation using Thiamine Hydrochloride as a catalyst instead of cyanide

Alternative Green solvents

5. Diels Alder reaction in water - Reaction between furan and maleic acid in water and at room temperature rather than in benzene and reflux.

6. Extraction of D-limonene from orange peel using liquid CO_2 prepared from dry ice.

7. Mechanochemical solvent free synthesis of azomethines

8. Co-crystal controlled solid state synthesis (C^2S^3) of N-organophthalimide using phthalic anhydride and 3-aminobenzoic acid.

Alternative sources of energy

9. Solvent free, microwave assisted one pot synthesis of phthalocyanine complex of copper (II).

10. Photoreduction of benzophenone to benzopinacol in the presence of sunlight.

Reference Books

- Anastas, P.T & Warner, J.C. *Green Chemistry: Theory and Practice*, Oxford University Press (1998).
- Kirchoff, M. & Ryan, M.A. *Greener approaches to undergraduate chemistry experiment*. American Chemical Society, Washington DC (2002).
- Ryan, M.A. *Introduction to Green Chemistry*, Tinnensand; (Ed), American Chemical Society, Washington DC (2002).
- Sharma, R.K.; Sidhwani, I.T. & Chaudhari, M.K. I.K. *Green Chemistry Experiment: A monograph International Publishing House Pvt Ltd. New Delhi*. Bangalore ISBN 978-93-81141-55-7 (2013).
- Cann, M.C. & Connelly, M. E. *Real world cases in Green Chemistry*, American Chemical Society (2008).
- Cann, M. C. & Thomas, P. *Real world cases in Green Chemistry*, American Chemical Society (2008).
- Pavia, D. L. Lamponan, G. H. & Kriz, G.S. *W B Introduction to organic laboratory*
- V.K. Ahluwalia & M.R. Kidwai: *New Trends in Green Chemistry*, Anamalaya Publishers (2005).
- P.T. Anastas & J.K. Warner: *Oxford Green Chemistry- Theory and Practical*, University Press (1998).
- A.S. Matlack: *Introduction to Green Chemistry*, Marcel Dekker (2001).

- M.C. Cann & M.E. Connely: Real-World cases in Green Chemistry, American Chemical Society, Washington (2000).
- M.A. Ryan & M. Tinnesand, Introduction to Green Chemistry, American Chemical Society, Washington (2002).

Chemistry of Natural product

Syllabus

UNIT I Terpenoids (10+2) Structure and synthesis of abietic acid, zingiberene, santonin,

UNIT II Alkaloids Structure, stereochemistry, synthesis and biosynthesis of the following Structure of morphine, reserpine, ephedrine, (+) Conin.

UNIT III a) Steroids Occurrence, nomenclature, basic skeleton, Diels hydrocarbon and study of the following hormones, Androsterone, Testosterone, Estrone, Progesterone, Aldosterone and cortisone. Biosynthesis of steroids.

b) Prostaglandins Occurrence, nomenclature, classification, biogenesis and physiological effects,

UNIT IV Biogenesis , Alkaloids (pyridine, morphine and indole type) terpenoids of classes with examples, cholesterol, flavones, coumarins, carbohydrates and proteins. Chemistry of Protein Hormones: Insulin, Oxytocin, Thyroxin and Anti-thyroid drugs

UNIT V Vitamins Synthesis and structure of biotin and vitamin B2, synthesis of vitamin B1, biological functions of B6, B12, folic acid and thiamin.

Practical

- Isolation and characterization of the following natural products:
- Piperine from black pepper
- Hesperidin from orange peel.
- Strychnine from Nux vomica seeds.
- Curcumin from turmeric powder.
- Lycopene from tomatoes.
- Myristicin and trimyristicin from nutmeg.
- Tannic acid from myrobalan.
- Isolation of casein from milk.
- Lysozyme from albumen.
- Extraction and estimation of carvone from caraway seeds.
- Separation of natural products through column chromatography.

Degradation and characterization of degradation products of a) Piperine b) Atropine and c) Caffeine. Any other relevant experiments based on theory.

REFERENCE BOOKS

- Burger's Medicinal Chemistry, M.E. – Wolff, Ed., John Wiley & Sons, New York.
- R. M. Acheson, An Introduction to the Chemistry of Heterocyclic Compounds, Interscience NY
- Organic Chemistry, Vol.II by I.L. Finar, The English Language Book Society, London.
- Natural Products Vol.I& II by O.P. AgarwalGoel publications – Meerut.
- F.G.Mann& B. Saunders, Practical Organic Chemistry Longmans Green & Co. Ltd., U.K

INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS

Syllabus

UNIT I Infrared spectroscopy: Interactions with molecules: absorption and scattering. Means of excitation (light sources), separation of spectrum (wavelength dispersion, time resolution), detection of the signal (heat, differential detection), interpretation of spectrum (qualitative, mixtures, resolution), advantages of Fourier Transform (FTIR). Samples and results expected. Applications: Issues of quality assurance and quality control, Special problems for portable instrumentation and rapid detection.

UV-Visible/ Near IR – emission, absorption, fluorescence and photoacoustic. Excitation sources (lasers, time resolution), wavelength dispersion (gratings, prisms, interference filters, laser, placement of sample relative to dispersion, resolution), Detection of signal (photocells, photomultipliers, diode arrays, sensitivity and S/N), Single and Double Beam instruments, Interpretation (quantification, mixtures, absorption vs. fluorescence and the use of time, photoacoustic, fluorescent tags). (16 Hours)

UNIT II Separation techniques Chromatography: Gas chromatography, liquid chromatography, supercritical fluids, Importance of column technology (packing, capillaries), Separation based on increasing number of factors (volatility, solubility, interactions with stationary phase, size, electrical field), Detection: simple vs. specific (gas and liquid), Detection as a means of further analysis (use of tags and coupling to IR and MS), Electrophoresis (plates and capillary) and use with DNA analysis.

UNIT III Immunoassays and DNA techniques Mass spectroscopy: Making the gaseous molecule into an ion (electron impact, chemical ionization), Making liquids and solids into ions (electrospray, electrical discharge, laser desorption, fast atom bombardment), Separation of ions on basis of mass to charge ratio, Magnetic, Time of flight, Electric quadrupole. Resolution, time and multiple separations, Detection and interpretation (how this is linked to excitation).

UNIT IV Elemental analysis: Mass spectrometry (electrical discharges). Atomic spectroscopy: Atomic absorption, Atomic emission, and Atomic fluorescence. Excitation and getting sample into gas phase (flames, electrical discharges, plasmas), Wavelength separation and resolution (dependence on technique), Detection of radiation (simultaneous/scanning, signal noise), Interpretation (errors due to molecular and ionic species, matrix effects, other interferences).

UNIT V NMR spectroscopy: Principle, Instrumentation, Factors affecting chemical shift, Spincoupling, Applications.

PRACTICALS

- Safety Practices in the Chemistry Laboratory
- Determination of the isoelectric pH of a protein.
- Titration curve of an amino acid.
- Determination of the void volume of a gel filtration column.
- Study of Electronic Transitions in Organic Molecules (i.e., acetone in water)
- Quantitative Analysis of Mixtures by Gas Chromatography (i.e., chloroform and carbon tetrachloride)
- Separation of Carbohydrates by HPLC
- Potentiometric Titration of a Chloride-Iodide Mixture
- Cyclic Voltammetry of the Ferrocyanide/Ferricyanide Couple
- Use of fluorescence to do “presumptive tests” to identify blood or other body fluids.

- Use of “presumptive tests” for anthrax or cocaine
- Collection, preservation, and control of blood evidence being used for DNA testing
- Use of capillary electrophoresis with laser fluorescence detection for nuclear DNA chromosome only or multiple chromosome)
- Use of sequencing for the analysis of mitochondrial DNA
- Laboratory analysis to confirm anthrax or cocaine
- Detection in the field and confirmation in the laboratory of flammable accelerants or explosives
- Detection of illegal drugs or steroids in athletes
- Detection of pollutants or illegal dumping
- Fibre analysis

(At least 10 experiments to be performed.)

Reference Books:

- Principles of Instrumental Analysis - 6th Edition by Douglas A. Skoog, F. James Holler, and Stanley Crouch (ISBN 0-495-01201-7).
- Instrumental Methods of Analysis, 7th ed, Willard, Merritt, Dean, Settle.
- Instrumental methods of Chemical Analysis, G.W. Ewing, 5th Edition, McGraw-Hill, New York, 1988.
- Principles of Instrumental Analysis, Skoog, D.A, S.J. Holler, T.A. Nilman, 5th Edn., Saunders college publishing, London, 1998.
- Instrumental Methods of Chemical Analysis, Chatwal Anand, 3rd Edition, Himalaya Publishing House, 1986.
- Principles of Electroanalytical Methods, T. Riley and C. Tomilinson, John Wiley and Sons, 2008.
- Instrumental Methods of Chemical Analysis, K. Sharma, Goel Publishing House Meerut 2000.

Fundamentals of Spectroscopy

Syllabus

UNIT I Ultraviolet Spectroscopy- Woodward- Fisher rules for conjugated dienes and carbonyl compounds; Calculation of max. Ultraviolet spectra of aromatic and heterocyclic compounds. Steric effect in biphenyls.

UNIT II IR Spectroscopy Characteristic vibrational frequencies of alkanes; alkenes; alkynes; aromatic compounds; alcohols; ethers; phenols and amines. Detailed study of vibrational frequencies of carbonyl compounds [ketones; aldehydes; esters; amides; acids; anhydrides; lactones; lactams and conjugated carbonyl compounds] Effect of hydrogen bonding and solvent effect on vibrational frequencies; overtones; combination bands and Fermi resonance.

UNIT III NMR Spectroscopy General introduction and definition; chemical shift; spin –spin interaction; shielding mechanism of measurement; chemical shift values and correlation for protons bonded to carbons [aliphatic; olefinic; aldehydic and aromatic] and other nuclei [alcohols; phenols; enols; acids; amines; amides and mercapto]; chemical exchange; effect of deuteration; complex spin-spin interaction, virtual coupling. Karplus curve variation of coupling constant with dihedral angle. shift reagent; solvent effect. nuclear overhauser effect [NOE] Resonance of other nuclei – F; P.

UNIT IV Mass Spectrometry Introduction, Different types of ion, factors affecting fragmentation, ion analysis, ion abundance. Mass spectral fragmentation of organic compounds, common functional groups, molecular ion peak, metastable peak, McLafferty rearrangement, nitrogen rule. High-resolution mass spectrometry. Examples of mass spectral fragmentation of organic compounds with respect to their structure determination.

UNIT V a) Carbon-13 NMR Spectroscopy General considerations; chemical shift [aliphatic; olefinic; alkyne; aromatic; heteroaromatic and carbonyl compounds]; problems associated with ^{13}C , FT-NMR, proton decoupled off resonance.

b) Structural problems based on combined spectroscopic techniques.

PRACTICALS

1. Determination of a Mixture of Cobalt and Nickel (UV/Vis spec.)
2. Nuclear Magnetic Resonance
3. Determination of Caffeine in Beverages by HPLC
4. IR Absorption Spectra (Study of Aldehydes and Ketones)
5. Determination of Calcium, Iron, and Copper in Food by Atomic Absorption
6. Mass spectral fragmentation of organic compounds
7. chemical shift (determination)

REFERENCE BOOKS

- V.M. Parikh, Application spectroscopy of organic molecules. (Mehata)
- D.W. Williams and Fleming, Spectroscopic methods of organic compound.
- Silverstein and Basallar, Spectroscopic identification of organic compounds V.M.
- Parikh ORPTION SPECTROSCOPY OF ORGANIC MOLECULES (J. Wiley)
- P.S. Kalsi Spectroscopy of organic compounds (New age publisher)
- J.R. Dyer. Application of absorption spectroscopy of organic compounds.
- Jackman and Sterneil , Application of NMR spectroscopy
- J.D. Roberts, Nuclear magnetic resonance (J. Wiley)

- Jafee and Orchin, Theory and application of U.V,
- K. Benjamin. Mass spectroscopy
- Beynon J H et.al , The mass spectra of organic molecules.
- Wehli F.W, Marchand A. P. Interpretation of carbon 13 NMR (J. Wiley)
- W. Kemp, Organic spectroscopy ELBS
- Willard Merritt and Dean. Instrumental methods of analysis CBS
- Das and Jame , Mass Spectroscopy.
- Group Theory by Cotton& Wilkinson.

Some Special aspects of Chemistry

Syllabus

Unit I Symmetry and Group Theory in Chemistry-Symmetry elements and symmetry operation, definition of a group, subgroup, relation between orders of a finite group and its subgroup.Point symmetry group.Character table and their use.

UNIT II Green Chemistry: Introduction and importance of green chemistry? Principles of green chemistry.Green alternative solvents and reagents in organic synthesis. Recent advances in green synthetic methodologies.

UNIT III Chemical Toxicology: Toxic chemicals in the environment, biochemical effects of arsenic, cadmium, lead, mercury, carbon dioxide, chloro-fluorocarbons, pesticides. Chemical and bio-warfare agents.Environmental and public health.

UNIT IV Separation Techniques: Liquid-liquid solvent extraction, super critical fluid extraction. Theory of chromatography, terminology used in chromatography, high performance liquid chromatography, gas chromatography and size exclusion chromatography.

UNIT V Chemistry of some Typical Natural Products: A study of the following compounds involving their isolation, structure elucidation and synthesis: Alkaloids- Hofmann exhaustive methylation, nicotine; Terpenes- Isoprene rule, citral, flavonoidsquercetin.

Practical

1. Paper chromatographic separation of metal ions (binary mixture only)
2. Colorimetric determination of metal ions.
3. Solvent extraction separation and estimation of Mg (ii) and Fe(ii)
4. Ion exchange Method- Separation and estimation of Mg (ii) and Zn(ii) v. EDTA titrations of Ca^{2+} , Mg^{2+} , Zn^{2+} and Cu^{+2} vi. Determination of hardness of water by EDTA.
5. Paper chromatographic separation of amino acids and sugars (only binary mixtures)
6. Determination of acid value of a vegetable oil.
7. Determination of iodine value of a vegetable oil.
8. Determination of saponification value of vegetable oil.
9. Hydrolysis of methyl acetate catalyses by an acid.
10. Hydrolysis of Ethylacetate.
11. Extraction of caffeine from tea leaves.
12. Analysis of Carbohydrate: aldoses and ketoses, reducing and non-reducing sugars.

Reference Books

- Manual of Biochemistry Workshop, 2012, Department of Chemistry, University of Delhi.
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