## KARNATAKA STATE OPEN UNIVERSITY

## **PROGRAMME GUIDE**

**MASTER OF SCIENCE IN CHEMISTRY** 



## DEPARTMENT OF POST GRADUATE STUDIES AND RESEARCH IN CHEMISTRY

Mukthagangothri, Mysore – 570 006

#### VICE CHANCELLOR'S MESSAGE

#### Dear Learner,

The family of KSOU welcomes you to pursue the academic programmes you have chosen to achieve not only academic excellence but also to fulfill the desire of your career. The University, established by the Act of State Legislature has created wonderful academic ambience. The programmes offered by the University have been recognized by University Grants Commission. Therefore, the degrees are valid for employment opportunities across the country. The 'core values' of the University are derived from its vision 'Higher Education to Everyone, Everywhere'. The ultimate touchstone of quality higher education is the motto of the University. Today, higher education stands at the crossroads of keeping pace with the emerging needs of the country.

The University has adopted a school concept in its functioning. The school of science headed by a Director offers academic programmes in basic and applied sciences. It combines an inter disciplinary and professional approach to pedagogy and research. The University believes that rigors of the contemporary world require competent quality human resources to create knowledge based society. The academic activities of B.Sc. programmes are initiated through well-established department/s led by the Chairperson/s. Well-qualified teaching faculty with equally dedicated non-academic team is an asset to the University, which is always, committed for the welfare of the students.

The University functions in a 3-tier system of student support service, namely Headquarters, Regional Centres and Learners Support Centres spread all over Karnataka. The learners can undergo teaching-learning process in the notified Regional Centres/Learner Support Centres. The University has adopted a mechanism to deliver Self Learning Material by print, limited audio visual and Counseling/Personal Contact Programme. As a learner, you will have greater opportunity to gain knowledge and skill through those mechanisms. The academic counselors will play a strategic role and supports you from the enrollment of the programme till you accomplish the goal. A proper blending of the knowledge and skill will be imparted so that you will be transformed as a good citizen to contribute to the development of society and the country.

The UGC in its Public Notice dated: 23.02.2018 stated that the Degree/Diploma/Certificate Programme awarded through distance mode are at par with corresponding Degree/ Diploma/ Certificate Programme obtained through conventional universities. The degrees acquired through distance education are recognized for the purpose of employment in State/Central Government, MNCs, Private Sector etc. and also for pursuing higher education in other educational institutes. Therefore, you have greater opportunity of pursuing Higher Education without any kind of fear about your career.

I am sure you will enjoy good experience with services rendered by the university through its Regional centres and Learner Support Centres, besides Headquarters. I wish you all the best in your academic endeavors.

#### MESSAGE FROM DEAN (ACADEMIC)

#### Dear learner,

As you know education imparts knowledge and skills which empowers all to build civilized society. Higher education policy which was once a priority sector is no longer maintaining the same, due to General Agreements and Trade in Services (GATS). The education policy of the government provides a greater opportunity to accelerate Gross Enrolment Ratio (GER).

Higher education is imparted both by conventional system and ODL system. The former education has inbuilt rigidity where ODL enjoy flexibility. Presently the GER in higher education around is 27%, thanks to the role played by ODL system. The ODL system operates under access, flexibility and success.

The Karnataka State Open University, which came up in 1996 under the Act of state legislation 1992 play a stupendous role in imparting quality education. As one of the premier institution in ODL system of the country, the university strive hard to empower various disadvantaged sections of the society like, house wives, economically and culturally backward, tribal, senior citizens, working groups, differently abled, professionals, technocrat, jail inmates etc., The University cater to the needs of students ranging from the age of 18 years to 80 years.

The programmes offered by KSOU are strictly in conformity with quality and standards set by regulatory bodies UGC/AICTE etc., The Karnataka State Open University was established on 1<sup>st</sup> June 1996 vide Government Notification No. EDI/ UOV/ 95 dated 12<sup>th</sup> February 1996- KSOU Act 1992, keeping in view the educational needs of our country, in general, and the state in particular. The University has a long and rich experience in the field of Distance Education as the erstwhile Institute of Correspondence Course and Continuing Education. University Grants Commission (UGC) New-Delhi vide order No: F.No 14-5/2018 (DEB-I) Dated : 14th August 2018 for the period from 2018-19 to 2022-23. The KSOU operates on dictum quality first and students foremost. Further the university is highly committed to provide need based education to the door steps of the students.

The KSOU has students' support services which work in 3 tiers - head office; regional centres and study centres within the jurisdiction of state. The admissions, counseling and the examinations are conducted in different places, hence, education at the door steps.

The dedicated staffs in various department and state of the art student support services create a conducive environment for teaching learning. The university put in places all possible efforts to keep the learners happy from the stage of enrolment till they get employed. I am confident that, as a learner in the university, you will enjoy good experience in the system.

I wish you all the best in your academic endeavors.

Truly yours,

Dean (Academic)

#### **Department of studies and Research in Chemistry**

#### Vision:

To enhance our status as an outstanding teaching and multidisciplinary research hub which is recognized for its quality teaching, innovative research to promote and discovery of new molecular entities that attracts the best students globally

#### Mission:

Our mission is to cultivate a world-class quality teaching environment for undergraduate, postgraduate, and doctoral research programs to empower our students to meet the challenges of academic and industrial arenas. We foster and encourage the pursuit of interdisciplinary research in the thrust areas of chemical sciences.

- > To promote scientific thinking among the learners through offering accessible, affordable quality higher education.
- > To empower learners to gain knowledge and skills in the field of Chemical Science.
- > To train the learners on curriculum to imbibe with moral, ethical and civic values.
- To impart the specific skills to the learners so as to enable them to be a responsible citizen in the society.
- > To enhance the attitude of the learners in such a way that they realize individual responsibility in the society.
- > To enhance the professionalism to diagnose and offer solutions thereof.

#### 1. Chairman's message

I would like to take this opportunity to welcome you to the Karnataka State Open University and the Department of Studies and Research in Chemistry. I am delighted that you have chosen to enrol in our Chemistry program and work towards being awarded the Master of Science degree in Chemistry.

The Department of Studies and Research in Chemistry was established in 2013. Over the last years, and with the excellent and rigorous academic preparation provided by our program, the department has produced many outstanding graduates who have gone on to successful and exemplary careers in industry, academia and government.

Chemistry is the branch of basic science that applies the core scientific disciplines (chemistry, physics, biology, mathematics, computer basics and applied engineering sciences) to transform raw materials or chemicals into more useful or valuable forms, invariably in processes that involve chemical change. In research and development, chemical science not only create new, more effective ways to manufacture chemicals, but also work collaboratively with chemists to pioneer the development of new hightech materials for specialized applications. The development, commercialization, and optimization of the industrial-scale processes for manufacturing chemicals and advanced materials are feats of chemical science. Indeed, virtually every aspect of a modern industrial economy is critically dependent upon chemical science for manufacturing the vast array of bulk and specialty chemicals and high-tech materials needed to create a limitless array of value-added products.

The faculties of the Department are committed to continuous improvements of our program. We encourage your questions and comments on the various aspects of our program and are particularly interested in your comments regarding the program's educational objectives, outcomes and curriculum.

Warm Regards,

Chairman Department of Studies and Research in Chemistry Karnataka State Open University Mukthagangothri, Mysuru-570007

#### 2. About the Department

The Department of Chemistry is one of newly established departments of Karnataka State Open University, established in 2013 and since then we are running postgraduate program. From this year, undergraduate and Ph.D. courses in different specializations, Analytical, Inorganic, Organic and Physical chemistry are also introduced. The chemistry department has a rich tradition of imparting high-quality teaching and research in cutting-edge thrust areas of chemical science, providing intensive learning and research training to students and research scholars. The students have access to a seminar library where a large collection of international and national reputed textbooks are housed. Besides this, the department has a state-of-art laboratory infrastructure for training and conducting quality research. The department has smart classroom, modern Audio and Video studio for offering teaching in online mode. The department of chemistry organized workshops, symposia, and national and international conferences on thrust areas of chemical sciences. A large number of postgraduate students have qualified NET and GATE examinations every year. During the last 5 years, the department has published more than 10 research papers in Scopus indexed journals during 2013-2021.

#### **Faculty Details**

#### **Faculty Details**

S1.	Name of the Faculty	Designation	Qualification	Specialization	Expe-	Mobile
No.					rience	Number
					in	
					Years	
1	Dr. M. Umashankara	Assistant Professor	M.Sc. Ph.D.	Organic Chemistry	7	9482510061
		& Chairperson				
2	Dr. Arjun H.A	Assistant Professor				
		(Contract Basis)				
3	Dr. Kemparaje Gowda	Assistant Professor				
		(Contract Basis)				
4	Dr. Krishna M.H	Assistant Professor				
		(Contract Basis)				
5	Dr. Obaiah G.O	Assistant Professor				
		(Contract Basis)				

#### a. Department of Chemistry

#### 3. Program offered:

M. Sc. in Chemistry

B.Sc. in Chemistry

Ph.D. in Chemical Science

#### 4. Course detail of M.Sc. Chemistry

- a. Duration of the course: Two years (Four semesters)
- b. Medium of Instruction: Medium of Instruction is English only.
- c. Mode of Instruction: Print material, E-content, PCP/Counseling.
- d. Attendance (Minimum required): 75% for counselling sessions of theory courses. 85% for practical sessions.

#### 5. Course detail of B.Sc. Chemistry

- a. Duration of the course: Three years (six semesters)
- b. Medium of Instruction: Medium of Instruction is English only
- c. . Mode of Instruction: Print material, E-content, PCP/Counseling.
- d. **Attendance (Minimum required):** 75% for counselling sessions of theory courses. 85% for practical sessions.

\* \* \* \* \*

## **CBCS** Course Matrix

Course			Counselling/	Ν	Iaximum Marks		Examinat
Code	Semester and Course	Credits	PCP hours*	IA	Term-End Examination	Total	ion duration
	Semester - I						
HC 1 1	Course 1	4	12	20	80	100	3
HC 1.2	Course 2	4	12	20	80	100	3
HC 1.2	Course 3	4	12	20	80	100	3
HC 1.4	Course 4 ((Practical)	4	120	-	50+50	100	3+3
SC 1.1	Course 5	3	10	20	80	100	3
EL-1	Inter Disciplinary course – I	2	06	10	40	50	$1^{1/2}$
	Semester - I Total	21	172	90	460	550	
	Same attack H						
HC 2.1	Semester - II	4	12	20	80	100	3
HC 2.2	Course 6	4	12	20	80	100	3
HC 2.3	Course 7	4	12	20	80	100	3
HC 2.4	Course 8 Course 0 (Prestical)	4	120	-	50+50	100	3+3
SC 2.1	Course 9 (Practical)	3	10	20	80	100	3
EL-2	Inter Disciplingry course. II	2	06	10	40	50	$1^{1/2}$
	Semester - II Total		. = -				
	Semester - II Total	21	172	90	460	550	
	Semester - III		10	•		100	2
HC 3.1	Course 11	4	12	20	80	100	3
HC 3.2	Course 12	4	12	20	80	100	3
HC 3.3	Course 13 (Practical)	4	120	-	50+50	100	3+3
SC 3.1	Course 14	3	10	20	80	100	3
SC 3.2	Course 15	3	10	20	80	100	3
SDC-1	Skill development course-1	2	6	10	40	50	1.2
	Semester – III Total	20	170	90	460	550	
	Semester - IV		10	20	00	100	2
HC 4.1	Course 16	4	12	20	80	100	3
HC 4.2	Course 17 (Practical)	4	120	-	50+50	100	3
HC 4.3	Course 18	4	12	20	80	100	3
SC 4.4	Course 20	3	10	20	80	100	5
SC 4.1	Course 21	3	10	20	80	100	5 1 <sup>1/2</sup>
SC 4.2 SDC-2	Skill development course-2	2	6	10	40	50	1
500-2	Semester – IV Total	20	170	90	460	500	
Sem	ester I to IV Grand total	82	684	360	1840	2200	

- Note: HC-Hard Core, SC-Soft Core, EL-Interdisciplinary Elective.
   ➢ During 4<sup>th</sup> Semesters student can study two soft cores course 20 and course 21 or opt desertation.
  - > Student might take the department concern to opt specialized soft courses with limited mobility.

Course and examination details of M.Sc. Chemistry Program under Choice Based Credit

System (CBCS)

	M.Sc. Chemistry Semester-I										
	1	Tea	ching sch	neme			]	Examina	tion sc	heme	
	ctica		(Hours)		~	s				Min	Dessing
ode	/prae	x	al		edit	n Hr	Max.	Marks	arks	Marks	
0	Theory	Theor	practic	Total	Cr	Duration i	External Marks	Internal Marks	Total Ma	Theory	Practical
HCT101	Inorganic Chemistry-I	12	-	12	4	3	80	20	100	40	-
HCT102	Organic Chemistry-I	12	-	12	4	3	80	20	100	40	-
HCP103	Physical Chemistry-I	12		12	4	3	80	20	100	40	20
P1	Analytical Practical - I	-	60	60	2	3	50	-	50	-	20
Р2	Inorganic Practical - I	-	60	60	2	3	50	-	50	-	-
SCT101	Analytical chemistry	10	-	10	3	3	80	20	100	40	-
EL	Open elective Chemistry-I	6	-	6	2	11/2	40	10	50	20	
	Total	52	120	172	21	<b>19½</b>	460	90	550	180	40

### M.Sc. Chemistry Semester-II

	ry/practical	]	Feachin schem (Hours	ng ie s)		Examination scheme					
Code		ory	ical	Total	Credits	in Hrs	Max. Marks		<b>1</b> arks	Min. Passing Marks	
	Theo	Theo	pract			Duration	External Marks	Internal Marks	Total <b>N</b>	Theory	Practical
HCT201	Inorganic Chemistry-II	12	-	12	4	3	80	20	100	40	-
HCT202	Organic Chemistry-II	12	-	12	4	3	80	20	100	40	-
HCP203	Physical Chemistry-II	12		12	4	3	80	20	100	40	20
Р3	Organic Practical - I	-	60	60	2	3	50	-	50	-	20
Р4	Physical Practical - I	-	60	60	2	3	50	-	50	-	-
SCT201	Molecular Spectroscopy	10	-	10	3	3	80	20	100	40	-
EL	Open elective Chemistry-II	6	-	6	2	11/2	40	10	50	20	
	Total	52	120	172	21	<b>19</b> ½	460	90	550	180	40

	M.Sc. Chemistry Semester-III										
	cal	] ]	Teaching scheme (Hours)				Exa	minatio	n sche	me	
Code	heory/practic	eory	ctical	Total	Credits	Duration in Hrs	Max.	Marks	Marks	M Pas Ma	lin. sing arks
		The	prae				External Marks	Internal Marks	Total	Theory	Practical
HCT301	Application of spectroscopy-1	12	-	12	4	3	80	20	100	40	-
HCT302	Bioinorganic and Biophysical Chemistry	12	-	12	4	3	80	20	100	40	-
P5	Analytical Practical - II	-	60	60	2	3	50	-	50	-	20
P6	Inorganic Practical - II	-	60	60	2	3	50	-	50	-	20
SDC-1	Skill development course-1	6	-	6	2	11/2	40	10	50	20	
SCT301 & SCT302	<ul> <li>a) Inorganic Chemistry special</li> <li>b) Organic chemistry special</li> <li>c) Physical Chemistry special</li> <li>d) Separation techniques</li> </ul>	20	-	20	6	6	160	40	200	80	-
	Total	50	120	170	20	191/2	460	90	550	180	40

	N	I.Sc. (	Chemis	try Sei	meste	r-IV					
	al	]	Feachin schem (Hours	ng e s)		Examination scheme					
Code	heory/practic	eory	ctical	Total	Credits	on in Hrs	Max.	Marks	Marks	M Pas Ma	lin. sing arks
	L L	Th	pra			Durati	external Marks	Internal Marks	Total	Theory	Practical
HCT401	Application of spectroscopy-2	12	-	12	4	3	80	20	100	40	-
HCT402	Bioorganic Chemistry	12	-	12	4	3	80	20	100	40	-
P7	Physical Practical - II	-	60	60	2	3	50	-	50	-	20
P8	Organic Practical - II	-	60	60	2	3	50	-	50	-	20
SDC-2	Skill development course-2	6	-	6	2	11/2	40	10	50	20	
SCD	Desecration				6	-	2	00	200	-	
SCT401 & SCT402	<ul> <li>a) Advanced inorganic Chemistry</li> <li>b) Advanced physical Chemistry</li> <li>c) Advanced organic chemistry</li> <li>d) Material Chemistry</li> </ul>	20	-	20	6	6	160	40	200	80	-
	Total	50	120	170	20	191/2	460	90	550	180	40

 Note: HC-Hard Core, SC-Soft Core, EL-Interdisciplinary Elective.
 ➢ During 4<sup>th</sup> Semesters student can study two soft cores course 20 and course 21 or opt desertation.

> Student might take the department concern to opt specialized soft courses with limited mobility.

### **Interdisciplinary Electives**

SL No	Department	Sub Code	l Semester	Sub Code	II Semester
1	KANNADA	ELK-01	ಆಧುನಿಕ ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಇತಿಹಾಸ	ELK-02	ಪ್ರಾಚೀನ ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಇತಿಹಾಸ
2	ENGLISH	ELE-01	Indian Literature -I	ELE-02	Indian Literature -II
3	HINDI	ELH-01	Vyavaharik Hindi Vyakaran	ELH-02	Hindi Cinema
4	TELUGU	ELT-01	Tilak	ELT-02	Telugu Samskruthi – Samaajam
5	HISTORY	ELHS-01	Ancient World Civilisations (Egypt, Mesopotamia, Greek, Roman, Inca, Chinese)	ELHS-02	Social Reform Movement in India
6	ECONOMICS	ELEC-01	Economic Policies of India Since 1991	ELEC-02	Institutions for International Development
7	POLITICAL SCIENCE	ELP-01	Local Government in India.	ELP-02	Indian Constitution
8	PUBLIC ADMINISTRATION	ELPA-01	Indian Polity-1	ELPA-02	Indian Polity-2
9	SOCIOLOGY	ELS-01	Invitation to Sociology	ELS-02	Study of Indian Society
10	JOURNALISM AND MASS COMMUNICATION	ELJ-01	Aspects of Journalism and Mass Communication - I	ELJ-02	Aspects of Journalism and Mass Communication - II
11	ANCIENT HISTORY AND ARCHEOLOGY	ELA-01	World heritage sites of India	ELA-02	Cultural History of Hoysalas
12	EDUCATION	ELED-01	Foundations of Education	ELED-02	Higher Education

13	COMMERCE	ELC01	Personal Financial	ELC02	Entrepreneurship
			Planning		Development
14			Disastar		Г. Commorco
14	WANAGEWIENT		Management	ELIVI –02	E-Commerce
			Management		
15	BIOCHEMISTRY	ELMBC –01	Basics of	ELMBC –02	Basic Bioorganic
			Bioinorganic and		chemistry for Biology
			Biophysical		graduates.
			chemistry for Biology		
			graduates.		
16		ELMBT -01	Biotechnology	FLMBT -02	Fundamentals of
10	BIOTECHNOLOGI		Principles and		Biotechnology
			annlications		Dioteennology
			applications		
17	CHEMISTRY	ELMC –01	Open Elective I	ELMC –02	Open Elective II
18	CLINICAL NUTRITION	ELMCND –01	Healthy lifestyles and	ELMCND-02	Nutraceuticals and
	AND DIETETICS		nutrition		health foods
10			Mohilo Ann		E Commorco
19	CONFORER SCIENCE		Development	ELIVICS -02	E-Commerce
			Development		
20	ENVIRONMENTAL	ELMES –01	Basics of	ELMES –02	Advances in
	SCIENCE		Environmental		Environmental
			Science		Science
21	GEOGRAPHY	FLMG –01	Introduction to	FIMG -02	Geography of
			Physical Geography		Karnataka
22	MATHEMATICS	FLMM –01	Fundamentals of	FI MM02	Combinatorics and
~~			Mathematics		Graph Theory
			mathematics		erupii meory
23	MICROBIOLOGY	ELMMB-01	Microbial World and	ELMMB –02	Microbes in
			Microbial Diversity		Sustainable
					Agriculture and
					Development
24	PHYSICS	ELMP –01	Mechanics	ELMP –02	Waves and Optics
25	PSYCHOLOGY	ELMPSY –01	Introduction to	ELMPSY –02	Psychology in
			Psychology		Everyday Life

26	INFORMATION TECHNOLOGY	ELMIT –01	Green Computing	ELMIT –02	E-Commerce
27	BOTANY (NEW)	ELMBOT –01	Plant-Microbe Interactions	ELMBOT –02	Plant Diversity and Human Welfare
28	ZOOLOGY (NEW)	ELMZ –01	Parasites Vectors & communicable diseases	ELMZ-02	Essential of Reproductive Health
29	FOOD AND NUTRITION SCIENCES	ELMFNS –01	Food Psychology	ELMFNS –02	Nutritional Management in Disaster Conditions

#### Note:

- A. I and II Semester Open elective (Interdisciplinary Electives) syllabus are attached in Annexure I and Annexure II respectively.
- B. The Students may contact respective department chairperson in case of any queries regarding open elective course. The contact details available in the university website.

Course	Course Code	Course Title	Credits
Course 1	HCT-101	Inorganic Chemistry-I	4
Course 2	HCT-102	Organic Chemistry-I	4
Course 3	HCT-103	Physical chemistry-I	4
Course 4(Practical)	P1	Practical 1:Analytical Chemistry-I	4
	P2	Practical 2: Inorganic Chemistry-I	
Course 5	SCT-101	Analytical chemistry	3
Interdisciplinary Elective-1	IE -1	Open elective Chemistry-I	2
Total			21

#### M.Sc. Chemistry - First Semester

### M.Sc. Chemistry - Second Semester

Course	Course	Course Title	Credits
	Code		
Course 6	HCT-201	Inorganic Chemistry-II	4
Course 7	HCT-202	Organic Chemistry-II	4
Course 8	HCT-203	Physical Chemistry-II	4
Course 9(Practical)	P3	Practical 3: Organic Chemistry-I	4
	P4	Practical: Physical Chemistry-I	
Course 10	SCT-201	Molecular spectroscopy	3
Interdisciplinary Elective-2	IE-2	Open elective Chemistry-II	2
Total			21

Interdisciplinary Electives to be offered by Department of Chemistry

- Open elective Chemistry-I
- Open elective Chemistry-II

#### M.Sc. Chemistry - Third Semester

Course	Course Code	Course Title	Credits
Course 11	HCT-301	Application of spectroscopy-1	4
Course 12	HC-302	<b>Bio-Inorganic and Bio-Physical chemistry</b>	4
Course 13 (Practical)	P5	Practical 5: Analytical Chemistry-II	4
	P6	Practical 6: Inorganic Chemistry-II	
Skill development course-1	SDC-1		2
Course 15	SCT-301	Inorganic chemistry Special	6
&	&	Organic chemistry Special	
Course 15	SCT-301	Physical chemistry Special	
		Separation techniques	

Total		20

#### M.Sc. Chemistry - Fourth Semester

Course	Course Code	Course Title	Credits
Course 16	HCT-401	Application of spectroscopy-2	4
Course 17	HCT-402	Bio organic chemistry	4
Course 18(Practical)	P7	Practical 7: Organic Chemistry-II	4
	P8	Practical 8: Physical Chemistry-II	
Skill development course-1	SDC-1		2
Course 19*	HCD	Dissertation	6
Course 20 <sup>#</sup>	SCT-401	Advanced Inorganic Chemistry	6
&	&	Advanced Physical Chemistry	
Course 21 <sup>#</sup>	SCT-402	Advanced Organic chemistry	
		Material chemistry	
Total			20

- Note: HC-Hard Core, SC-Soft Core, EL-Interdisciplinary Elective.
   ➢ During 4<sup>th</sup> Semesters student can study two soft cores course 20 and course 21 or opt desertation.
  - > Student might take the department concern to opt specialized soft courses with limited mobility.

## **DETAILED SYLLABUS**

### **FIRST SEMESTER**

### **Course 1: Inorganic Chemistry -1**

Block -1.1.1	Title: Covalent Compounds
Unit-1	Formation and properties of covalent compounds, oxidation numbers theory,
	Octet rule theory, multicenter bonding, Bent rules.
Unit-2	Valence bond theory (VBT) and its limitations; Hybridization theory and
	energetic of hybridizations.
Unit-3	VSEPR model and $d\pi$ -p $\pi$ bonds, shape of molecules-ClF <sub>3</sub> , ICl <sub>4</sub> , TeF <sub>5</sub> , I <sub>3</sub> ,
	$TeCl_{6}^{2-}$ , $XeF_{6}$ , $SbCl_{6}^{3-}$ , $IF_{7}$ , $ReF_{7}$
Unit-4	Concepts of resonance, criteria for resonating structures, electro negativity

and polar covalent bond.	
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Block -1.1.2	Title: Ionic compounds
Unit-5	Formation and properties of ionic compounds, dissolution of ionic compounds
	in polar solvents and its energetic, lattice energy, Born-Lande's equation,
	Born-Haber cycle and its applications.
Unit-6	Ionic radii, size effect, factors affecting the radii of ions, efficiency of packing
	and crystal lattices, radius-ratio rule and its significance, calculation of some
	limiting radius ratio values.
Unit-7	Geometry of AB type crystals: NaCl, CsCl & NiAs, reasons for preference
	for a particular structure in above AB type of compounds.
Unit-8	Geometry of AB <sub>2</sub> type crystals: Fluorite, antifluorites, Rutile structures. Li <sub>2</sub> O,
	Na <sub>2</sub> O, CdCl <sub>2</sub> , CdI <sub>2</sub> structures. Zintl-isoelectronic relationship in solids

Block -1.1.3	Title: Modern theories of chemical bonding
Unit-9	Molecular orbital theory, Linear combination of atomic orbitals, Formation of
	$\sigma$ , $\pi$ and $\delta$ molecular orbitals, Molecular orbital energy diagram.
Unit-10	Calculation of bond order, prediction of magnetic properties and stability of
	hetero nuclear di-atomic molecules (ex: CO, NO) and linear tri-atomic
	molecules (ex: $CO_2$ , $NO_2$ ).
Unit-11	Covalent character in ionic compounds, polarization, dipole moment, Fajan's
	rules, effect of polarization on crystals, effect of polarization on thermal
	stability of carbonates and melting points of anhydrous halides.
Unit-12	Metallic bond, Introduction and properties of metallic state, metallic bond,
	VB theory of metallic bond, band theory of metallic bond, types of metals
	(conductors, semiconductors, and insulators).

Block-1.1.4	Title: Metallic compounds and Metal pi-Complexes
Unit-13	Metal-Metal bonds: Occurrence of metal-metal bond, Classification of metal
	clusters, Binuclear, trinuclear, tetranuclear, pentanuclear and hexanuclear
	with reference to halide, oxide, alkoxide and acetate clusters, Isopoly,

	Heteropoly acids and their anions.
Unit-14	Metal carbonyls: structure and bonding, EAN rule, Metal carbonyl clusters
	with reference to classification, synthesis,
Unit-15	Vibrational spectra of metal carbonyls for bonding and structure elucidation,
	important reaction of metal carbonyls, Synthesis reactions and applications of
	Sandwich compounds.
Unit-16	Metal nitrosyls: Nitrosylating agents for synthesis of metal nitrosyls,
	vibrational spectra and X-ray diffraction studies of transition metal nitrosyls
	for bonding and structure elucidation, important reactions of transition metal
	nitrosyls, structure and bonding

#### **Reference Books**

- 1. Inorganic Chemistry, 4<sup>th</sup> Ed, J. E. Huheey, E.A. Keiter and R. S. Keiter. *Addission-Wesley* (1993).
- Inorganic Chemistry, 2<sup>nd</sup> Ed, D. F. Shriver, P. W. Atkins and C. H. Langford. Oxford University Press (1994)
- 3. Basic Inorganic Chemistry, 3<sup>rd</sup> Ed, F. A. Cotton, G. Wilkinson and P. L. Gaus, *John-Wiley and sons* (**1995**)
- 4. Concepts and Models in Inorganic Chemistry 3<sup>rd</sup> Ed, B. Douglas. D. H. Daniel and J. J. Alexander, *John-Wiley and Sons* (**1983**).
- 5. Concise Inorganic Chemistry-J. D. Lee, 5<sup>th</sup> Ed, New Age International (1996).
- 6. Inorganic chemistry-K. F. Purcell and J.C. Kotz W.B. Saunders San Francisco.

### **Course 2: Physical Chemistry -1**

Block-1.2.1	Title: Fundamentals of thermodynamics
Unit-1	Introduction to three laws of thermodynamics, Entropy and equilibrium, interpretation of Gibb's function.
Unit-2	Variation of free energy with T and P, Maxwell's relations, thermodynamics
	equations of states, minitations of valit fions equation, Nerst heat medicinis
	and its applications.
Unit-3	Determination of absolute entropies. Application of thermodynamics:
	Entropy and free energy of mixing, partial molar quantities, partial molar
	volume and free energy (chemicals potential), their significance and

	determinations (slope and intercept methods).
Unit-4	Gibbs – Duhem and Duhem- Margules equations, Calculations of standard
	entropies from Cp data, Problems, Exceptions to third law.

Block-1.2.2	Title: Fundamentals of chemical kinetics
Unit-5	Definition of the terms: molecularity, stoichiometry, order and rate of the
	reaction and their relationship, Factors influencing the rate of chemical
	reactions, Types of chemical reactions with respect to rate (zero order, first
	order and second order), Derivation of rate equation for zero order, first order
	and second order reactions, Half-life period.
Unit-6	Derivation of rate equation for third order reaction, Experimental
	determination of order of reaction with respect to reactant, Determination of
	total order of a reaction, Problems.
Unit-7	Complex and Parallel reaction, Derivation of rate equation for complex and
	parallel reactions, Problems.
Unit-8	Consecutive and Reversible reactions, Derivation of rate equation for
	consecutive and reversible reactions, Problems.

Block-1.2.3	Title: Introduction to Quantum chemistry
Unit-9	Concept of operator, quantum mechanical operators (Cartesian, Spherical,
	polar co-ordinate systems), Properties of quantum mechanical operators,
	Postulates of Quantum mechanics.
Unit-10	Wave function, significance of wave function, Time dependent and
	independent Schrodinger equation, Progressive and Stationary wave, their
	wave equation, well behaved functions, Eigen values and Eigen functions.
Unit-11	Wave equation for a Particle in a one and three dimension box, problem,
	Wave equation of harmonic oscillator & the rigid rotator, Born-Oppenheimer
	approximation, solution of the Hydrogen-like atom and problems.
Unit-12	Radial and angular wave functions, Angular momentum and electronic

structure of atom, General theory of angular momentum, Eigen functions and
Eigen values of angular momentum operators, Spin angular momentum.

Block-1.2.4	Title: Theory of Gases
Unit-13	PVT relations for an ideal gas, non-ideal behavior of gases, Equation of state,
	Compressibility factor, Virial equation.
Unit-14	van der Waals equation, excluded volume and molecular diameter, Maxwell-
	Boltzmann law for distribution of molecular velocities, problems.
Unit-15	Derivation of expressions for average, root mean square and most probable
	velocities, Experimental verification of distribution law, Problems.
Unit-16	Molecular collision in gases, collision diameter and collision number in a gas,
	Kinetic theory of viscosity and diffusion, Problems.

#### **Reference Books**

- 1. Physical Chemistry, P. W. Atkins, ELBS, 1998
- 2. Physical Chemistry, G. M. Barrow, International student edition, 2003.
- 3. Physical Chemistry, G. W. Castellan, AddisionWeslay.
- 4. Physical Chemistry, W. J. moore, Orient Longman, 1998.
- 5. Thermodynamics for Chemist, S. Glasstone, D. Van Nostrand, 1965.
- 6. Essentials of Nuclear Chemistry, H. J. Arnikar, New Age Publication Ltd., 1995.
- 7. Nuclear and Radiochemistry, Friedlander, Kennedy and Miller, John-Wiley, 1981.
- 8. Introduction to Nuclear Physics and Chemistry, B. G. Harwey, Prentice Hall, 1963.
- 9. Sourcebook of Atomic Energy, S. Glasstone, van Nostrand, 1967.
- 10. Chemical Kinetics, K. J. Laidler, McGraw Hill, 1985.

### **Course 3: Organic Chemistry -1**

Block-1.3.1	Title: Stereochemistry of organic molecule			
Unit-1	Conformation, conformational analysis of saturated and unsaturated acyclic			
	molecule (Ethane Butane,1,4- butadiol, cis and trans compounds), stability of			
	cis and trans compounds.			
Unit-2	Conformations of cyclic systems up to six membered- conformational			
	analyses of mono-and di-substituted cyclohexane, conformation and stability			
	of decalins and perhydro phenentherenes.			

Unit-3	Configuration, Stereoisomerism, Chirality, Center of chirality, axis of
	chirality, plane of chirality and helicity, Enantiomers and diastereomers,
	racemic mixture, methods of resolution of racemic mixtures.
Unit-4	Stereochemistry of - allenes, spirans, biphenyls, cyclophanes and helicenes.
Block-1.3.2	Title: Reactive intermediates
Unit-5	Electrophiles and nucleophiles, carbocations, formation, stability and
	geometry of carbocation, chemical reactions of carbocations, classical and
	non-classical carbocations.
Unit-6	Carbanions, formation, stability and geometry of carbanions, chemical
	reactions of carbanions, Free radicals, formation, stability and geometry of
	free radicals, diradicals, singlet and triplet diradicals, their reactions and
	detection methods
Unit-7	Carbenes and Nitrenes, formation, stability and geometry of carbenes and
	nitrenes, chemical reactions of carbenes and nitrenes, singlet and triplet
	carbenes, their reactions and detection methods
Unit-8	Formation, stability and geometry of Nitrile oxide, chemical reactions of
	nitrile oxide, Synthetic equivalents, Unpolung reactions

Block-1.3.3	Title: Aromatic compounds
Unit-9	Alternant and non-alternant hydrocarbons, Concept of aromaticity, Aromaticity
	in benzenoids, Huckels rule, anti-aromatic and non-aromatic compounds
Unit-10	Calculation of energies of different conjugated $\pi$ -systems in cyclic and acyclic
	systems, Calculation of charge densities, PMO theory and reactivity index.
Unit-11	Non benzenoid aromatic compounds, aromaticity in non- benzenoids
	compounds, annulenes, hetroannulenes, fullerence-C60, ferrocene.
Unit-13	Azulene, fulvene, tropylium salts, three and five membered systems-Crown
	ether complexes, cyclodextrins, cryptands, catenanes and Tropone, tropolone.

Block-1.3.4			I	Title: Organ	nic substituti	on reactions		
Unit-13	Types	of	organic	reactions	(Addition,	substitution,	elimination	and
	rearran	gem	ent), neu	cleophiles,	electrophile	s, nucleophili	city v/s bas	icity,

	factors affecting the relative strength of neucleophiles and electrophiles.
Unit-14	Nucleophilic substitution reactions, kinetics, mechanism and stereochemical
	factors of S <sub>N</sub> 1, S <sub>N</sub> 2, S <sub>N</sub> i, reactions. Neighboring group participation, Weldon
	inversion, sterochemical outcomes of $S_N 1$ , $S_N 2$ and $S_N i$ reactions.
Unit-15	Factors affecting the rate of $S_N1$ and $S_N2$ , reactions, substrate effect, solvent
	effect, ionic effect, isotopic effect, solvent isotopic effect, substituent effect,
	steric effect.
Unit-16	Electrophilic substitution reactions, Kinetics, mechanism and stereochemical
	factor of $SE^1 \& SE^2$ reactions.

#### **Reference books:**

- 1. Organic Chemistry P.Y. Bruice, Pearson Education Pvt. Ltd., New Delhi (2002).
- 2. Organic Chemistry S. H. Pine, McGraw-Hill, London (1987).
- 3. Organic Chemistry R.T. Morrison and R.T. Boyd, Prentice Hall, New Delhi(1994).
- 4. Organic Chemistry T.W. G. Solomons, 4<sup>th</sup> Edition, John Wiley and Sons, (1988).
- 5. Organic Chemistry F.A. Carey and S.J Sundberg 4<sup>th</sup> Edition, McGraw Hill (2000).
- 6. Advanced Organic Chemistry, Reactions, Mechanism and Structure J. March, 3<sup>rd</sup> Edition, Wiley Eastern Ltd. (2004).
- 7. Stereochemistry Conformation and Mechanism P. S. Kalsi, Wiley Eastern Ltd, New Delhi (1992).
- 8. Stereochemistry of Carbon Compounds, Ernest L Eliel, <u>T M H</u> edition, 1994
- 9. Stereochemistry of Organic Compounds, D. Nasipuri, Newage International, 1991
- 10. Guidebook to Mechanism in Organic Chemistry P. Sykes. Orient Longman, London, 2<sup>nd</sup> edition, (2002).
- 11. Organic Chemistry, Jonathan Clayden, Nick Geeves, Stuart Warren, 2nd Edition, 2012

## **Course 5: Chemical Spectroscopy**

Block-1.5.1	Title: Microwave spectroscopy
Unit-1	Introduction to electromagnetic radiation, Properties of electromagnetic
	radiation, Relation between Wavelength, Frequency, Wavenumber and
	Energy, and their units, Regions of the electromagnetic spectrum, energies
	corresponding to various kinds of radiation. Interaction of electromagnetic
	radiation with matter (absorption, emission, transmission, reflection,
	dispersion, polarisation and scattering)
Unit-2	Energy levels in atom and molecule, total energy of a molecule, transition
	moment integral, selection rules. Classification of polyatomic molecules.
Unit-3	Rotation spectra of diatomic molecules, rigid and nonrigid rotators, Rotational
	quantum number and selection rules, Effect of isotopic substitution on rotation

	spectra, problems.
Unit-4	Relative intensities of spectral lines, Applications to determination of bond
	length and moment of inertia of diatomic molecule, problems

Block-1.5.2	Title: Vibration spectroscopy
Unit-5	Vibration of diatomic molecules, vibrational energy curves of simple
	harmonic oscillator. Effect of anharmonic oscillator, Vibration-rotation
	spectra of carbon monoxide, Problems.
Unit-6	Fundamental and overtone frequencies. Vibration of polyatomic molecules-
	degree of freedom of vibrations. Parallel and perpendicular vibrations (CO <sub>2</sub>
	and H <sub>2</sub> O), Problems
Unit-7	Intensity of absorption band and types of absorptions. Important spectral
	regions - hydrogen stretching region, double and triple bands region,
	fingerprint region, Problems.
Unit-8	Applications for $XY_2$ - linear, $XY_3$ – planar. Factors affecting the group
	frequency – electrical effect, hydrogen bonding, sterric and ring strain.

Block-1.5.3	Title: Raman and Electronic spectroscopy					
Unit-9	Raman spectroscopy - Introduction, Raman and Rayleigh scattering, Stokes					
	and antistokes lines, polarization of Raman lines, depolarization factor,					
	polarizability ellipsoid.					
Unit-10	Theories of Raman spectra - classical and quantum theory, Rotation-Raman					
	and vib-Raman spectra, Comparison of Raman and IR spectra, rule of mutual					
	exclusion princilple, Advantages of Raman spectra.					
Unit-11	Electronic spectroscopy- Introduction – Beer's law. Theory of molecular					
	absorption, Frank-Condon principle, Fluorescence and phosphorescence,					
	intersystem crossing, Vibration-rotation, fine structure of absorption bands: $\boldsymbol{\sigma}$					
	$\rightarrow \sigma^*, \pi \rightarrow \pi^*, n \rightarrow \sigma^*, n \rightarrow \pi^*.$					
Unit-12	Solvent effect on the spectral lines. Empirical rules for predicting the wave					
	length of maximum, - olefins, conjugated dienes, ketones and substituted					
	benzene					

Block-1.5.4	Title: Optical and Electrochemical spectroscopy
Unit-13	Atomic absorption spectroscopy: Principle. Atomic energy levels. Grotrian
	diagrams, Population of energy levels, Instrumentation. Sources: Hollow
	cathode lamp and electrodeless discharge lamp, factors affecting spectral
	width. Atomizers: Flame atomizers, graphite rod and graphite furnace.
Unit-14	Cold vapour and hydride generation techniques. Factors affecting atomization
	efficiency, flame profile, Monochromators and detectors, Beam modulation.
	Detection limit and sensitivity, Interferences and their removal, Comparison
	of AAS and flame emission spectrometry, Applications of AAS.
Unit-15	Stripping Voltammetry: Principle and technique in anodic and cathodic
	stripping voltammetry, applications to metal ion analysis, limitations.
	Adsorptive stripping voltammetry: Principle, technique, applications to metal
	ions and organic analysis. Advantages over anodic stripping voltammetry.
	Catalytic effects in voltammetry. Working electrodes: Mercury electrodes,
	carbon electrodes, film electrodes.
Unit-16	Cyclic voltammetry: Principle and technique, Randles-Sevcik equation,
	Interpretation of voltammogram- reversible, irreversible and quasi-reversible
	systems, Applications of cyclic voltammetry in study of reaction mechanism
	and adsorption processes.

## **Second Semester**

# **Course 6: Inorganic chemistry-II**

Block-2.6.1	Title: Modern theory of Acid-Base and non-aqueous solvents
Unit-1	Arrhenius concept, Lux-Flood and Usanovich concepts, Bronsted-Lowry,
	theory, Lewis concepts, General theory of solvent system.
Unit-2	Measures of acid-base strength, Acid-base interactions, Hard and soft acids
	and bases, Classification, HSAB principle and its applications, Irving-
	William series.

Unit-3	General properties of ionizing solvents (dielectric constant, donor and
	acceptor property), Solutions of metals in Liquid ammonia, hydrated
	electron, Super acids.
Unit-4	Liquid Ammonia, Liquid sulphur dioxide, liquid dinitrogen tetra oxide,
	liquid hydrogen fluoride, and liquid bromine trifluoride as solvents.

Block-2.6.2	Title: Co-ordination compounds
Unit-5	Introduction, definition of terms, classification of ligand, chelation effect,
	Preparative methods of coordination compounds- simple addition reactions,
	substitution reactions, oxidation-reduction reactions, thermal dissociation
	reactions, reactions of coordinated ligands
Unit-6	Valence bond theory (VBT) of coordination compounds, Formation of
	Tetrahedral, octahedral and square planar complexes on the basis of VBT.
Unit-7	Outer orbital and inner orbital octahedral complexes, limitations of VBT,
	Geometries of metal complexes of higher coordination numbers
Unit-8	Isomerism in coordination compounds, geometrical isomerism, optical
	isomerism, study of isomerism in coordination compounds using CD, ORD,
	Cotton effect and magnetic circular dichroism,

Block-2.6.3	Title: Crystal Field Theory (CFT)
Unit-9	Crystal Field Theory, Salient features of CFT, Splitting of d-orbital in
	tetragonal, octahedral, square planar and trigonal bipyramid complexes
Unit-10	CFSE, measurement of 10Dq, Factors affecting 10Dq, Spectrochemical
	series, Nephelauxetic effect, d-d transitions and color of coordination
	compounds, limitations of CFT, Problems.
Unit-11	High spin and low spin complexes; magnetic moments of high spin and low
	spin complexes, John-Teller effect and John-Teller distortion in metal
	complexes and metal chelates, spectroisomerism.
Unit-12	Application of crystal field theory and prediction of magnetic and spectral
	properties of the co-ordination compounds, Spectra of aqua complexes of
	trivalent V, Cr divalent Mn, Co Ni and Co 3d-metal ions, Calculation of
	$10Dq$ , B and $\beta$ parameters, charge-transfer spectra.

Block-2.6.4	Title: Organometallic chemistry
Unit-13	Introduction, Nomenclature and general characteristics, hapticity,
	classification of organometallic compounds based on hapticity and polarity
	of M-C bond, stability and decomposition pathways, 16 and 18 electron
	rules, electron counting, covalent and ionic models.
Unit-14	Synthesis, structure and applications of organometallic compounds of main
	group elements, (Li, Mg, Ca, B and Al), and d-group elements (Cu, Zn, and
	Co), Group trends.
Unit-15	Compounds with Metal-carbon multiple bonds, Alkylidenes, alkylidynes,
	synthesis, structure bonding, reactions and their role in organic synthesis.
Unit-16	Transition metal $\pi$ -complexes: transition metal $\pi$ - complexes with
	unsaturated organic molecules, alkenes, alkynes, allyl, diene,
	cyclopentadienyl, arene, cyclooctatrienyl, cyclooctatetraene complexes and
	their decomplexaion reactions.

# Course 7: Physical Chemistry-II [HCT-P02]

Block-2.7.1	Title: Theories of Chemical kinetics
Unit-1	Collision theory and its application to reactions in solution, limitations, problems
Unit-2	Activated complex theory and its application to reactions in solution, Energy
	of activation, activation parameters-determinations and their significance, problems.
Unit-3	Lindemann theory of uni-molecular and bi-molecular reactions, Problems.
Unit-4	Factors affecting the order of reaction – primary and secondary salt effects. Effects of dielectric constant, pressure and volume on the rate of reaction, Problems.

Block-2.7.2	Title: Quantum mechanics
Unit-5	Radial and angular wave functions, Angular momentum and electronic
	structure of atom, General theory of angular momentum. Eigen functions
	and Eigen values of angular momentum operators, Ladder operators, Spin

	angular momentum, anti- symmetry and Pauli's principle,
Unit-6	Wave functions of poly-electron atoms, Slater determinant, Approximation
	methods- Necessity of approximation methods
Unit-7	Perturbation methods- first order correction, application to He-atom (first
	order correction only) calculation of first ionization potential and binding
	energy.
Unit-8	Variation theorem- Statement and proof, application variation methods to
	particle in one dimensional box, linear oscillator, coupling of angular
	momentums.

Block-2.7.3	Title: Statistical thermodynamics
Unit-9	Introduction, Concepts of distribution, thermodynamic probability and most
	probable distribution, Ensemble, postulates of ensemble overlapping,
	coninical, grand coninical and micro coninical ensembles.
Unit-10	Maxwell-Boltzmann distribution law, Maxwell's distribution of molecular
	velocities, Maxwell-Boltzmann statistics and applications, Bose-Einstein
	and Fermi-Dirac statistics.
Unit-11	Partition functions – definitions and separations, evaluation of translational,
	rotational, vibrational and electronic partition functions for monoatomic,
	diatomic and polyatomic gases molecules.
Unit-12	Calculation of thermodynamic functions and equilibrium constant in terms
	of partition functions, entropy of monoatomic gas - Sacker-Tetrode
	equation, comparison of 3 <sup>rd</sup> law and statistical entropies, Heat capacity
	behavior of solids.

Block 2.7.4	Title: Surface and colloidal chemistry
Unit-13	Definition of absorption and adsorption, adsorption of gases on solid, factors
	influencing adsorption (temperature, pressure and pH) Langmuir adsorption
	for uni molecular and bi molecular reactions.
Unit-14	Adsorption forces, thermodynamics of physical adsorption, heat of
	adsorption and its determination, measurement of adsorption by different
	methods, chemisorptions and its mechanism.
Unit-15	Multilayer adsorption - critical comparison of various multilayer models-

	BET, Potential and Polanyi models (no derivation). Measurement of surface
	area of solids by different methods, Harkins and Jura equation.
Unit-16	Porous solids – Defination, pore size distribution, methods to determine pore
	size, hysteresis of adsorption, theories of hysteresis, Adsorption behaviors of
	porous materials.

# **Course 8: Organic chemistry-II**

Block-2.8.1	Title: Elimination and free radical reactions and their mechanisms
Unit-1	Elimination reactions, kinetics, mechanism and stereochemical outcome, and
	factor affecting the rate of $E^{1}$ , and $E^{2}$ , reactions.
Unit-2	E1cb reactions, mechanisms of cis and trans eliminations, Hofmann and
	Saytzeff and Chugaev eliminations reaction.
Unit-3	Competition between elimination and substitution reactions, solvent effect,
	ionic effect, isotopic effect, solvent isotopic effect, substituent effect, steric
	effect on elimination and substitution
Unit-4	Types of free radical reactions, free radical substitution mechanism,
	neighboring group assistance. Reactivity of aliphatic substrates at a bridgehead.
	Reactivity in attacking radicals.

Block-2.8.2	Title: Aromatic substitution reactions and their mechanisms
Unit-5	Aromatic Electrophilic Substitution: Mechanism and Orientation in
	Electrophilic Aromatic Substitution, An Addition-Elimination Mechanism,
	Ortho, Meta and Para Orientation, Relative Rates of Substitution, the Rate
	Orientation Relation, Orientation in Multiply Substituted aromatics
Unit-6	Arynes: Formation, structure, stability, and reactivity, examples of reactions
	involving aryne and nitrile oxide intermediates.
Unit-7	Nucleophilic Aromatic Substitutions, The elimination-addition
	mechanismbenzyne. The aryl cation mechanism- diazonium salts, Nucleophilic
	Substitution via Thallium derivatives
Unit-8	Free radical reactions mechanism at an aromatic substrate, arylation of
	aromatic compounds by diazonium salt, Sandmeyers reaction. Free radical

rearrangement, Hunsdiecker reaction.		rearrangement, Hunsdiecker reaction.
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Block-2.8.3	Title: Reagents in organic reactions
Unit-9	Use of Soadamide (NaNH <sub>2</sub> ), Trimethylsilyl iodide (Peterson's synthesis),
	Titaniumchloride, titaniuiopropoxide, Phase transfer catalysts: Quaternary
	ammonium and phosphonium salts, Crown ethers, Misceller Catalysis, in
	organic synthesis
Unit-10	Use of Born trifluoride (BF <sub>3</sub> ), N-Halosuccinimides (NBS and NCS),
	Diazomethane, Sodiumcyanobrorohydride (NaCNBH <sub>3</sub> ),
	Trifluoromethanesulfonic anhydride $(CF_3SO_2)_2O_2$ , Diisobutylaluminium
	hydride (DIBAL), N-Methoxy-N-methylamides (Weinreb amides)
Unit-11	Use of Lead tetra acetate (Pb(OAc) <sub>4</sub> , Periodic acid H <sub>5</sub> IO <sub>6</sub> or HIO <sub>4</sub> .2H <sub>2</sub> O,
	Se <sub>2</sub> O, MCPBA, Bu <sub>3</sub> SnH, Me <sub>3</sub> SiCl, Me <sub>3</sub> SiH, OsO <sub>4</sub> . DDQ, O <sub>3</sub> in organic
	synthesis
Unit-12	Use of Organo-zinc and organomercury and organotin reagents,
	lithiumdialkylcuprate (Gilman's reagent) and their addition to acylhalides and
	unsaturated carbonyl compounds, Wilkinson's and Ziegler-Natta Catalyst in
	organic synthesis.

Block-2.8.4	Title: Types of organic reactions
Unit-13	Oxidation reactions olifins: Dehydrogenation with S, Se, Fremy's salt,
	chloranil, Woodward and Prevost dihydroxylation, Oxidation of alcohols:
	pyridinium chlorochromate (PCC), pyridinium dichromate (PDC), Collin and
	Jones reagent, Combination of DMSO with DCC, (COCl)2, NCS and
	$(CH_3CO)_2O$ , Oxidation with MnO <sub>2</sub> ,
Unit-14	Oxidation of aldehydes and ketones, Oppenauer oxidation. Conversion of
	ketones to $\alpha$ , $\beta$ -unsaturated ketones and $\alpha$ -hydroxy ketones, Baeyer-Villiger
	oxidation, Dess-Martin periiodinane, IBX.
Unit-15	Reduction reactions, (i) Reduction of aldehydes and ketones with complex
	metal hydride [LiAlH <sub>4</sub> and NaBH <sub>4</sub> ], (ii) Reduction of conjugated systems:
	reduction by dissolving metals (Birch reduction), (iv) Miscellaneous
	reduction reactions
Unit-16	Catalytic heterogeneous and homogeneous hydrogenation (Wilkinson's

catalyst),	Hydrogenation	of	alkenes,	alkynes	and	arenes,	Selectivity	of
reduction,	Mechanism and	d st	ereochem	istry of r	educt	tion, Rar	ney Ni-catal	yst,
Adam cat	alyst, Lindlar cat	alys	st					

#### **Reference books:**

- 1. Organic reaction mechanisms (II edition), 1995 V. K. Ahluwalia & R. K.Parasar
- 2. Organic reaction Mechanism, Singh and Mukherjee, Mc millan 3<sup>rd</sup> ed, 2000.
- 3. Reaction mechanism and reagents in organic chemistry, 2<sup>nd</sup>ed ,1991-Gurdeep R. Chatwal
- 4. Organic chemistry (VI edition),2001 Morrison Boyd.
- 5. Organic chemistry I.L. Finar, Vol.1, 3rd edition, 1975
- 6. Organic chemistry (VII edition), 2008 Mc Marry)
- 7. Advanced organic chemistry (IV edition), 2001 J March
- 8. Reaction mechanisms and problems in organic chemistry 2nd edition 2001 P. Chattopadhyay
- 9. Reactive intermediates in organic chemistry 1st Edition, 2001 J. P. Trivedi
- 10. Principles of reaction mechanism in organic chemistry Parmar & Chawla, Ed. II, 1978.
- 11. Organic Photochemistry2nd Edition ,1984 J. Coxon & B. Halton
- 12. Advanced organic chemistry Part B F.A. Carey & R. J. Sundberg Ed II, 1990.
- 13. Organic Chemistry P.Y. Bruice, Pearson Education Pvt. Ltd., New Delhi (2002), Ed III

# **Course 10: Organic spectroscopy**

Block-2.10.1	Title: Ultraviolent (UV) and Infrared(IR) spectroscopy for organic
	molecule characterization
Unit-1	Ultraviolent (UV) spectroscopy: Introduction, Absorption Laws, Molar
	absorptivity, Instrumentation, sample handling, theory of UV-Visible
	spectroscopy.
Unit-2	Electronic transitions, Formation of absorption bands, types of absorption
	bands, transition probability, allowed and forbidden transitions, conjugate
	systems and transition energies.
Unit-3	Chromophore, Auxochrome, absorption and intensity shift, solvent effect,
	Woodward and Fisher rules for calculating $\lambda_{max}$ in conjugated dienes and
	trienes.
Unit-4	Calculating $\lambda_{max}$ in $\alpha$ - $\beta$ -unsaturated carbonyl compounds, $\alpha$ - $\beta$ -unsaturated
	carboxylic acids and esters, benzene and its derivative, applications of UV-
	Visible spectroscopy, Problems.

Block-2.10.2	Title: Nuclear magnetic resonance ( <sup>1</sup> HNMR) spectroscopy for organic
	molecule characterization
Unit-5	<sup>1</sup> H NMR spectroscopy: Introduction, nuclear spin, energy absorption &
	relaxation. Basic ideas about instrument, sample handing, chemical shift
	magnetic anisotropy, Shielding deshielding,
Unit-6	Measurement chemical shift, NMR scale, factors affecting it, magnetic
	anisotropy, Equivalent and non equivalent protons, number of PMR signals,
Unit-7	spin-spin splitting, coupling constant (J), nomenclature of spin system, First
	order & non first order splitting for two, three & four interacting nuclei,
	Magnetic equivalence, spin-spin coupling of proton with other nuclei,

Unit-8	Protons	on	heteroatoms,	proton	exchange	reactions,	simplification	of
	complex	NM	IR spectra (lar	thanide	shift) Nucl	ear Overha	user effect (NC	ÞΕ),
	analysis	(inte	erpretation) of I	NMR spe	ectra.			

Block-2.10.3	Title: ( <sup>13</sup> CNMR) and Mass spectroscopy for organic molecule
	characterization
Unit-9	<sup>13</sup> C NMR spectroscopy, introduction and theory, C-C and C-H spin-spin
	coupling, effect of deuterium substitution on CMR signals, Proton decoupled
	<sup>13</sup> C NMR, chemical shift equivalence.
Unit-10	, <sup>13</sup> C chemical shift, factor affecting <sup>13</sup> C chemical shift, use of shift reagents,
	some solved examples
Unit-11	Mass spectroscopy, Introduction, Instrumentation, Ionization methods,
	Molecular and fragment ions, mass spectrum and base peak, nitrogen rule,
	metastable ions, multicharged ions,
Unit-12	Recognition of molecular ion peak and detection of isotopes, factors
	governing general fragmentation process, fragmentation modes of various
	classes of organic compounds, solved problems.

Block-2.10.4	Title: Infrared(IR) Spectroscopy for organic molecule characterization
Unit-13	Infrared(IR) Spectroscopy, Introduction, Instrumentation, sampling handling,
	theory of infrared spectroscopy, number of fundamental vibrations,
	calculation of virational frequencies,
Unit-14	Characteristic absorptions in common classes of organic compounds,
	Fingerprints region, factors affecting the vibrational frequencies,
Unit-15	Applications of infrared spectroscopy to solve the structure of organic
	molecule.
Unit-16	Photoelectron Spectroscopy Basic principles of photoelectric effect
	ionization. Process, PES and XPS photo-electron spectra of $O_2$ , $N_2$ and NO
	(simple molecule). Adiabatic and vertical ionization energy, Koopman's
	theorem.

## **Third Semester**

# **Course 11: Materials Chemistry**

Block 3.11.1	Title: Hi-tech materials:
Unit-1	Solar cells (Photovoltaic cell), types of Solar cells. perovskites Solar cells,
	super conducting materials, supercondcutivity in cuprates, isotropic and
	anyzotropic materials, Thin films, Langmuir-Blodgett films, Preparation
	techniques, sputtering, chemical process, sol gel, Photolithography,
	Applications of LB films. Rectifiers, transistors, capacitors.
Unit-2	Solid State Reactions: General principle, types of reactions: Additive,
	decomposition and phase transition reactions, tarnish reactions, kinetics of
	solid state reactions, factors affecting the solid state reactions, photographic
	process.
Unit-3	Nanoparticles and Nanostructural materials: Introduction, methods of
	preparation, physical properties, and chemical properties, sol-gel chemistry of
	metal alkoxide, application of Nanoparticles, Charecterization of
	Nanoparticles by SEM and TEM. Nanoporous Materials:
	Introduction, Zeolites and molecular sieves, determination of surface acidity,
	porous lamellar solids, composition-structure, preparation and applications.
Unit-4	Smart Materials: Definition of smart materials (SM), Design of intelligent
	materials, actively smart and passively smart materials and their
	characteristics. e.g smart ceramics, oxides, smart polymers and gels, shape
	memory alloys, electorheological fluids, ferrofluides, smart windows, smart
	sensors, smart electroceramics, Magnetostrictive materials, biomineralisation
	and biosensing.

Block-3.11.2	Title: Homogeneous and Heterogeneous catalysis
Unit-5	Introduction, basic principle, industrial requirements, thermodynamic and
	kinetic aspects, classification of catalytic system.
Unit-6	Principle, experimental techniques, acid-base catalysis, catalysis involving
	transition metal salts and metal complexes- hydrogenation, asymmetric
	hydrogenation, transfer hydrogenation, hydrosilation and hydrocyanation.
Unit-7	Fisher- tropsch process, Acrylonic synthesis using mixed metal oxides,
	alcohol, dehydration on $\gamma$ -elimination reaction of olefin on zinc oxide.
Unit-8	Anchored catalysis- merits, polymer and metal oxides as supports, Zeolites as
	shape selective catalysts, Clays as catalyst, pillavd clays- advantages,
	decomposition of isopropanol using oxide catalyst, catalytic converter.

Block-3.11.3	Polymer Chemistry
Unit-9	Basic concepts of polymer science, classification of polymers as biological - nonbiological, linear branched network, condensation, addition homo- and heterochain, thermoplastic- thermosetting, molecular forces and chemical bonding in polymers degree of polymerization, polydispersity of polymers, Natural and synthetic polymers.
Unit-10	Solubility of polymers, Thermodynamics of polymer solutions - Entropy and heat of mixing of polymer solutions - ideal behaviour and deviations. Experimental results, flory – Krigbaum theory - Thermochemistry of chain polymerization. Morphology and rheology of polymers - configuration of polymer chains crystal structure, crystallization processes, viscous flow, rubber elasticity, viscoelasticity.
Unit-11	Types of polymerization: Ionic, coordination and ring opening polymerization, Copolymerization - Kinetics of copolymerization, the copolymer equation, monomer reactivity ratios, instantaneous composition of polymer. Polymer structure and physical properties - The crystalline melting point Tm- the glass transition temperature (Tg ) - properties involving small and large deformations- polymer requirements and polymer utilization.
Unit-12	Average molecular weight concepts- Number, weight and viscosity average molecular weight, Determination of molecular weights – viscosity method, osmotic pressure method and light scattering method Conducting polymers - Basics, synthesis, conduction mechanism, applications.

Block-3.11.4	Title: Chemistry of p block elements
Unit-13	Inorganic chain catenation, hetero catenation, silicate minerals, intercalation chemistry, and one dimensional conduction.
Unit-14	Inorganic rings: Borazines, Phosphazenes, phosphazene polymer, Homo cyclic and heterocyclic inorganic ring system.
Unit-15	Cage structure, phosphorus cage molecules, Boron cage molecule, Boranes Carboranes, and metellocarboranes.
Unit-16	Interhalogen compounds, polyhalides, chemistry of halogen oxides and oxyfluorides, oxyacids of heavier halogens, pseudohalides.

# **Course 12: Bio-inorganic and Bio-physical**

# chemistry

Block 3.12.1	Title: Chemistry of essential elements								
Unit-1	Essential and trace elements in biological process, elements in biological								
	cell, bio molecules associated with metal ions and their roles, Molecular								
	mechanism of ion transport across cell membranes, ionophores, crown								
	ethers, $Na^+/K^+$ pump.								
Unit-2	Metal ion deficiency, toxicity, detoxification Chelation therapy, Importance								
	of Ca <sup>2+</sup> in muscle contractions and in blood clotting process, Metal ligand								
	interactions with DNA, Transition metal complexes as chemical nucleases,								
	Nuclease activity of Cu-(o-phen) <sup>2+</sup> metal complexes used in anticancer and								
	antiarithritic drugs.								
Unit-3	Metallo proteins, metello enzymes, Transport and storage of Oxygen, Heme								
	protein, Hemoglobin and myoglobin, dioxygen bonding, model complexes.								
	Non-heme iron								
Unit-4	Metal	ion	storing	and	transfer-ferritin,	transferr	in	and	siderophores,
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	Photosy	nthe	esis, struc	cture	of chlorophyll, PS	1 and PS	II in	cleav	vage of water.

Block-3.12.2	Title: Metelo enzymes				
Unit-5	Structure and functions of metalloproteins in electron transfer process.				
	Cytochromes, ferridoxins and rubredoxins. Cytochrome-C and Cytochrome-				
	C oxidase.				
Unit-6	Zinc enzymes- carboxy peptidase, copper enzymes Xanthine oxidase. Iron				
	enzymes, Cytochrome P-450, Vit $B_{12}$ co enzymes & model compounds,				
	Actions of Cobalamines, Adenosylcobalamine as a coenzyme,				
	Ribonucleotide reductase, Methylcobalamine as cofactor, Mo-cofactors,				
	Antagonism between Cu & Mo Hydroxylase				
Unit-7	Nitrogen fixation: Nitrogenase -bacterial nitrogenise synthesis and synthetic				
	studies. <i>Photosynthesis</i> : structure of chlorophyll, PS1 and PS II in cleavage				
	of water.				
Unit-8	Biochemistry of chromium and Vanadium, Vanadium proteins including				
	bromoperoxidases, Glucose Tolerance Factor, Vanadium Nitrogenase,				
	Vanadium as possible insulin modifiers, Characterization of insulin mimetic				
	effect, Sites of action of vanadium, toxicological considerations, and				
	improved tissue uptake.				

Block 3.12.3	Title: Bioenergetics and Thermodynamics
Unit-9	The cell and its constituents, molecular basis of life, Colloids, Classification
	of colloids, properties of colloidal solutions, coagulation of colloidal
	solutions. Size of biopolymers, Methods of determining particle shape and
	molecular weight, Interactions with water.
Unit-10	Molecular interpretation of Energy and Enthalpy, Non-covalent reactions,
	hydrophobic interactions, Biochemical Applications of Thermodynamics,
	Thermodynamics of Metabolism, Double Stranded Formation in Nucleic
	Acids, Ionic Effect on Protein–Nucleic Acid Interactions
Unit-11	Basic Concepts of Enzyme kinetics, catalytic antibodies and RNA enzymes
	Ribozymes, Michaelis Menten Kinetics, Competition and Inhibition, Monod-

	Whyman Changeux Mechanism, Substrate as inhibitors, effect of $Cr^{3+}$ , $Fe^{2+}$ ,			
	Zn <sup>2+</sup> zeolite, UV-light on enzyme catalyzed reactions.			
Unit-12	Polymerization of DNA and nature of blood flow through different vessel,			
	Detection of intrastrand disulphide bonds in proteins, Gel electrophoresis,			
	DNA Sequencing, DNA Finger Printing, Conformations of Nucleic Acids,			
	Protein Charges.			

Block 3.12.4	Title: Biophysical process
Unit-13	Lipid Molecules and Bilayer Phase Transitions in Lipids, Bilayers and
	Membranes, Biological Membranes, Membrane Equilibrium, Transport
	through cell membrane, Active and Passive Transport, Osmosis and
	Diffusion, Energy Generation. Nerve Cells, Neutron: Structure and Functions,
	Nerve Impulse and its conduction,
Unit-14	Biological significance of Donnon membrane phenomena, micells and its
	involvement during digestion and absorption of dietery lipids. Difference of
	solvents across bio membranes and its application of solvents across bio
	membranes and its application in the mechanism of respiratory exchange,
	Bio-electrochemistry: Threshold membrane phenomena, Nernst Plank
	equation, Hodges Huxley equations, core conductor models,
	electrocardiography.
Unit-15	Electrical double lever, theories of double layer, electro-capillary phenomena,
	electro-capillary curve, Electro-osmosis, electrophoreses, Streaming and
	Sedimentation potentials, Zeta potentials and its determination by
	electrophoresis, influence of ions on Zeta potential.
Unit-16	Salting in and salting out of proteins, osmotic behaviour of cells and asmo-
	regulation and its application in coordination of excretory system of
	organism, Significance of viscosity in biological systems, Effect of
	temperature and pH on the viscosity of bio molecules (albumin solution),
	Mechanism of muscles contraction, Biological significance of surface tension,
	Effect of temperature, solute concentration (Aminoacids) on surface tension,
	Interfacial tension in living cells (Danell and Davson model),

1. Uses of Inorganic Chemistry in Medicine Ed. Nicholas. P. Farrel

- 2. Metal Complexes as drugs and Chemotherapeutic agents. N. Farrell, Comprehensive Coordination Chemistry II, Volume 9, pp 809–840.
- 3. The biological Chemistry of the Elements: The Inorganic Chemistry of Life–J. J. R. Fraustoda Silva and R. J. P. Williams. Clarendron Press, Oxford, 1991.
- 4. Bioinorganic Chemistry: Inorganic elements in the Chemistry of life. An Introduction and Guide—Wolfgang Kaim, Brigille Schwedrski John Wiley and sons, 1994.
- 5. Principles of Bioinorganic Chemistry –S. J. Lippard and J. M. Berg, University Science Books, 1994.
- 6. Bioinorganic Chemistry: A ShortCourse-RosetteM.Malone3 Wiley Interscience, 2002.
- 7. Biological Inorganic Chemistry-An Introduction, Robert Crichton, Elsevier Science, 2007.
- 8. The biological Chemistry of the Elements: The Inorganic Chemistry of Life–J. J. R. Fraustoda Silva and R. J. P. Williams. Clarendron Press, Oxford, 1991.
- 9. Bioinorganic Chemistry: Inorganic elements in the Chemistry of life., An Introduction and Guide—Wolfgang Kaim, Brigille Schwedrski John Wiley and sons, 1994.
- 10. Principles of Bioinorganic Chemistry –S.J. Lippard and J.M.Berg, University Science Books, 1994.
- The Biological Chemistry of the Elements: The Inorganic Chemistry of Life– Silva, J. J. R. Fraustoda and R. J. P. Williams; 2nd Ed. Oxford University Press, 2012.

Block-3.14.1	Title: Introduction and statistical analysis
Unit-1	Introduction to analytical chemistry: Types of analysis-qualitative and
	quantitative, Classification of analytical methods- classical and instrumental,
	basis of their classification with examples.
Unit-2	Statistical analysis and validation: Errors in chemical analysis. Classification
	of errors: systematic and random, additive and proportional, absolute and
	relative, Accuracy and precision, Mean, median, average deviation and
	standard deviation.
Unit-3	Significant figures and rules to determine significant figures, Calculations
	involving significant figures, Confidence limit, correlation coefficient and
	regression analysis.
Unit-4	Comparison of methods: F-test and T-test, Rejection of data based on Q-test,
	Least squares method for deriving calibration graph, Numerical problems.

## **Course 14: Analytical Chemistry**

Block-3.14.2	Title: Classical methods of analysis								
Unit-5	Volumetric a	analysis:	General	principle.	Criteria	for	reactions	used	in
	titrations, Prin	mary star	ndards and	d secondary	y standard	ds, T	heory of ir	ndicato	ors,

	Types of titrations with examples- Acid-base, precipitation, redox and complexometric.
Unit-6	Titration curves for monoprotic and polyprotic acids and bases, Indicators used in various types of titrations, Masking and demasking agents.
Unit-7	Gravimetric analysis: General principles and conditions of precipitation, Concepts of solubility, solubility product and precipitation equilibria, Steps involved in gravimetric analysis. Purity of precipitate: Co-precipitation and post-precipitation.
Unit-8	Fractional precipitation, Precipitation from homogeneous solution, Particle size, crystal growth, colloidal state, aging and peptization phenomena, Ignition of precipitates.

Block-3.14.3	Title: Electrochemical methods of analysis					
Unit-9	Conductometry: Concepts of electrical resistance, conductance, resistivity					
	and conductivity, Specific, molar and equivalent conductance and effect of					
	dilution on them, Measurement of Conductance.					
Unit-10	Kohlrausch's law, Applications of conductometry in determination of					
	dissociation constant, solubility product, Conductometric titrations, High					
	frequency titrations, Numerical problems.					
Unit-11	Potentiometry: Circuit diagram of simple potentiometer, Indicator					
	electrodes: hydrogen electrode, quinhydrone electrode, antimony electrode					
	and glass electrode. Reference electrodes: Calomel electrode and Ag/AgCl					
	electrode.					
Unit-12	Theory of potentiometric titrations, Nernst equation, standard electrode					
	potential, Determination of cell potential, n, Kf and Ksp. pH titrations,					
	Buffers and buffer capacity, pH of buffer mixtures based on Henderson-					
	Hasselbalch equation.					

Block-3.14.4	Title: Electrochemical methods of analysis			
Unit-13	Chromatography: Definition and Classification, Techniques used in Paper,			
	Thin Layer and Column chromatography, Applications in qualitative and			

	quantitative analysis.					
Unit-14	Gas Chromatography: Principle including concept of theoretical plates and					
	van-Deemter equation. Instrumental set up- carrier gas, sampling system,					
	column and detector, Types of columns, their advantages and limitations.					
	Detectors in GC analysis. Temperature programmed GC. Factors affecting					
	retention, peak resolution and peak broadening.					
Unit-15	Liquid chromatography: Principle, Instrumentation, Advantages and					
	applications of HPLC. Types of columns and detectors. Principle and					
	applications of size exclusion, gel permeation, ion retardation, normal phase					
	and reverse phase chromatography					
Unit-16	Ion exchange: Principle and technique, Types of ion exchangers, Ion					
	exchange equilibria, Ion exchange capacity, Effect of complexing ions,					
	Zeolites as ion-exchangers, Applications.					

# **Course 15: Inorganic chemistry special [30IS]**

Block-3.15.1	Title: Ligand field theory [Molecular orbital theory (MOT)]
Unit-1	Introduction, evidence for metal-ligand covalence, MOT to octahedral,
	tetrahedral and square planar complexes without and with pi-bonding,
	limitations of MOT.
Unit-2	Electron transfer reactions. Types of electron transfer reactions, conditions
	of electron transfer, and mechanism of one-electron transfer reactions.
Unit-3	Outer sphere and inner sphere mechanisms, two electron transfer reactions
	complimentary and non-complimentary reactions.
Unit-4	Tunneling effect, cross-reaction, Marcus-Hush theory, bridged activated
	mechanism.

Block-3.15.2	Title: Reaction mechanisms of coordination compounds
Unit-5	Reactivity of metal complexes, Inert and Labile complexes, Kinetics of
	Octahedral substitution (SN <sup>1</sup> & SN <sup>2</sup> ), Acid hydrolysis, factors affecting acid
	hydrolysis, Stereochemistry of intermidiates in SN <sup>1</sup> & SN <sup>2</sup> reaction.
Unit-6	Base hydrolysis, Conjugate base mechanism, Direct and indirect evidences
	in favour of conjugate mechanism, Annation reaction, reaction without

	metal-ligand bond breaking.
Unit-7	Substitution reaction in square planer complexes: the trans effect, cis effect,
	steric effect, solvent effect, effect of leaving group, effect of charge, effect
	of nucleophile, effect of temperature.
Unit-8	Trans effect theories, uses of trans-effect, Mechanism of substitution
	reactions in Pt(II) complexes, application of trans effect in synthesis of new
	complexes, Mechanism of redox reactions, inner sphere and outer sphere
	mechanisms.

Block-3.15.3	Title: Magnetic and spectral Properties of coordination compounds
Unit-9	Magnetic susceptibility, types of magnetic behavior, diamagnetic
	corrections, orbital contributions, spin-orbit coupling, determination of
	magnetic susceptibility, ferro and anti ferro magnetic complex, spin cross.
Unit-10	Spectroscopic ground states, determining the Energy terms, Spin-orbit (L-S)
	coupling scheme, terms symbols for d <sup>n</sup> ions
Unit-11	Racal parameters, Orgel correlation and Tanabe-Sugano diagrams, Laporte
	'orbital' selection rule, spin selection rule, Hund's rule, Hole Formulation,
	Orgel diagrams for octahedral metal complexes.
Unit-12	Charge transfer spectra of transition metal complexes, Racah parameters,
	calculations of 10Dq, B, $\beta$ parameters, Tanabe-Sugano Diagrams of
	octahedral complexes with $d^2 \& d^8$ configuration.

Block-3.15.4	Chemistry of coordination compounds
Unit-13	Metal – Ligand Equilibria in Solution: Stability of coordination compounds,
	Stepwise and overall stability constant, Trends in stepwise formation
	constants;
Unit-14	Factors affecting stability of metal complexes with reference to nature of
	metal ion, ligand, chelate effect and thermodyanamic origin, Determination
	of formation constant by: spectrophotometric method (Job's and Mole ratio
	method) and Potentiometric method (Irving-Rossotti Method).
Unit-15	Liquid Crystals: Mesomorphic behaviour, thermotropic liquid crystals,
	positional order, bond orientational order, nematics & smectic mesophases;

	smectic-Nematic transition clearing temperature-homeotrpic, planer &
	schlieren textures twisted nematics, chiral nematics, molecular arrngement
	insmectic A & smectic C phases.
Unit-16	Optical properties of liquid crystals. Dielectric susceptibility & dielectric
	constants. Lyotropic phases & their description of ordering in liquid crystals.

# **Course 15: Physical chemistry special [30PS]**

Block-3.15.1	Title: Electrochemistry
Unit-1	Arrhenius theory of strong and weak electrolytes and its limitations, Debye-
	Huckel theory of strong electrolytes, Debye-Huckel-Ousager equation.
Unit-2	Activity co-efficient, Debye-Huckel limiting equation for activity co-
	efficient, Debye-Huckel equation for appreciable concentrations, Problems.
Unit-3	Electrical double layer, Brief survey of Helmoltz-Perrin, Gouy-Chapman
	and Stern electrical double layer (derivation), Liquid Junction potentials and
	its determination.
Unit-4	Transport numbers, Determination of transport number by Hittorf method
	and emf method, True and apparent transport numbers, abnormal transport
	numbers, effect of temperature and concentration on transport number.

Block 3.15.2	Title: Electrochemistry of solutions
Unit-5	Metal/Electrolyte interface: Reversible and irreversible electrodes, Reversible
	and irreversible cells, Reversible Irreversible electrode process, Polarization,
	overvoltage- Ohmic overvoltage, concentration overvoltage and activation
	overvoltage, Experimental determination of overvoltage.
Unit-6	Equation for concentration over potential, diffusion-current, stationary-
	current, potential-current, thickness of diffusion layer, diffusion controlled
	current, dropping mercury electrode, half-wave potential.
Unit-7	Polorography and its application in quantitative and qualitative analysis,
	Butter-Volmer equation under near equilibrium and non-equilibrium

	conditions,, Tafel equation- Tafel plot, Hydrogen and Oxygen overvoltage,
	Factor affecting overvoltage.
Unit-8	Fuel cells and batteries – primary and secondary power cells, fuel cells, Li
	ion battery, evaluation of performance of electrochemical systems, energy
	density, shelf life, and Faradic efficiency.
	<i>Corrosion and corrosion prevention-</i> Thermodynamics and kinetics of corrosion, methods of prevention to corrosion.
	<i>Electrosynthesis</i> – use of electrodes in synthesis of organic compounds

Block-3.15.3	Title: Irreversible thermodynamics and Solid state reactions
Unit-9	Microscopic reversibility and Onsager reciprocity relation, phenomenological
	equations, Transformation of generalized fluxes and forces, The cyclic
	version of Clausius' inequality and its integrated form and their
	correspondence with time's arrow and irreversibility.
Unit-10	Clausius' uncompensated heat. Derivation of the differential form of
	Clausius' inequality, Rate of entropy production and the concept of Chemical
	affinity and its application to the cases of chemical reactions, coupled
	reactions, electrochemical reactions.
Unit-11	Derivation of Gibbs relation and its DeDonderian version (time rate form) for
	spatially uniform chemically reacting closed systems, entropy production in
	spatially non-uniform systems like heat flow, Electrokinetic effect - Saxen
	relation.
Unit-12	Solid State Reactions: General principle, types of reactions: Additive,
	decomposition and phase transition reactions, tarnish reactions, kinetics of
	solid state reactions, factors affecting the solid state reactions, photographic
	process.

Block-3.15.4	Title: Nuclear chemistry
Unit-13	Radioactive decay- General characteristics, decay kinetics, parent-daughter

	decay growth relationship, determination of half lives, Nuclear stability-
	packing fraction, binding energy.
Unit-14	A review of $\alpha$ , $\beta$ and $\gamma$ – decays, Bathe's notation, types of nuclear reactions –
	photonuclear reactions, oppenteimer- Phillips process, spallation reactions,
	Definition of Curie & Zilard – Chalmers process, GM Counter.
Unit-15	Radiation chemistry – Introduction of electromagnetic radiation with matter,
	G-value, dosimetry, Ficke dosimeter, Radiolysis-Cystein and biphenyl.
Unit-16	Radioisotopes as tracer- structure determination, reaction mechanism and
	solubility of sparingly soluble substances, <sup>14</sup> C dating and medical
	applications, Hazards in radiochemical wars and radiation protection.

# **Course 15: Organic chemistry special [30OS]**

Block-3.15.1	Title: Rearrangement reactions
Unit-1	Rearrangement to Electron Deficient Carbon: Wagner-Meerwein
	rearrangement, Pinocol-pinocolone rearrangement, Benzidine rearrangement,
	Benzylic acid rearrangement, Arndt-Eistert Homologation rearrangement,
	Dienophine rearrangements
Unit-2	Rearrangement to Electron Deficient Nitrogen: Hofmann rearrangement,
	Curtius rearrangement, Lossen rearrangement, Schmidt rearrangement,
	Beckmann rearrangement, Meisenheimer rearrangement and Wolff
	Rearrangements
Unit-3	Rearrangement to Electron-Rich Carbon: Cope Rearrangement, Fries
	rearrangement, Favorskii rearrangement, Hauser rearrangement, Stevens
	Rearrangement,
Unit-4	Sommelet rearrangement, Smiles rearrangement, Neber rearrangement, Japp-
	Klingemann rearrangement, allylic rearrangement and Bayer-villeger
	rearrangement

Block-3.15.2	Title: Organic named reactions
Unit-5	Condensation and annulations reactions: Aldol, Acyloin, Benzoin, Stobbe,
	claisen-Schmidt, Perkin Darzens and Dieckmann condensation reactions,
	Robinson, Danheiser and Anionic annulation reactions
Unit-6	Oxidation and Reduction reactions: Clemmensen Reduction, Wolff Kishner
	Reduction, Stephen reaction, Rosenmund Reduction, Meerwein-Ponndorf-
	Verley Reduction, Carbylamine reaction, Oppenauer Oxidation, Tishchenko
	Reaction, Cannizaro, reaction.
Unit-7	Addition reactions: Diels-Alder, Mannich, Reimer-Tieman, Chichibabin,
	Knoevenagel addition, Michael addition, Enolate chemistry: Generation:
	Kinetic and thermodynamic controls, use of LDA. Aldol reaction, alkylations
	and acylation reactions of enolates.
Unit-8	Enamines Preparation (Stork enamine reaction) and synthetic applications,

organophosphorus	(Wittig	reaction)	Sulphur	ylides	and	their	synthetic
applications							

Block-3.15.3	Title: Chemistry of heterocyclic compounds
Unit-9	Azoles: Structural and chemical properties; Synthesis of pyrazole,
	imidazoles, oxazoles isoxazole; thiazoles and isothiazole, Nucleophilic and
	electrophilic substitutions; Carbonyldiimidazole as coupling agent
Unit-10	Benzofused heterocycles: Synthesis of indole, benzofuran and benzo-
	thiophene, quinoline and isoquinoline, Nucleophilic, electrophilic and
	radical substitutions; Addition reactions; Indole rings in biology.
Unit-11	Diazines: Structural and chemical properties; Synthesis of pyridazines,
	pyrimidines, pyrazines; benzodiazines, Diazi nes containing one nitrogen
	atom and an oxygen or sulphur atom, Nucleophilic and electrophilic
	substitutions.
Unit-12	Triazines, tertazines, Osotriazoles and triazoles, Oxadiazoles, Syndones,
	tetrazole, Nucleophilic and electrophilic substitutions

Block 4.15.4	Title: Synthetic methodology in organic chemistry
Unit-13	Introduction, Chemo selective, regio selective, steroselctive and stereospecific, reactions, examples of chemo selective and regio selective reactions.
Unit-14	Stereo selectivity and diasteroselctivity, Stereochemical control in synthesis of cyclic comounds, Conformational control in the formation of six membered rings, Synthesizing single diastereomers using stereosecltive reactions, Prochirality, streoselectivity reversion by chelation.
Unit-15	Chiral auxiliary and Chiral agent assisted organic reactions, Baker's yeast assisted reductions, Asymmetric desymetrization method for synthesis of single enantiomers, Thermo dynamic controlled conjugate addition of enolates, reactions.
Unit-16	Protection and deprotection of functional groups, Protection of hydroxyl, thiol amino carbonyl, carboxyl, groups. Orthogonal protection and Illustration of protection /deprotection in synthesis.

#### **Reference books:**

- Organic reaction mechanisms (II edition), 1995 V. K. Ahluwalia & R. K.Parasar
   Organic reaction Mechanism, Singh and Mukherjee, Mc millan 3<sup>rd</sup> ed, 2000.

- 3. Reaction mechanism and reagents in organic chemistry, 2<sup>nd</sup>ed ,1991-Gurdeep R. Chatwal
- 4. Organic chemistry (VI edition),2001 Morrison Boyd.
- 5. Organic chemistry I.L. Finar, Vol.1, 3rd edition, 1975
- 6. Organic chemistry (VII edition), 2008 Mc Marry)
- 7. Advanced organic chemistry (IV edition), 2001 J March
- 8. Reaction mechanisms and problems in organic chemistry 2nd edition 2001 P. Chattopadhyay
- 9. Reactive intermediates in organic chemistry 1st Edition, 2001 J. P. Trivedi
- 10. Principles of reaction mechanism in organic chemistry Parmar & Chawla, Ed. II, 1978.
- 11. Organic Photochemistry2nd Edition ,1984 J. Coxon & B. Halton
- 12. Advanced organic chemistry Part B F.A. Carey & R. J. Sundberg Ed II, 1990.
- 13. Organic Chemistry P.Y. Bruice, Pearson Education Pvt. Ltd., New Delhi (2002), Ed III

### **Fourth Semester**

## **Course 16: Inorganic spectroscopy**

Block-4.16.1	Title: Symmetry and Group theory
Unit-1	Definition of groups, sub groups, cyclic groups, conjugates relationships.
Unit-2	Symmetry elements and symmetry operations, point groups (of molecules)
Unit-3	Reducible and irreducible representations, characters of representation.
Unit-4	Character tables and their uses (representations, of Cn, Cnv, Cnh, Dnh etc
	groups to be worked out)

Block-4.16.2	Spectroscopic Applications for inorganic compounds
Unit-5	Vibrational spectroscopy- vibrational spectra of diatomic linear and bent
	triatomic, AB3, AB4 AB5 and AB6 molecules,
Unit-6	IR Spectra of metal complexes, amines, amido, nitro, nitrito, lattice water,
	aquo and hydrido, carbonato, sulphato, cyanato, thiocyanato complexes,
	mano and multinuclear carbonyl complexes, Ethylene diamino and
	diketonate complexes.
Unit-7	ESR spectroscopy-Spin polarization for atoms and transition metal ions,
	spin-orbit coupling and significance of g-tensors, zero/non zero field
	splitting, Kramer's degeneracy, applications to transition metal complexes
	(having one to five unpaired electrons) including biological molecules and
	free radicals such $PF_4$ $F_2$ and $BH_3$ .
Unit-8	<i>NMR spectroscopy</i> - applications of <sup>31</sup> P, <sup>19</sup> F, <sup>11</sup> B NMR spectroscopy in the
	structural assessment of inorganic compounds, proton/ hydride interactions
	with Rn103, W 183, Pt 185 and Pb207 in metal complexes/organometallic
	compounds.

Block-4.16.3	Modern spectroscopic techniques-I
Unit-9	Photoelectron Spectroscopy: Introduction, principles, chemical shifts,
	photoelectron spectra of simple molecules. X-ray photoelectron and Auger
	electron spectroscopyPrinciples and applications.
Unit-10	NQR Spectroscopy: Introduction, Principles, Quadrupolar nuclei, electric
	field gradient, nuclear quadrupole coupling constants, energies of
	quadrupolar transitions, effect of magnetic field. Applications.
Unit-11	Mössbauer spectroscopy: The Mössbauer effect, chemical isomer shifts,
	quadrupole interactions, magnetic splitting, measurement techniques and
	spectrum display, application to the study of $Fe^{2+}$ and $Fe^{3+}$ compounds; iron
	in very high oxidation states $Fe(V)$ and $Fe(VI)$ nitride complexes; $Sn^{2+}$ and
	Sn <sup>4+</sup> compounds, nature of M-L bond, coordination numberand structure,
	detection of oxidation states and aninterhalogen compound I <sub>2</sub> Br <sub>2</sub> Cl <sub>4</sub> .
Unit-12	Principles, Instrumentation & applications of the following Thermal
	techniques
	TG, DTA, DSC, Cyclic Voltametry, Problems based on above techniques
	should be solved

Block-4.16.4	Title: Modern spectroscopic techniques-II			
Unit-13	General idea about two dimensional NMR spectroscopy, Correlation			
	spectroscopy (COSY)- Homo COSY ( <sup>1</sup> H- <sup>1</sup> H), TOCSY, Hetero COSY			
	(HMQC, HMBC), Homo and Hetero nuclear 2D resolved spectroscopy,			
	NOESY and 2D-INADEQUATE experiments and their applications.			
Unit-14	<sup>13</sup> C NMR Spectra: un-decoupled, Proton decoupled, Off resonance, APT,			
	INEPT, DEPT, chemical shift, Homo nuclear ( <sup>13</sup> C- <sup>13</sup> C) and Hetero nuclear			
	$(^{13}\text{C}-^{1}\text{H})$ coupling constants.			
Unit-15	Flame photometry: Principle, Instrumentation and types of burners, Factors			
	affecting flame photometric determination. Limitations of flame			
	photometry, Interferences in flame photometry, Applications, Stripping			
	Voltammetry: Principle and technique in anodic and cathodic stripping			
	voltammetry, applications to metal ion analysis, limitations.			
Unit-16	Introduction to scanning probe microscopy (SPM), scanning tunneling			
	microscopy (STM), atomic force microscopy (AFM) and scanning			
	electrochemical microscopy (SECM), CD and ORD			

#### **Reference books**

- Introduction to Spectroscopy D. L. Pavia, G.M. Lampman, G. S. Kriz, 3rd Ed. (Harcourt college publishers).
- Spectrometric identification of organic compounds R. M. Silverstein, F. X. Webster, 6<sup>th</sup> Ed. John Wiley and Sons.
- 3. Spectroscopic methods in organic chemistry D. H. Williams and I. Flemming Mc Graw Hill

- 4. Absorption spectroscopy of organic molecules V. M. Parikh
- 5. Nuclear Magnetic Resonance Basic Principles- Atta-Ur-Rehman, Springer-Verlag (1986).
- 6. One and Two dimensional NMR Spectroscopy Atta-Ur-Rehman, Elsevier (1989).
- Organic structure Analysis- Phillip Crews, Rodriguez, Jaspars, Oxford University Press (1998)
- 8. Organic structural Spectroscopy- Joseph B.Lambert, Shurvell, Lightner, Cooks, PrenticeHall (1998).
- Organic structures from spectra –Field L.D., Kalman J.R. and Sternhell S. 4th Ed. John Wiley and sons Ltd.
- Spectroscopic identification of organic compound- R M Silverstein, G C Bassler and T C Morril, John Wiley
- 11. Introduction to NMR spectroscopy-R J Abrahm, J Fisher and P loftus Wiley
- 12. Organic spectroscopy-William kemp, E L B with McMillan
- 13. Spectroscopy of organic molecule-PS Kalsi, Wiley, Esterna, New Delhi
- 14. Organic spectroscopy-RT Morrison and RN Boyd
- 15. Practical NMR spectroscopy-ML Martin, J J Delpench, and D J Martyin
- 16. Spectroscopic methods in organic chemistry-D H Willson, I Fleming
- 17. Spectroscopy in organic chemistry- C N R Rao and J R Ferraro
- 18. NMR Basic principle and application-H Guntur
- 19. Interpretation of NMR spectra-Roy H Bible
- 20. Mass spectrometry organic chemical applications, J H Banyon.
- Structural methods in Inorganic Chemistry E.A.V. Ebsworth, D.W.H. Rankin & S. Cradock, Blackwell Scientific Publication, 1987.
- 22. Physical Methods for Chemists-R.S. Drago, (2nd edition, Saunders).
- 23. Instrumental methods of Chemical Analysis Chatwal & Anand.
- Laboratory Techniques in Electro analytical Chemistry edited by P.T. Kissinger and W.R. Heinman (1984) M. Dekker vinc (USA).
- 25. Dennis H. Evans, Journal of Chemical Education, vol.60, pp290 (1983).

## **Course 17: Bio-organic chemistry**

Block-4.17.1	Title: Proteins and peptides
Unit-1	Amino acids and peptides: Amino acids, structural characteristics, acid base
	property, stereochemistry of amino acids, Stecker synthesis, Zwitter ionic
	nature isolectric points optical resolution.
Unit-2	Peptide structure and conformations, biological functions, C and N terminal
	residue determination, Reaction of polypeptide, structure determination of
	polypeptide.
Unit-3	Proteins, Classification of proteins, protein structure; primary, secondary (α-
	helix, $\beta$ -sheet and $\beta$ -turns), tertiary and quaternary structure.
Unit-4	Factors contributing to the secondary, tertiary and quaternary structure, role of
	salt bridge, disulphide bond, denaturation and renaturation of proteins,
	Ramachandran plot and its significance.

Block-4.17.2	Title: Nucleic acids and carbohydrates
Unit-5	Nucleic acids: Introduction, nucleosides and nucleotides, numbering method
	for sugar unit, base unit, synthesis of nucleobases, Protecting groups used for
	amino groups in bases and hydroxyl group in sugar unit for synthesis of DNA
	and RNA.
Unit-6	Structures and functions of DNA and RNA, Watson-crick model, types of
	DNA, Base paring and stability.
Unit-7	Chelator and interchelator, codons, genetic code, replication of DNA,
	biosynthesis of proteins
Unit-8	Carbohydrate: Types of naturally occurring sugars, deoxy sugars, amino
	sugars, branched chain sugars, methyl ethers and acid derivatives of sugars,
	general methods of structure and ring size determination with reference to
	maltose, lactose, sucrose, Anomeric effect and epimerization and
	mutarotation, Chemistry of starch and cellulose.
Block-4.17.3	Title: Steroids, Prostaglandins and Terpenoids
Unit-9	Steroids: Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and

	stereochemistry, Isolation, structure determination and synthesis of
	Cholesterol and Bile acids, Biosynthesis of steroids (lanosterol).
Unit-10	Plant Pigments: Occurrence, nomenclature and general methods of structure
	determination, isolation and synthesis of Apigenin, Luteolin,
Unit-11	Prostaglandins: Occurrence, nomenclature, classification, biogenesis and
	physiological effects. Synthesis of $PGE_2$ and $PGF_{2\alpha}$
	Porphyrins: Structure and synthesis of Haemoglobin and Chlorophyll.
	Lipids: Introduction, nomenclature, classification and purifications. waxes,
	triacyl glycerol, phospholipids, their biological importance.
Unit-12	Terpenoids: Classification, nomenclature, occurrence, isolation, general
	methods of structure determination, isoprene rule. Structure determination,
	stereochemistry, and synthesis of the following representative molecules:
	Citral, Geraniol, α-terpeneol, Menthol, Farnesol, Zingiberene, Biosynthesis of
	the tepenoids (limonene, camphor, $\alpha$ -pinene, $\beta$ -pinene)

Block-4.17.4	Title: Alkaloids, Vitamins and Enzymes
Unit-13	Alkaloids: Definition, nomenclature and physiological action, occurrence,
	isolation, classification based on nitrogen heterocyclic ring, role of alkaloids
	in plants Structure,
Unit-14	General methods of structure elucidation, degradation stereochemistry, and
	synthesis of the following: Ephedrine, (+)-coniine, Nicotine, Atropine,
	Quinine, Reserpine and Morphine,
Unit-15	Vitamins: Introduction, constitution of thiamine, riboflavin, pyridoxine,
	biotin, ascorbic acid, vitamin A, E and K groups and synthesis thiamine,
	ascorbic acid biosynthesis and biological importance vitamins
	Introduction to hormones, antibodies and anti oxidents, their Biological
	importance
Unit-16	Enzymes: Introduction, chemical and biological catalysis, remarkable
	properties of enzymes like catalytic power, specificity and regulation.
	Cofactors as derived from vitamins, coenzymes, prosthetic groups,
	apoenzymes. Nomenclature and classification, Fischer's lock and key and
	Koshland's induced fit hypothesis, concept and identification of active site by

the use of inhibitors, affinity labeling and enzyme modification by site-
directed mutagenesis. Baker's yeast catalyzed reactions

# **Course 20: Analytical techniques**

Block-4.20.1	Title: Extraction and precipitation methods
Unit-1	Solvent extraction: Principle and techniques, Distribution ratio and
	distribution coefficient, Factors affecting extraction efficiency, Ion
	association complexes, chelation, synergistic extraction,
Unit-2	Role of chelating ligands, crown ethers, calixarenes and cryptands in solvent
	extraction, Introduction to Solid phase extraction (SPE) and Microwave
	assisted extraction (MAE), Applications.
Unit-3	Gravimetric analysis: General principles, stoichiometry, calculation of results
	from gravimetric data, Properties of precipitates, Nucleation and crystal
	growth.
Unit-4	Factors influencing completion of precipitation. Co-precipitation and post-
	precipitation, purification and washing of precipitates, Precipitation from
	homogeneous solution.

Block-4.20.2	Title: Titration methods-1
Unit-5	Principles of titrimetric analysis, titration curves for strong acid-strong base,
	weak acid-strong base and weak base-strong acid titrations. Titration of
	polyprotic acids, poly equivalent bases,
Unit-6	Detection of end points, Theories of acid base indicators, selection of proper
	indicators, Finding the end point by visual indicators, monitoring pH and
	temperature.
Unit-7	Acid-base titrations in non-aqueous media: Role of solvent in acid-base
	titrations, solvent systems, differentiating ability of a solvent, some selected
	solvents, titrants and standards,
Unit-8	Titration curves, effect of water, determining the equivalence point, typical
	applications - determination of carboxylic acids, phenols and amines.

Block-4.20.3	Title: Titration methods-2

Unit-9	Titration methods employing EDTA-direct, back and displacement titrations,
	Selectivity, masking and demasking agents, typical applications of EDTA
	titrations-hardness of water, magnesium and aluminium in antacids,
	magnesium, manganese and zinc in a mixture, titrations involving unidentate
	ligands-titration of chloride with Hg2+ and cyanide with Ag+.
Unit-10	Karl-Fischer titrations: Stoichiometry of the reaction, precipitation of reagent,
	titration method, standardization, determination of water in samples.
	Application to quantitative analysis of organic compounds- Alcohols,
	carboxylic acids, acid anhydrides and carbonyl compounds.
Unit-11	Redox titrations- Principles, Nerst equation, standard and normal potentials,
	titration curves, endpoint signals.
Unit-12	Indicators- criteria for the selection of indicators, feasibility of redox titration.
	Titration of multicomponent systems. Applications- oxidens such as KMnO <sub>4</sub> ,
	K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> , Ce(IV), bromates and Iodates

Block-4.20.3	Title: Complexometric titrations
Unit-9	Complex formation reactions, stability of complexes, stepwise formation
	constants, chelating agents, EDTA-acidic properties, complexes with metal
	ions, equilibrium calculations involving EDTA.
Unit-10	Conditional formation constants, derivation of EDTA titration curves, Effect
	of other complexing agents, factors affecting the shape of titration curves-
	completeness of reaction, indicators for EDTA titrations.
Unit-11	Inorganic analysis - alkalinity, acidity and free $CO_2$ in water and waste
	waters, nitrogen, sulphur ammonium salts, nitrates and nitrites, carbonates
	and bicarbonates.
Unit-12	Organic analysis - functional groups like carboxylic acid, sulphonic acid,
	amine, ester, hydroxyl and carbonyl.

#### References

1. Fundamental of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch,

8th edition, 2005, Saunders College Publishing, New York.

2. Analytical Chemistry, G.D. Christian, 5th edition, 2001, John Wiley & Sons, Inc,

India.

3. Quantitative Analysis, R.A. Day and A.L. Underwood, 6th edition, 1993, Prentice Hall, Inc. New Delhi.

4. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D.

Barnes and M.J.K. Thomas, 6th edition, Third Indian Reprint, 2003, Pearson

Education Pvt. Ltd., New Delhi.

5. Quantitative Analysis, R.A. Day and A.L. Underwood, 6th edition, 1993 prenticeHall, Inc. New Delhi.

6. Analytical Chemistry Principles, John H. Kennedy, 2nd edition, Saunders CollegePublishing, California, 1990.

7. Principles and Practice of Analytical Chemistry, F.W. Fifield and Kealey, 3rd edition, 2000, Blackwell Sci., Ltd. Malden, USA.

8. Modern Analytical Chemistry, David Harvey, McGraw Hill, New Delhi, 2000.

# Course 21: Advanced inorganic chemistry [40AI]

Block-4.21.1	Title: Applied inorganic chemistry
Unit-1	Ionic liquids: Molten salt solvent systems, Ionic liquids at ambient temperature, Reactions in and applications of molten salt/ionic liquid media
Unit-2	Supercritical fluids: Properties of supercritical fluids and their uses as solvents. Supercritical fluids as media for inorganic chemistry
Unit-3	Symmetry in Chemical bonding: Group theory to Crystal fieldtheory and Molecular orbital theory (octahedral and tetrahedral complexes).
Unit-4	Symmetry in Vibrational Spectroscopy: Determining the symmetry groups of normal modes for non-linear molecules ( $H_2O$ , $NH_3$ , $CH_4$ , trans- $N_2F_2$ ) and linear molecules (CO, HCl, HCN and CO <sub>2</sub> ) (Integration method).

Block- 4.21.2	Tile: Modern theories of chemical bonding
Unit-5	Molecular orbital theory, Linear combination of atomic orbitals (LCAO),
	Rules for linear combination of atomic orbitals, Formation of $\sigma,~\pi$ and $\delta$
	molecular orbitals, Non-bonding combinations of orbitals.
Unit-6	Molecular orbital energy diagram, bond order and magnetic properties of
	hetero nuclear di-atomic molecules (CO, NO, HCl) and linear tri-atomic
	molecules involving delocalized $\pi$ bonding (ex: CO <sub>2</sub> , NO <sub>2</sub> ).
Unit-7	Molecular geometry, the ligand close packing (LCP) model, comparison of
	the VSPER and LCP models.
Unit-8	Reexamination of crystalline solids, intermediate types of bonding in solids,
	quantum theory of atoms in molecule.

Block-4.21.3	Title: Synthesis and catalytic applications of organometallics of transition
	elements
Unit-9	Synthesis and $\pi$ -bonding of Pd and Rh metals with olefins and their
	applications in C-C bond formations including Wacker process, Heck

	reaction, Carbonylation, hydroformylation, decarbonylation, olefin
	isomerism.
Unit-10	Synthesis and bonding in Ru metal, Grubb's catalysts, Olefin metathesis
	using Grubb's catalysts, Sonogashira reaction, Stille coupling, Buchwald
	reaction and Pauson -Khand reaction.
Unit-11	Synthesis and bonding in Zn, Pt, Ir and metals,
Unit-12	Fluxional organometallic compounds- Fluxionality and dynamic equilibria in
	organometallic compounds - (i) Compounds with acyclic alkenes (ii)
	Compounds with $\sigma$ -bonded cyclic alkenes (iii) Compounds with one or more
	cyclopolyenes $\pi$ -bonded or $\sigma$ and $\pi$ -bonded to several metal atom.

Block-4.21.4	Title: cluster molecules
Unit-13	Hydrides, Isocyanides and tertiary phosphine complexes- synthesis, structure
	and bonding,
TI • 4 1 4	Dihuduasan dianusana and dinitasaan samulayaa Comthesis structure and
Unit-14	Dinydrogen, dioxygens and dinitrogen complexes-Synthesis, structure and
	bonding.
Unit-15	Boron hydrides: Classification, nomenclature, structure, bonding and
	topology of boronos 4 digit coding ( $s + y + y$ ) numbers for higher boronos and
	topology of boranes, 4-digit couning (s, t, y, x) numbers for higher boranes and
	their utilities.
Unit-16	Chemistry of diboranes: Study of Metalloboranes, Carboranes and
	Matallocarboranas with reference to proparations and structures
	metanocarboraties with reference to preparations and structures.

# **Course 21: Advanced physical chemistry [40AP]**

Block 4.21.1	Title: Solid state chemistry
Unit-1	Types of imperfections, classification of imperfections, point defects,
	schottky defect, Fremkell defects, disordered crystals, line defect, dislocation
	types plane defects, small-angle and large angle boundaries. Stacking fanets,
	crystal growth and twimming
Unit-2	Semiconductors, Band theory, energy band, intrinsic and extrinsic
	semiconductors. Conductivity- electron and holes, temperature dependence on
	conductivity, Photovoltamic effect, P-N junctions, transistors.
Unit-3	Supper conductors-Meissner effect, Type-I and Type-II superconductors,
	isotope effect, manifestation of energy gap, Josephson devises.
Unit-4	X-ray diffractions: Crystal lattices, Unit cell, identifications of lattice planes-
	Miller indices, Bragg equation, elucidation of structure by Lacers and powder
	methods

Block-4.21.2	Title: Kinetics of fast reactions			
Unit-5	Chain reactions- Kinetics of explosive reactions, explosion limits (H $_2$ and O $_2$			
	reaction). Autocatalysis and oscillatory chemical reactions, Kinetics and			
	mechanism of Ru(III) catalyzed oxidation reactions of primary amines by			
	Chloramine-T in HCl media.			
Unit-6	Fast reactions- Study of kinetics by flow technique, equation for contact time,			
	stopped flow and continuous flow methods, Relaxation method, equation for			
	relaxation time, temperature jump and pressure jump methods, flash			
	photolysis, pulse radiolysis and shock tube method			
Unit-7	Homogeneous catalysis, Acid-base catalysis, general acid-base catalysis,			
	specific acid-base catalysis. Acidity functions, Huckel, Hammett and			
	Bummett hypothesis.			
Unit-8	Linear free energy relationship- Taft and Hammette equation, Swain-Scott			
	equation, Edward equation and their significance.			

Block-4.21.3	Title: Photochemistry			
Unit-9	Consequences of light absorption, Laws of photochemistry-Grothus-Draper			
	law, Stark-Einstein law, Quantum yield, determination of quantum yield,			
	actinometers, The Jablask diagram and its significance.			
Unit-10	Photochemical reactions: The photochemical rate law, Kinetics o			
	photochemical reactions, Kinetics of Hydrogen-Chlorine, Hydrogen-Bromine			
	reactions, Kinetics of decomposition of HI.			
Unit-11	Energy transfer in photochemical reaction, Photosensitization and quenching,			
	Fluorescence and Phosphorescence, Quenching of fluorescence. delayed			
	fluorescence mechanisms, kinetics of collisional quenching, Stern-Volmer			
	equation, quenching by added substances charge transfer mechanism, energy			
	transfer mechanism.			
Unit-12	Chemiluminesence, The oscillator strength, The geometry of excited states,			
	the laser and maser, self-phase modulation, single photon counting,			
	experimental techniques, flash photolysis, Picosecond and Femtosecond flash			
	photolysis, applications: Solar energy conversion and storage,			

Block 4.21.4	Title: Non-equilibrium Thermodynamics
Unit-13	Conservation of mass and energy in time dependent closed and open systems,
	Thermodynamic criteria of irreversibility, rate of entropy production and
	entropy exchange in irreversible processes. The generation of the concept of
	Chemical Affinity and the extent of advancement of chemical reactions,
	Thermodynamic constraints on the signs of chemical affinity and the velocity
	of chemical reaction, application to any one coupled reaction, problems.
Unit-14	Colligative properties, Relation between the relative lowering of vapour
	pressure of the solvent Osmosis phenomenon, Van't Hoff theory of dilute
	solution, Van't Hoff relation between osmotic pressure of a solution and
	molecular weight, theories of osmosis, Elevation in boiling point, depression
	in freezing point, relationship between molecular mass of solute and

	Elevation in boiling point/ depression in freezing point, Van't Hoff factors,
	Problems.
Unit-15	Phase equilibrium, phase diagrams, lever rule, phase rule, counting components, Different experimental techniques for determination of transition point, liquid-solid phase transition, phase diagram of carbon dioxide and sulphur systems, two component system involving soild-liquid equilibria ( FeCl <sub>3</sub> -H <sub>2</sub> O, NaCl-H <sub>2</sub> O, Na <sub>2</sub> SO <sub>4</sub> -H <sub>2</sub> O), experimental determination of phase diagram of two component
Unit-16	Liquid-Liquid mixtures, Expressing concentration of solutions, Raoult's Law, Henry's Law, Duhem-Margules equation, completely soluble liquids, vapour pressure composition diagram for Ideal and non-dial solutions, principle of distribution of binary miscible liquids, azeotropes, Immiscible liquids, partially miscible liquids, critical solution temperature, effect of impurities on critical solution temperature.

# **Course 21: Advanced Organic chemistry [40AO]**

Block-4.21.1	Title: Photochemistry of organic molecule			
Unit-1	Introduction, types of excitation $n-\pi$ , $\pi - \pi$ *, Photochemistry of carbonyl			
	compounds, reactivity of electronically excited ketones, representation o			
	excited states of ketones, $\alpha$ -cleavage, $\gamma$ -hydrogen transfer. Norrish Type-1			
	and Type-2 reactions			
Unit-2	Photochemistry of alkenes conjugated alkenes, aromatic compounds with			
	reference to isomerisation, addition and substitution, pyridinium yields and			
	p- Benzoquinones. Photochemical isomerisation, addition and substitution.			
Unit-3	Photochemical isomerization of cis and trans alkenes, Photo-Fries			
	rearrangement of ethers and anilides; Barton reaction, Hoffmann-Loefller-			
	Freytag reaction, Paterno-buchi reaction,			
Unit-4	di- $\pi$ -methane rearrangement; Singlet molecular oxygen reactions; Photo-			
	cleavages. Greenhouse effect. Photo theory reaction of anilides,			
	photochemistry of vision, Applications of photochemical methods in			
	synthesis: Isocomene, Cedrene, Hirsutene			

Block-4.21.2	Title: Pericyclic Reactions		
Unit-5	Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3-butadiene, 1,		
	3, 5-hexatriene, allyl system, classification of pericyclic reaction. FMO		
	approach, Woodward-Hoffman correlation diagram method and Perturbation		
	of Molecular Orbital (PMO) approach of pericyclic reaction under thermal		
	and photochemical conditions.		
Unit-6	Electrocyclic reactions, conrotatary and disrotatary motion 4n and (4n+2		
	systems, Cycloaddition reaction with more emphasis on [2+2] and [4+2],		
	Cycloaddition of ketones Secondary effects in [4+2] cycloaddition.		
	Stereochemical effects and effect of substituents on rate of cycloaddition		
	reaction, Diels-Alder reaction,		
Unit-7	Sigmotropic rearrangement, suprafacial, and antarafacial shift involving		

	carbon moieties, retention and inversion of configuration, [3,3] and [3,5]				
	sigmotropic	rearrangements,	Claisen,	Cope,	Sommelet-Hauser
	rearrangement	s, Ene reaction.			
Unit-8	1,3-dipolar cycloaddition and chelotropic reactions, Application to synthesis				
	of heterocyclic	compounds.			

Block-4.21.3	Title: Modern synthesis concepts
Unit-9	Umpolung concept: Dipole inversion, generation of acyl anion, use of 1,3- dithiane, ethylmethylthiomethylsulphoxide, bis-phenylthiomethane, metallated enol ethers, alkylidene dithiane, ketone thioacetals, 2- propenethiobismethyl thioallyl anion, thiamine hydrochloride based generation of acyl anion
Unit-10	Organopalladium in organic synthesis-Heck reaction, carbonylation, Wacker oxidation, coupling reactions: Kumada Reaction, Stille coupling, Sonogashira, Negishi and Suzuki coupling reactions and their importance, Applications of Co <sub>2</sub> (CO) <sub>8</sub> , Ni(CO) <sub>4</sub> , Fe(CO) <sub>5</sub> in organic synthesis. Wilkinson catalyst of Ruthenium and Rhodium–synthesis and uses its use in hydrogenation reactions-deallylation, C-C, C-O, C-N bond cleavages.
Unit-11	Olefin metathesis by $1^{st}$ and $2^{nd}$ generation catalyst, reaction mechanism and application in the synthesis of homo and heterocyclic compounds,
Unit-12	Multicomponet reactions, combinatorial organic synthesis, solid phase organic synthesis, dominoreactions, microwave assisted organic synthesis.

Block-4.21.4	Title: Advanced synthetic methods
Unit-13	Planning of organic synthesis, Linear and convergent synthesis Illustration
	of Total synthesis, Formal synthesis and Cosine synthesis of simple organic
	molecules, Planning the synthesis of simmple organic molecule using named
	reactions, reagents and arganometallic compounds.

Unit-14	Retrosynthetic analysis, An introduction to synthons and synthetic
	equivalents, disconnection approach, functional group inter-conversions, the
	importance of the order of events in organic synthesis, one group C-X and
	two group C-X disconnections,
Unit-15	One Group C-C Disconnections: Alcohols and carbonyl compounds, Two
	Group C-C Disconnections: Retro-Diels-Alder reaction 1,3-difunctionalised
	compounds, $\alpha$ , $\beta$ - unsaturated carbonyl compounds,
Unit-16	Chirality transfer, Stereoselective addition of nucleophiles to carbonyl
	group: Re-Si face concepts, Cram's rule, Felkin Anh rule, Houk model,
	Cram's chelate model. Asymmetric synthesis use of chiral auxiliaries,
	asymmetric hydrogenation, asymmetric epoxidation and asymmetric
	dihydroxylation,

#### **Reference Books**

- 1. Principle of Organic Synthesis R. O. C. Norman and J. M. Coxon
- 2. Modern Synthetic Reaction. H. O. House and W. A. Benjamin
- 3. Organic Synthesis: The Disconnection Approach-S. Warren
- 4. Designing Organic Synthesis-S. Warren
- 5. Some Modern Methods of Organic Synthesis-W. Carruthers
- 6. Advance Organic Reaction. Mechanism and Structure-Jerry March
- 7. Advance Organic Chemistry Part-B-F. A. Caray and R. J. Sundberg Plenum Press
- 8. Organic Reaction and their Mechanism-P. S. Kalsi
- 9. Protective Groups in Organic Synthesis-T. W. Greene
- 10. The Chemistry of Organo Phosphorous-A. J. Kirbi and S. G. Warren
- 11. Organo Silicon Compound-C. Eabon
- 12. Organic Synthesis via Boranes-H. C. Brown
- 13. Organo Borane Chemistry-T. P. Onak
- 14. Organic Chemistry of Boron-W. Gerrard

## **Third semester**

#### Skill enhancement course-1

Block-1	Title: Data Analysis and chemical handling
Unit-1	The Investigative Approach: Making and Recording Measurements. SI Units and
	their Use, different expression of concentrations and their interconcersions,
Unit-2	Buffer solution and calculation of pH, Buffer actions, Calculation of % yield and
	overall yield in multistep organic synthesis, Safe working procedure and
	protective environment, protective apparel, emergency procedure and first aid,
	laboratory ventilation.
Unit-3	Safe storage and use of hazardous chemicals, procedure for working with
	substances that pose hazards, flammable or explosive hazards, Handling the
	following chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda,
	bleaching powder, sodium thiosulphate, hydrogen peroxide
Unit-4	Structure Elucidation of organic compounds on the basis of spectral data (UV,
	IR, <sup>1</sup> H and <sup>13</sup> CNMR and Mass)

Block-2	Title: Green Chemistry
Unit-5	Definition and Objective of Green Chemistry, The twelve principles of Green
	Chemistry, atom economy in chemical synthesis,
Unit-6	Important technique employed in practice of Green Chemistry, Application of
	microwave irradiation and ultrasound in chemical reactions.
Unit-7	Use of renewable raw materials and biosynthesis, use of safer reagents and green
	solvents and green catalysts.
Unit-8	Real Applications of Green Chemistry: Replacement of CFC and hydrocarbon
	blowing agents with environmental friendly blowing agent CO <sub>2</sub> in the production
	of polystyrene. Replacement of Ozone depleating and Smog producing solvents
	by surfactant assisted liquid or supercritical carbon dioxide for cleaning in
	manufacture of ICs and Computer chips.

### **Fourth semester**

#### Skill enhancement course-2

Block-1	Title: Methods of Scientific Research and Writing Scientific Papers
Unit-1	Sources of information: Primary, secondary, tertiary sources; Journals: Journal
	abbreviations, abstracts, current titles, reviews, monographs, dictionaries, text-
	books, current.
Unit-2	Introduction to Chemical Abstracts and Beilstein, Subject Index, Substance
	Index, Author Index, Formula Index, and other Indices with examples.
Unit-3	Reporting practical and project work, Writing literature surveys and reviews,
	Organizing a poster display, Giving an oral presentation.
Unit-4	Writing scientific papers – justification for scientific contributions, bibliography,
	description of methods, conclusions, the need for illustration, style, publications
	of scientific work, Writing ethics, Avoiding plagiarism.

Block-2	Title: Industrial Application of Chemistry
Unit-5	Chemistry of Cement, Paper and Pulp, and Petroleum
Unit-6	Conducting polymers - Introduction, conduction mechanism, polyacetylene,
	polyparaphenylene and polypyrrole, applications of conducting polymers, Ion-
	exchange resins and their applications.
Unit-7	Industrial waste identification and classifications, sorting, washing, shredding, extruding.
Unit-8	Waste Management Nuclear waste management, e-waste management, organic
	waste management, recycling of plastic.

### I SEMESTER

#### **CHEMISTRY PAPER – I**

Block-1	Inorganic Chemistry
Unit-1	Rutherford model of atom, Bohr's theory of Hydrogen atom, line spectra of atom, Zeeman effect, Quantum theory, Quantum numbers and their significance, Shapes of s, p and d orbitals, Effective nuclear charge, screening effect-based on Slater's rules (problems to be worked out), Pauli's exclusion principle.
Unit-2	General energy level diagram of multi electron atom (up to n=4), Aufbau principle Hund's rule, (n+1) rule, Electronic configuration of elements (up to At. No. 40), stability of completely filled and half-filled orbitals based on the concepts of pairing energy.
Unit-3	Periodic Table and Periodicity: Classification of elements, cause of periodicity, Detailed discussion of the Atomic, Covalent, ionic, Vanderwaal's and crystal radii, Additive nature of covalent radii, Determination of ionic radii by Lande's method, Variation of covalent radii in a group and in a period, explanation for the observed trends, Comparison of the size of the atoms with the corresponding anions and cations, Variation of ionic radii in isoelectronic ions.
Unit-4	Ionization enthalpy, Successive ionization enthalpy, factors affecting ionization enthalpy, applications of ionization enthalpy. Variation in a group and in a period, explanation for the observed trends. Electron gain enthalpy, Successive electron gain enthalpy variation of electron gain enthalpy in period and in a group, explanation for the observed trends. Electronegativity, Variation of electronegativity in a group and in a period,

	explanation for the observed trends, Factors determining electro negativity
	(charge on the atom and hybridization). Pauling, Mulliken and Allred-Rochow
	scale of electronegativity.
Block-2	Physical Chemistry
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Unit-5	Gases: Maxwell-Boltzmann distribution of molecular velocities, Effect of
	temperature on distribution of molecular velocities using distribution curve
	(graph). Boltzmann factor (significance and equation), Energy distribution as a
	function of temperature, Types of molecular velocities – average $(U_{av})$ - root
	mean square velocity ( $U_{rms}$ ) - most probable velocity ( $U_{mp}$ ) – their definition
	and equations, Relation between $U_{av}$ , $U_{rms}$ and $U_{mp}$ velocities of molecules and
	their calculations (based on temperature dependence)
Unit-6	The critical phenomena – Andrew's experiments on CO <sub>2</sub> , critical constants –
	$T_c$ , $P_c$ and $V_c$ , definitions experimental determination of Critical temperature
	and Critical pressure by using Cagniard delaTour's apparatus, critical volume
	by Cailletes and Mathias method – Vander Waal's equation – relation between
	Vander Waal's Constants 'a' and 'b' and critical constants Tc, Pc and Vc to be
	derived using isotherms of CO <sub>2</sub> .
Unit-7	Law of corresponding states and reduced equation of state (to be derived)
	Liquefaction of gases - Principle underlying liquefaction of gases - Joule
	Thomson effect, Joule Thomson experiment – Show that Joule Thomson effect
	is an isoenthalphic process ( $\Delta H = 0$ ). Joule Thomson coefficient, Inversion
	temperature, definitions and its relation between Vander Waal's constants ('a'
	and'b').
TIn:+ 0	Indicator Definitions types (and have reday advertion indicators)
Unit-o	Indicator – Definitions, types (actu-base, redux, ausorption indicators),
	examples for each type. Theory of indicators – Osward's theory and Quinonoid
	theory – indicator constant – action of phenoiphinatein and methyl orange in
	acid-base solutions – pH titration curves for strong acid vs strong base, weak
	acid vs strongbase, weak base vs strong acid, choice of indicators in these types
	of utrations – color change and pH range, Universal indicator – definition.

Block-1	Organic Chemistry
Unit-9	Definition and importance of organic compounds, classification of organic compounds, Tetravalency of carbon, $sp^3$ , $sp^2$ and $sp$ – hybridization (in brief). Bond length, bond angle, bond energy, localized and delocalized chemical bonds – resonance and hyperconjugation effects, isomerism and their different types
Unit-10	<ul> <li>Alkanes: General formula and IUPAC nomenclature, properties, Preparation by Corey-House reaction, conversion of alkanes to aromatic compounds via alkenes and alkynes- aromatization and pyrolysis, reactions of alkanes.</li> <li>Alkenes: General formula, and IUPAC nomenclature, geometrical isomerism in alkenes, Preparation of alkenes by Witting's reaction, Hoffmann's elimination, reactions of alkenes: electrophillic addition, oxymercuration, reduction, hydroboration – oxidation and epoxidation reactions and their mechanisms, oxidation with KMnO<sub>4</sub> and OsO<sub>4</sub>, ozonolysis, industrial applications of ethane and propene.</li> </ul>
Unit-11	<ul> <li>Dienes: Types, relative stabilities of dienes, conjugated dienes – 1,3 butadiene- structure, 1,2 and 1,4- addition reactions with H<sub>2</sub> and halogens, Diel's Alder reaction with an example.</li> <li>Alkynes: General formula, and IUPAC nomenclature, acidity of acetylenic proton, Methods of preparation – dehydrohalogenation from vicinal and geminal dihalides, reactions of alkynes – Electrophillic additions with HCN, CH<sub>3</sub>COOH and H<sub>2</sub>O, polymerization.</li> </ul>
Unit-12	<b>Cycloalkanes:</b> General formula, Definition, synthesis, relative stability Bayer's strain theory and its limitations, SachseMohr's theory of strainless rings, Chair and boat conformations of cyclohexane and their stability, structure and

# **II SEMESTER**

### **CHEMISTRY PAPER – II**

Block-2.1	Inorganic Chemistry
Unit-1	<b>Ionic bond</b> - Introduction, Factors that favor the formation of ionic bonds, Lattice energy, BornLande's equation (no derivation), Born-Haber cycle, setting up of Born-Haber cycle for 1:1 ionic solids, Numerical calculations of LE and EA based on Born-Haber cycle for 1:1 ionic solids, uses of Born-Haber cycle, Role of lattice energy and hydration energy and their importance in the context of stability and solubility of ionic solids.
Unit-2	<b>Covalent bond</b> - Introduction, Factors favoring the formation of covalent bond (ionization energy, electron affinity, electronegativity, nuclear charge, inter nuclear distance and number of valence electrons). Valence bond approach – explanation with examples (H <sub>2</sub> , F <sub>2</sub> , HF, O <sub>2</sub> and N <sub>2</sub> ) to illustrate valence bond approach. Sigma and Pi bonds – explanation by taking H <sub>2</sub> , O <sub>2</sub> and N <sub>2</sub> as examples.
Unit-3	Fajan's rules of polarization and their explanation. Bond length, bond order, bond energy and their significance, polarity of covalent bonds, polar and non-polar molecules, Dipole moment and polarity of molecules to be explained by taking HCl, $CO_2$ , $CCl_4$ and $H_2O$ as examples.
Unit-4	<b>Hybridization</b> -directional property and geometry of sp, $sp^2$ , $sp^3$ , $sp^3d$ and $sp^3d^2$ hybrid orbitals taking BeCl <sub>2</sub> , BF <sub>3</sub> , SiCl <sub>4</sub> , PCl <sub>5</sub> and SF <sub>6</sub> as examples respectively. VSEPR theory with SO <sub>2</sub> , NH <sub>3</sub> , H <sub>2</sub> O, SF <sub>4</sub> and ClF <sub>3</sub> as examples.

Block-2	Physical Chemistry
Unit-5	Adsorption- Introduction, principle involved, Sorption, absorption and adsorption (statement, differences and examples) physical and chemical adsorption – definition and differences, Adsorption of gases on solids – factors which influence, Adsorption isotherms (definition) – mathematical expression for Freundlich's and Langmuir's adsorption isotherms, Applications of adsorption.
Unit-6	Liquid mixtures: Classification of binary mixtures – partially miscible, completely miscible and completely immiscible pairs of liquids (explanation with examples for each type). Raoult's law, definition of ideal and non- ideal solutions based on Raoult's law. Partially miscible liquids: Critical solution temperature (CST) – types – phenol- water system, triethylamine-water system, nicotine-water system (mutual solubility temperature (MST) vs composition curves to be drawn). Effect of addition of non-volatile solute on CST. Binary mixtures of completely miscible liquids.
Unit-7	<ul> <li>Vapour pressure – definition, vapor pressure – composition diagrams and boiling point – composite diagrams. Classification into the types – obeying Raoult's law (type I), showing positive deviation from Raoult's Law (type II) and showing negative deviation from Raoult's Law (type III) – examples for each type.</li> <li>Principles of fractional distillation: Fractional distillation of type I, type II and type III liquid mixtures (with examples). Azeotropic mixtures (definition).</li> <li>Binary mixtures of completely immiscible liquids (with examples), weight fraction of distillates, principle of distillation, applications (numerical problem on weight fractions of components).</li> </ul>

Unit-8	Polyme rs: Introduction, monomer, repeating units, types (linear, branches and
	network) with examples, degree of polymerization, classification (arrangement
	and shape) with examples, polymerization reaction (addition and
	condensation), molar masses of polymers - types (number average and mass
	average), determination of molar mass (viscosity and osmotic pressure method)
	(Numerical problems).

Block-3	Organic Chemistry
Unit-9	Aromatic hydrocarbons: Nomenclature of benzene derivatives, Resonating
	structures of benzene, naphthalene and anthracene. Huckel's rule with respect
	to benzenoids, (benzene, naphthalene, anthracene and phenanthracene)
	Aromatic electrophillic substitution – General mechanism, electronic
	interpretation of orientating influence of electron donating groups (-CH <sub>3</sub> , -Cl, -
	NH <sub>2</sub> and -OH groups) and electron withdrawing groups (-NO <sub>2</sub> , -CHO, -COOH
	and –SO <sub>3</sub> H groups) on electrophillic substitution reactions.
Unit-10	Non-benzenoid compounds, Huckel's rule with respect to non-benzenoid
	compounds (cyclopentadienyl anion, cycloheptadienyl cation) anti-aromaticity.
	Hydrogenation of aromatic compounds: Birch reduction, side chain oxidation
	of toluene to benzaldehyde and benzoic acid. Diel's Alder reactions of
	anthracene with maleic anhydride. Biphenyls: Preparation – Ullmann reaction.
	Alkenyl Benzenes: Cis and Trans stilbene and their preparation (any one
	method).
Unit-11	Alcohols: Definition and classification, IUPAC nomenclature, Monohydric
	alcohols: Preparation of alcohols from alkene, carbonyl compounds, and
	carboxylic acids, Distinction tests between $1^{\circ}$ , $2^{\circ}$ , and $3^{\circ}$ alcohols by Victor
	Meyer oxidation method. Conversion of $1^{\circ}$ to $2^{\circ}$ , $2^{\circ}$ to $3^{\circ}$ and $1^{\circ}$ to $3^{\circ}$ alcohols.
	Dehydration of 1°, 2°, 3° alcohols and comparison of their rates, Reactions:
	With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk.
	KMrQ acidia disharmata anna UNQ ) Ornangayar avidation
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	KivinO <sub>4</sub> , actuic dichroniate, conc. HivO <sub>3</sub> ), Oppeneauer oxidation.
Unit-12	Dihydric alcohols: Glycol – preparation from vicinal dihalides and uses.
	Pinacoles – synthesis, mechanism of pinacol-pinacolone rearrangement.
	<b>Trihydric alcohols:</b> Glycerol, synthesis from propene, reactions with HNO <sub>3</sub> ,
	H <sub>2</sub> SO <sub>4</sub> , oxalic acid and HI. Uses of glycerol.
	Ethers: IPUAC Nomenclature, synthesis, reactions – cleavage and auto-
	oxidation-Ziesel's method. Epoxides: Synthesis by Darzen's method. Acid and
	base catalyzed opening of epoxides. Crown ethers: Introduction with examples
	Phenols: Definition, classification with examples, acidity of phenols, effect of
	substituents on acidity of phenols. Mechanism of Reimer-Tiemann reaction and
	Kolbe reaction, Houben–Hoesch Condensation, Schotten–Baumann Reaction.

# III SEMESTER CHEMISTRY PAPER – III

Block-3.1	Inorganic Chemistry
Unit-1	Molecular Orbital Theory: An elementary account of MOT, linear combination
	of atomic orbitals (no mathematical approach). Bonding and antibonding
	molecular orbitals, conditions for the combination, energy levels of molecular
	orbitals, Molecular orbital structures and bond orders of species like H <sub>2</sub> , He <sub>2</sub> ,
	$He_2^+$ , N <sub>2</sub> , O <sub>2</sub> , HF, LiH, and CO, Prediction of magnetic properties of these
	species.
Unit-2	Metallic bond: Definition, factors favouring the formation of metallic bond,
	Band theory, explanation of electrical conductance of metals, semiconductors
	(n- and p-type), Insulators and Superconductors (explanation and applications
	with suitable examples).
	Hydrogen bonding: Types of hydrogen bonding, conditions for the formation of
	H-bond. Hydrogen bonding in HF, H <sub>2</sub> O, NH <sub>3</sub> , alcohols, carboxylic acids and
	nitrophenols. Appropriate anomalous properties like physical state, boiling
	point and solubility. Structure of ice. Theories (or nature) of hydrogen bond
	(electrostatic approach, VBT and MOT treatments)
Unit-3	Noble gases: Isolation from air by Rayleigh's method, preparation, separation
	of Noble gases-Dewar's method. Preparation, Structure and applications of
	compounds of Xenon and Krypton (XeF <sub>2</sub> , XeO <sub>7</sub> , XeO <sub>3</sub> , KrF <sub>2</sub> , KrF <sub>4</sub> , KrO <sub>3</sub>
	XH <sub>2</sub> O-one method of preparation for each), Clathrates (explanation with
	suitable examples, essential conditions for the formation and uses).
Unit-4	s-block elements: alkali and alkaline earth metal, occurrence and abundance,
	electronic structure, general physical properties: size of atoms, and ions,

density, ionization energy, electronegativity and bond type, melting and boiling points, flame colour and spectra, structures of the metals, hardness and cohesive energy, chemical properties, reactions with air, water, dinitrogen, oxides, hydroxides, peroxides and superoxides, anomalous properties of Lithium and Beryllium,

Block-3.2	Physical Chemistry
Unit-5	Colligative Properties: Concept of vapour pressure, variation of vapour pressure with temperature. Definition of boiling point and freezing point, effect of dissolution of solute on the vapour pressure of the solvent. Lowering of vapour pressure. Raoult's law – relation between relative lowering of vapour pressure and molar mass (to be derived). Determination of relative molar mass
	of solute by dynamic method. Elevation of boiling point and its relation to lowering of vapour pressure and molar mass (to be derived). Ebullioscopic constant of the solvent and its relation to the boiling point (only equation). Determination of molar mass of the solute by Walker-Lumsden method.
Unit-6	Depression in freezing point and its relation to lowering of vapour pressure and molar mass (to be derived). Cryoscopic constant and its relation to the melting point (equation). Determination of molar mass of a non-volatile solute by Beckmann's method (problems to be worked out). Definition of osmosis, osmotic pressure (mention application), determination of osmotic pressure by Berkley-Hartley's method, laws of osmotic pressure analogy with gas laws, determination of molar mass from osmotic pressure measurements (relation to be derived), isotonic solutions, Semi permeable membrane – natural and artificial, preparation of copper ferrocyanide membrane by Morse- Frazer method, plasmolysis.
Unit-7	Distribution Law: Nernst distribution law in liquid-liquid systems, distribution coefficient, statement of Nernst distribution law – verification of distribution law taking distribution of $I_2$ in $H_2O$ and $CCl_4$ – limitations of the law,

	conditions for the validity of distribution law, association of the solute in one of
	the solvents, dissociation of the solute in one of the solvents, application of
	distribution law with respect to solvent extraction process (numerical problems)
Unit-8	Physical Properties and chemical constitution: Additive and constitutive
	properties, properties of liquids– viscosity, definition of coefficient of viscosity,
	factors affecting viscosity - temperature, size, weight, shape of molecules,
	intermolecular forces, determination of viscosity of liquids by Ostwald's
	method
	incurou.
	Surface tension: Definition, effect of temperature on surface tension, effect of
	solute on surface tension, determination of surface tension of liquids using
	stalgmometer
	Parachor: Definition – Sugden equation, calculation of parachor and its
	application with respect to structural elucidation of benzene and quinone,
	numerical problems based on surface tension, viscosity and parachor
	in the second of second of second, insecond and paracher
	applications

Plack 2.2	Organia Chamistry
DIOCK-3.5	Organic Chemistry
Unit-9	Alkyl Halides: IUPAC Nomenclature, Preparation: from alkenes and alcohols,
	Reactions: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation,
	Elimination vs substitution, Reactivity and Relative strength of C-Halogen
	bond in alkyl, allyl, benzyl, vinyl and aryl halides,
	Aryl Halides: Preparation: (Chloro, bromo and iodo-benzene case): from
	phenol, Sandmeyer & Gattermann reactions, Reactions (Chlorobenzene):
	Aromatic nucleophilic substitution (replacement by -OH group) and effect of
	nitro substituent. Benzyne Mechanism: KNH <sub>2</sub> /NH <sub>3</sub> (or NaNH <sub>2</sub> /NH <sub>3</sub> ).
Unit-10	Carbonyl Compounds: Distinction between aldehydes and ketones, structure
	of carbonyl group, reactivity trend, IUPAC Nomenclature, acidity of $\alpha$ -
	hydrogen atom, synthesis of carbonyl compounds by oxidation and reduction

	method, Reactions of carbonyl compounds:
	Addition of alcohols- formation of hemiacetal and acetal, Condensation with
	NH <sub>2</sub> OH and 2,4-DNP. Perkins reaction, Cannizzaro reaction, Claisen
	condensation, Knovenagel reaction, Wittig reaction, Benzoin condensation.
	Clemensen reduction and Wolff Kishner reduction. Meerwein-Pondorff Verley
	reduction.
Unit_11	Peactions of carbonyl compounds: Aldol condensation Mechanism of aldol
0111-11	Reactions of carbonyl compounds. Allor condensation, we chansin of allor $\alpha$ $\beta$ Unsaturated
	Carbonyls The Mixed Aldol Reaction and Regiocontrol Involving Enclates
	Englate Reactions: Synthesis of 1.3-Dicarbonyls 1.5-Dicarbonyls and
	Cyclobevenones Synthesis of Aromatic Ketones (Friedel_Crafts
	Cyclonexchones, Synthesis of Aromane Retores (Treder Craits
	Acylation) Synthesis of Aromatic Aldehydes (Formylation Reactions),
	Iodoform reaction, Addition of organomagnessium, organozinc and
	arganocopper reagents to carbonylgroup.
Unit-12	<b>Carboxylic acids</b> (aliphatic and aromatic). IUPAC nomenclature. Preparation:
	Acidic and Alkaline hydrolysis of esters. Nitrile, amids, oxidation of alcohols
	and carbonyl compounds, acidity of carboxylic acid group, Reactions: Hell –
	Vohlard - Zelinsky Reaction, Reformatsky Reaction, Perkin condensation, $\alpha$ -
	halogenation, decarboxylation,
	Derivatives of carboxylic acids: synthesis of Acid chlorides, Anhydrides,
	Esters, Lactums and Amides and their reactions.
	Hydroxy acids: Synthesis of lactic, citric and tartaric acids. One method each
	and their importance. Effect of heat on $\alpha$ , $\beta$ , $\gamma$ -hydroxy acids.

## **IV SEMESTER**

## CHEMISTRY PAPER-IV

Block-4.1	Inorganic Chemistry
Unit-1	<b>Boron:</b> Boron hydrates – diborane, preparation, structure and uses.
	<b>Carbon:</b> allotropy of carbon, Fullerenes – production, structure of $C_{60}$ and $C_{70}$ ,
	Diamond, graphite – properties and structure.
	<b>Silicon:</b> Structure of silica. Silicates – types and structure with one example for
	each type.
	Nitrogen: Preparation, properties, structure and applications of hydrazine,
	hydroxyl amine and nitrogen trichloride.
Unit-2	Sulphur: Preparation, properties, structures and applications of thionyl
	chloride, sulphuryl chloride and $SF_6$ .
	Halogens: Bleaching powder – preparation, properties and structure.
	Pseudo halogens: Preparation, properties and structure of cyanogen and
	thiocyanogen (any one method of preparation and any three properties to be
	discussed).
Unit-3	Chemistry of transition elements: Position in the periodic table, electronic
	configuration, general characteristics- atomic and ionic radii, ionization energy,
	variable oxidation states, spectral properties, redox potentials, colour and
	magnetic properties, catalytic activity, complex formation and interstitial
	compounds formation (3d, 4d and 5d series).
Unit-4	<b>Chemistry of inner transition elements</b> : Electronic configuration and position
	in the periodic table, oxidation states, spectral properties, colour and magnetic

	proper	tie	s, complex form	natio n ar	d ionic	radi	i, lanthanic	le c	contraction –	cause
	and it	S	consequences.	General	survey	of	actinides	_	comparison	with
	lanthar	nid	es, transuranic e	elements.						

Block-4.2	Physical Chemistry
Unit-5	<b>Ionic equilibria:</b> Ionic equilibria in aqueous solutions, strong and weak electrolytes – definition and examples. Ostwald's dilution law (to be derived) and its limitations (numerical problems). Activity and activity coefficients – definition and their relation. Mean ionic activity coefficients – ionic strength – determination and its calculation. Debye-Huckel theory of strong electrolytes
	(relaxation time effect, electrophoretic effect and viscous effect).
Unit-6	Debye-Huckel-Onsagar equation, Debye-Huckel Limiting equation for activity coefficients, Solvent system concept of acids and bases. Role of solvents in altering strengths of acids and bases, Hydrolysis of salts – derivation of hydrolysis constant and degree of hydrolysis of the salt of weak acid and weak base (ammonium acetate), effect of temperature on degree of hydrolysis.
Unit-7	<b>Thermodynamics</b> : Introduction, First Law of Thermodynamics and its limitations of– need for II Law of thermodynamics, spontaneous, non- spontaneous and equilibrium processes (definitions and examples for each), different ways of stating II Law, heat engine (example) Carnot cycle, efficiency of Carnot cycle (derivation), concept of entropy – definition and physical significances of entropy – criteria of spontaneity in terms of entropy change, statements of II law in terms of entropy (numerical problems to be worked out on entropy and efficiency of Carnot engine)
Unit-8	<b>Free energy:</b> Helmholtz and Gibb's free energy – their definitions and their relationship, Gibb's–Helmholtz equation at constant pressure and volume (derivations), thermodynamic criteria of equilibrium and spontaneity, variation of free energy with temperature and pressure, Claussius – Clappeyron equation

(differential form to be derived), integrated form of Claussius – Clappeyron equation (to be assumed) and its applications (enthalpy of vapourization, boiling point and freezing point at different temperatures), (numerical problems on these applications), Van't Hoff's reaction isotherms and isochore equations (to be derived).

Block-4.3	Organic Chemistry
Unit-9	Amines: Definition, classification with example. Separation of amine mixture
	by Hinsberg's method using toluene sulphonyl chloride. Distinction tests for 1°,
	2°, 3° amines (acetylation and Hoffmann's exhaustive methylation. Action of
	nitric acid on different amines. Both aliphatic and aromatic 1°, 2°, 3° amines,
	basicity of amines, effect of substituents on basicity of aliphatic and aromatic
	amines. Hoffmann-Martius rearrangement.
	Diazonium Compounds: preparation, mechanism of preparation and synthetic
	applications of benzene diazonium chloride. Conversion to phenol,
	halobenzene, phenyl hydrazine and coupling reaction.
Unit-10	Stereochemistry: Introduction, definition, elements of symmetry (plane,
	centre, simple axes and alternative axes), asymmetry and dissymmetry,
	Chirality, designation of configuration - R-S notation. Optical activity -
	explanation – cause of optical activity (non-super impossibility). Enantiomers
	and diastereomers optical isomerism in tartaric acid and biphenyls,
	racemisation, resolution, methods of resolution (Chemical and biochemical
	methods)
Unit-11	Geometrical isomerism: Definition with example, designation of cis-trans and
	E-Z notations with examples. Geometrical isomerization of aldoximes and
	ketoximes, Beckmann rearrangement, cis-trans conformations in disubstituted
	cyclohexanone.
	Conformational analysis of acycalic molecule: ethane, propane and butane and

	bicyclic molecule: Decalins and substituted decalines
Unit-12	Active methylene compounds: Definition, ethyl acetoacetate, preparation and keto-enol tautomerism in ethyl acetoacetate- its evidence.
	<b>Synthetic applications:</b> Acid hydrolysis, ketonic hydrolysis, mono carboxylic acids, dicarboxylicacids succinicacid, adipicacid, antipyrine, uracil, acetyl acetone, crotonic acid and cinnamic acid.

## **V SEMESTER**

## **CHEMISTRY PAPER-V**

### Paper –VA

Block-	Inorganic Chemistry
5A.1	
Unit-1	Nuclear chemistry: Fundamental particles of nucleus- nucleons, isotopes,
	isobars and isotones (definition with suitable examples), Nuclear forces (brief
	explanation), nuclear stability-n/p ratio, Mass defect, Binding energy, Inner
	structure of nucleus- Liquid drop model, Nuclear fission- (definition with
	suitable examples), Calculation of energy release in nuclear fission, modes of
	release of fission energy (uncontrolled and controlled), Plutonium as a
	fissionable material (Plutonium bomb),
Unit-2	Nuclear fusion and its advantages over nuclear fission reactions, hydrogen
	bomb, nuclear transmutation-artificial radioactivity. Detection and
	measurement of radioactivity - G. M. counter. Cyclotron, Nuclear reactor,
	Breeder reactor, Q values of nuclear reactions. Uses of radio isotopes - tracer
	technique, agriculture, medicine, food preservation and dating (explanation).
	Separation of uranium isotopes – Laser irradiation method (atomic and
	molecular routes).
Unit-3	Fuels: Definition, classification with examples – characteristics, calorific value,
	determination of calorific value of a solid or liquid fuel. Applications of
	gaseous fuels. Compressed natural gas, water gas, producer gas and LPG -
	their production, composition and applications Propellants: Definition,
	characteristics, classification and applications.
Unit-4	Abrasives: Definition, classification with examples – hardness, manufacture

and applications of carborundum, alundum and tungsten carbide.Refractories: Definition, properties, classification with examples. Differentsteps involved in the manufacture of refractories. Applications of refractories.Explosives: Definition, classification with examples, characteristics ofexplosives. Preparation and uses of dynamite, cordite and RDX.

Block-	Physical Chemistry
5A.2	
Unit-5	Crystallography: Elements of symmetry – plane, axis and center, elements of
	symmetry in cubic crystals, law of rational indices – Weiss and Miller indices,
	lattice planes in cubic crystals. Crystal lattice and unit cell, types of Lattice -
	Bravais lattices.
Unit-6	X-Ray diffraction and Bragg's Law (to be derived), determination of crystal
	structure of rock salt by rotating crystal method using Bragg's spectrometer,
	application of X-ray studies - distance between lattice planes, density of
	crystals, determination of Avogadro Numbe r (numerical problems on
	applications).
Unit-7	Liquid Crystals: Definition, classification of thermotropic liquid crystals into
	smectic and nematic with examples-molecular arrangement of these and their
	uses.
Unit-8	Nanotechnology: Definition, uses and nature of nanotechnology,
	Nanomaterials-definition, properties and applications, Carbon nanotubes-
	definition, types, methods of preparation (mention), properties and industrial
	applications of carbon nanotubes, Nanowires-definition, types, production of
	crystalline nanowires by vapour- liquid-solid synthesis method, applications of
	nanowires

Block-	Organic Chemistry

5A.3	
Unit-9	Organometallic compounds: Definition with example, organo zinc
	compounds – preparation of diethyl zinc and its applications. Organo
	magnesium compounds (Grignard reagent)- preparation and applications
	Organolithium Compounds- Preparation and synthetic applications.
	Organocopper reagents- Preparation and synthetic applications.
Unit-10	Active methylene compounds: Definition, ethyl acetoacetate, preparation and
	keto-enol tautomerism in ethyl acetoacetate- its evidence.
	Synthetic applications: Acid hydrolysis, ketonic hydrolysis, mono carboxylic
	acida dicarboxylic acidasuccinic acid adinic acid antipyrine uracil acetyl
	acids, dicarboxyne acidssuccinic acid, adipic acid, antipyrnie, drach, acetyr
	acetone, crotonic acid and cinnamic acid.
Unit-11	Amines: Definition, classification with example. Separation of amine mixture
	by Hinsberg's method using toluene sulphonyl chloride. Distinction tests for 1°,
	2°, 3° amines (acetylation and Hoffmann's exhaustive methylation. Action of
	nitric acid on different amines. Both aliphatic and aromatic 1°, 2°, 3° amines,
	basicity of amines, effect of substituents on basicity of aliphatic and aromatic
	amines. Hoffmann-Martius rearrangement.
Unit-12	<b>Diazonium Compounds:</b> preparation, Sandmeyer reaction, mechanism of
	preparation and synthetic applications of benzene diazonium chloride.
	Conversion to phenol, halobenzene, phenyl hydrazine and coupling reaction,
	Nitro and nitraso compounds-preparations and synthetic applications

## Paper –vB

Block-5B.1	Inorganic Chemistry
Unit-1	Coordination Chemistry: Ligands, classification of ligands and chelation, nomenclature of co-ordination compounds, physical methods in the study of complexes – change in conductance, colour and pH. Stability of complexes – stability constant, a brief outline of thermodynamic stability of metal complexes, factors affecting the stability of complexes. Polynuclear complexes, inner metallic complexes.
Unit-2	Isomerism in co-ordination complexes: Stereo-isomerism – Geometrical and optical isomerism exhibited by co-ordination compounds of co-ordination number 4 and 6.
Unit-3	Metal-ligand bonding in transition metal complexes: Valence bond theory: Salient features, formation of octahedral complexes on the basis of VBT, outer and inner orbital octahedral complexes- $[Fe(CN)_6]^{4^-}$ , $[Fe(CN)_6]^{3^-}$ , $[Co(CN)_6]^{3^-}$ , $[CoF_6]^{3^-}$ $[Cr(H_2O)_6]^{3^+}$ and $[Fe(H_2O)_6]^{2^+}$ . Formation of tetrahedral and square planner complexes on the basis of VBT – $[Ni(CN)_4]^{2^-}$ , $[Cu(NH_3)]^{2^+}$ , $[Zn(NH_3)_4]^{2^+}$ and $[Ni(CO)_4]$ , limitations of VBT.
Unit-4	<b>Crystal field theory:</b> Important features of crystal field theory, crystal field splitting of d-orbitals in tetrahedral, octahedral and square planar complexes, crystal field stabilization energy (CFSE), factors affecting the magnitude of $\Delta$ o, (nature of ligand, oxidation state of the metal ion, size of the orbitals, geometry of the complex) high spin (HS) and low spin (LS) complexes, magnetic properties of metal complexes based on crystal field theory- $[Co(NH_3)_6]^{3+}$ , $[CoF_6]^{3-}$ , $[Fe(CN)_6]^{4-}$ , $[Fe(CN)_6]^{3-}$ and $[Ni(CN)_4]^{2-}$ . Magnetic susceptibility, measurement of magnetic

moment by Gouy's method. Limitations of CFT.

Block-5B.2	Physical Chemistry
Unit-1	Electrochemistry-I: Introduction, conductance – specific conductance,
	equivalent conductance and molar conductance – their definitions and SI units.
	Conductance cell and cell constant. Determination of equivalent conductance
	by meter – bridge method, ionic mobility, ionic conductance, Kohlrausch's law
	and its significance - determination of equivalent conductance at infinite
	dilution for weak electrolyte.
Unit-2	Transport number: Definition and explanation, anomalous transport number
	- explanation with examples, relationship between ionic conductance and
	transport number (to be derived), determination of transport number by moving
	boundary method – transport number of $H^+$ using $CdCl_2$ as supporting
	electrolyte (numerical problems on equivalent conductance, transport numbers
	and kohlra usch's law).
<b>II '</b> 2	
Unit-3	Application of conductance measurements – (a) solubility and solubility
	product of sparingly soluble salt, (b) ionic product of water, (c) degree of
	ionization of weak electrolyte. Numerical problems for the applications of a, b
	and c to be worked out. Conductometric titration: strong acid vs strong base,
	weak acid vs strong base, strong acid vs weak base, weak acid vs weak base,
	with suitable examples for each.
Linit 1	Phase equilibrie: Cibb's phase rule definition of the terms with examples
01111-4	Thase equilibria. Glob s phase full – definition of the terms with examples,
	application to one component system (water system), reduced phase rule –
	statement, reduced systems, two component system – simple eutectic type KI-
	water system, freezing mixtures, Pb-Ag system (desilverization of
	argentiferrous lead)

Block-5B.3	Organic Chemistry
Unit-5	Hetrocyclic Compounds: Definition, classification with examples, synthesis
	of furan, thiophene, pyrrole, pyridine, indole (Fischer method) quinoline
	(Skrup's synthesis with mechanism), isoquinoline, pyrimidine (one method
	each), aromaticity and basicity of pyrrole and pyridine. Electrophillic
	substitution reactions of pyrrole and pyridine.
Unit-6	Carbohydrates: Definition and importance, classification based on
	composition with examples-reducing and non-reducing sugars.
	Monosaccharides: Glucose: reactions of glucose (with H <sub>2</sub> N-OH, HCN,
	C <sub>6</sub> H <sub>5</sub> NHNH <sub>2</sub> , Br <sub>2</sub> water, Conc. HNO <sub>3</sub> , reductions with HI/red P , methanols,
	(dry HCl), acetic anhydride and reduction reactions.
	Structural elucidation of glucose: Open chain structure, configuration,
	drawbacks of open chain structure, ring structure.
Unit-7	Fisher and Haworth structure. Determination of ring size by methylation
	method. Fischer and Haworth structures of fructose, galactose and mannose.
	Conversion reactions $-1$ . Ascending (Kiliani's synthesis) 2. Descending
	(Wohl's degradation) 3. Aldose to ketose 4. Ketose to Aldose 5. Epimerisation
	Disaccharides: Structural elucidation of sucrose, structural formulae of maltose
	and lactose (Haworth tructure).
	Polysaccharides: Partial structural formulae of starch, cellulose, glycogen and
	their uses.
TI *4 0	Alleoloide Definition classification based on betweenelie rings isolation
Unit-8	Alkaloids: Definition, classification based on neterocyclic rings- isolation,
	synthesis and structural elucidation of mouthe and morphine, physiological
	Uric acid: Elucidation of structure and synthesis by Fischer's method,

	conversion of uric acid to purine and caffeine

## Paper -vc

Block-	Inorganic Chemistry
5C.1	
Unit-1	Non-aqueous solvents: Liquid ammonia-reasons for the solvent properties,
	typical reactions- solubility of alkali metals; acid-base, precipitation,
	ammonolysis, Ionization of weak acids, advantages and disadvantages.
	Liquid SO <sub>2</sub> -reasons for the solvent properties, typical reactions-acid-base,
	solvolysis, precipitation, amphoteric and redox
	HSAB: Classification of acids and bases as Hard and Soft. Pearson's HSAB
	concept, acid-base strength, hardness and softness, symbiosis.
Unit-2	Metal carbonyls: Definition, classification with examples, nature of M-CO
	bonding in carbonyls. Preparation, properties and structures of mono nuclear
	and binuclear metal carbonyls-Ni(CO) <sub>4</sub> , Cr(CO) <sub>6</sub> , Fe(CO) <sub>5</sub> , Mn <sub>2</sub> (CO) <sub>10</sub> ,
	Co <sub>2</sub> (CO) <sub>8</sub> . Applications of EAN rule to mononuclear metalcarbonyls.
Unit-3	Metallurgy: Types of metallurgy: Pyrometallurgy: Extraction of Nickel from
	sulphide ore - general metallurgy followed by Mond's process (purification),
	manganese from oxide ores - reduction by the Aluminothermite process -
	refining by electrolytic process.
	Hydrometallurgy: Extraction of gold from native ore by cyanide process and
	refining by quartation process.
Unit-4	Nanotechnology: Definition, uses and nature of nanotechnology,
	Nanomaterials-definition, properties and applications, Carbon nanotubes-
	definition, types, methods of preparation (mention), properties and industrial
	applications of carbon nanotubes, Nanowires-definition, types, production of
	crystalline nanowires by vapour- liquid-solid synthesis method, applications of

nanowires.

Block-	Physical Chemistry
5C.1	
Unit-5	Electromotive force-I: Electrolytic and electrochemical cells, electrode
	reaction of Daniel cell, single electrode potential, sign of electrode potential-
	convention (reduction potential to be adopted), convention of representing a
	cell, EMF and standard EMF of a cell, cell reaction, reversible and irreversible
	cells, Nernst equation (to be derived) and calculation of electrode potential.
Unit-6	Standard hydrogen gas electrode, reference electrodes-calomel and Ag-AgCl
	electrode-construction and working. Electrochemical series and its significance,
	equilibrium constant and free energy of cell reaction, spontaneity of a cell
	reaction, Concentration cells. EMF of concentration cells- Definition,
	explanation – with transference and without transference.
Unit-7	Liquid junction potential and salt bridge. (Numerical problems on Nernst
	equation and EMF calculations). Fuel cells: Working of H <sub>2</sub> -O <sub>2</sub> fuel cell and its
	importance.
Unit-8	Electromotive force-II: Application of EMF measurements: (a) Determination
	of pH of a solution using quinhydrone electrode and glass electrode (using dip
	type Calomel electrode) – Explanation with principle and procedure. (b)
	Potentiometric titration – principle, location of end points in - (1)
	Neutralization reactions [NaOH Vs HCl] (2) Oxidation-reduction reactions
	[K <sub>2</sub> Cr2O <sub>7</sub> Vs FAS] (3) Precipitation reaction [KCl Vs AgNO <sub>3</sub> ] and (4)
	Complexometric reactions (ZnSO <sub>4</sub> Vs K <sub>3</sub> [Fe(CN) <sub>6</sub> ])

Block-	Organic Chemistry
5C.3	

Unit-9	Chromatography: Paper: introduction to ascending, descending and circular,
	Rf value and it's applications
	TLC: Introduction and applications
	Column Chromatography: Introduction, principle and experimental details
	and applications
	Gas Chromatography: Introduction, apparatus, programmed temperature gas
	chromatography, quantitative analysis of GLC
	HPLC: Introduction, schematic diagram of instrumentation and application.
Unit-10	<b>Amino acids:</b> Structure of $\alpha$ -amino acids, peptide bond, protecting groups-Boc,
	Z, F-moc groups, use of HOBt and HOAt.
	<b>Vitamins:</b> Definition, classification, structural elucidation and synthesis of Vit-
	A, Synthesis of Vit-C, structural formulae of Vit $B_1$ , $B_2$ , $B_6$ , calciferol, E and K
	and their importance.
Unit-11	<b>Terpenes:</b> Definition, isoprene rule, classification, isolation (solvent extraction
	and steam distillation) structural elucidation of citral and its synthesis,
	structural formulae of $\alpha$ -terpeniols, camphor and menthol.
	Natural Pigments. Introduction to anthe evanines structural formulae and
	their importance of antho cyaning B carotene and haemoglobin
	then importance of antilo cyannis, p-carotene and naemogrouni.
Unit-12	Special techniques in organic synthesis:
	a) Polymer supported reagents – introduction, properties of polymer support-
	advantages of polymer support reagents, choice of polymers, types and
	applications.
	b) Phase transfer catalysis – introduction, definition, types, preparation,
	mechanism and advantages.
	c) Microwave induced organic synthesis – introduction, reaction vessel,
	reaction medium, advantages, limitations, precaution and applications.

	d) Sonochemistry – use of ultra sound in organic synthesis, introduction,
	instrumentation, physical aspects, types and applications.

# VI SEMESTER

## **CHEMISTRY PAPER-V**

### Paper-6A

Block-	Inorganic Chemistry
6A.1	
Unit-1	<b>Inorganic polymers:</b> Definition – examples, general properties, comparison with organic polymers, glass transition temperature
	Silicones: Definition, nomenclature, preparation (linear, cross- linked and cyclic). Factors affecting the nature of silicon polymers, properties (chemical and thermal stabilities, chemical properties) uses of silicon polymers, silicon fluids/oils – uses, silicon elastomers – rubbers, silicon resins (preparation and
Unit-2	<ul><li>uses)</li><li>Phosphazenes: Definition, types, structures, preparation, properties and uses.</li></ul>
	Crystalline polymetaphosphates – Maddrell's and Kuroll's salts – properties and uses. Nature of bonding in phosphazenes.
	<b>Fluorocarbons:</b> Definition, examples, preparation, properties and uses of Freon-12, Freon-22, PTFE and poly per fluorovinyl chloride
Unit-3	Paints: Constituents and their functions, manufacture of lithopone and titanium dioxide.
	<b>Fertilizers:</b> Definition and classification, manufacture of nitrogeneous fertilizers – CAN and urea. Phosphatic fertilizers – calcium dihydrogen phosphate, NPK type fertilizers.
Unit-4	<b>Fuels:</b> Definition, classification with examples – characteristics, calorific

	value, determination of calorific value of a solid or liquid fuel. Applications of
	gaseous fuels. Compressed natural gas, water gas, producer gas and LPG -
	their production, composition and applications.
	Propellants: Definition, characteristics, classification and applications.

Block-	Physical Chemistry
6A.2	
Unit-5	<b>Crystallography:</b> Elements of symmetry – plane, axis and centre, elements of
	symmetry in cubic crystals, law of rational indices – Weiss and Miller indices,
	lattice planes in cubic crystals. Crystal lattice and unit cell, types of Lattice -
	Bravais lattices, X-Ray diffraction and Bragg's Law (to be derived),
	determination of crystal structure of rock salt by rotating crystal method using
	Bragg's spectrometer,
	Amplication of V now studios distance between lattice slower density of
Unit-6	Application of x-ray studies – distance between lattice planes, density of
	crystals, determination of Avogadro Number (numerical problems on
	applications).
	<b>Liquid Crystals:</b> Defination, classification of thermotropic liquid crystals into
	smectic and nematic with examples-molecular arrangement of these and their
	sincere and nomatic with examples molecular arrangement of these and then
Unit-7	Spectrophotometry and photochemistry: Lambert – Beer's law – statement
	and mathematical form (to be derived). Molar extinction coefficient – definition
	- spectrophotometer - construction and working, its application.
	Laws of photochemistry – Grotthus-Draper law of photochemical activation
	and Einstein's law of photochemical equivalence, quantum efficiency, reasons
	for low quantum yield (HBr formation as example) and high quantum yield
	(HCl formation as example), actinometry – Uranyl oxalate actinometer.
Unit 9	<b>Destony</b>
01111-8	riotophysical processes: Definition with examples – photosensitization (eg.
	photosynthesis in plants), photo inhibition, fluorescence, phosphorescence,

chemiluminescence and bioluminescence with examples. Determination of
absorbed intensity - schematic diagram of apparatus used. Detectors -
thermopile, photoelectric cell and actinometer (Uranyl oxalate).

Block-	Organic Chemistry
6A.3	
Unit-9	<b>UV-visible spectroscopy:</b> Introduction, chromophores and auxo chrome, blue shift and red shift, graphical representation of spectra of 1,3-butadiene, benzene and lycopene. Influence of conjugation on UV absorption-comparison of UV spectra of acetone and methylyinyl ketone
Unit-10	<b>IR-Spectroscopy:</b> Introduction, stretching frequency of –OH (free and H-bonded), alkyl –C-H, C=C, C=C, C-C, C=O and C-O groups (by taking suitable examples). Graphical representation of IR spectra of benzoic acid and methyl benzoate
Unit-11	<b>NMR Spectroscopy:</b> Basic principles of proton magnetic resonance , nuclear magnetic spin quantum number I, influence of the magnetic field on the spin of nuclei, spin population, saturation using radio frequency, nuclear magnetic resonance-chemical shift ( $\delta$ value), uses of TMS reference, nuclear shielding effects, equivalent and non-equivalent protons, spin-spin splitting and coupling.
Unit-12	Applications of NMR spectroscopy to simple organic molecules (like ethyl alcohol, ethane, propane, ethylene, methylamine, aniline, benzene, toluene, acetone, acetophenone, methyl cyanide and other simple molecules.

### Paper-6B

Block-6B.1	Inorganic Chemistry
Unit-1	<b>Gravimetry:</b> Introduction to gravimetric analysis – precipitation methods (various steps involved to be discussed), advantages of gravimetric analysis, purity of the precipitates, co-precipitation and post precipitation, conditions of precipitation, precipitation from homogeneous solution (hydroxides and sulphates), washing and ignition of precipitate (general discussion only). Electro-gravimetric analysis estimation of copper. Organic precipitants: Advantages of organic precipitants over inorganic precipitants, DMG, 8-hydroxy quinoline (Oxine), 1,10-phenanthroline and EDTA. Structure of Ni <sup>2+-</sup> DMG and Mg <sup>2+</sup> -oxine complexes
Unit-2	<ul> <li>Glasses, Ceramics and composite: Glasses, Ceramics Composites and Nanomaterials: Glassy state, glass formers and GlassModifiers. Glasses, Ceramics, Clay products, Refractories with reference to: preparation, Properties and applications. Microscopic composites, dispersion, strengtheried and particlereinforced, fibre reinforced Composites, microscopic composites, nanocrystaline phase, preparation procedure, special properties and applications,</li> <li>Ores: Composition and analysis of the followings ores- Bauxite, Pyrolusite, Dolomite, Chromite.</li> <li>Portland cement: Composition, raw material, manufacturing processes, characteristics, analysis</li> </ul>
Unit-3	Analysis of alloys: Definition of alloy, Phase diagrams of Fe-C, Pb-Sn, Pb-Ag systems and their applications. Types of steel: hypoeutectic, hypereutectic

	steels, mild steel, and stainless steel. Uses of steel. Composition and uses of
	brass, bronze and soldering alloy. Analysis of iron, nickel, chromium and
	manganese in steel. Analysis of copper and zinc in brass, lead and tin in
	soldering alloy. Industrial applications of alloys.
Unit-4	Analysis of petroleum and petroleum products: Introduction, determination
	of flash and fire point, Pensky Marten's apparatus, cloud and pour point,
	aniline point, drop point, viscosity and viscosity index, Redwood and Saybolt
	viscometer, API specific gravity, water and sulphur in petroleum products,
	carbon residue, corrosion stability, decomposition stability, emulsification,
	neutralization and sanonification number
	neuralization and saponification number.

Block-6B.2	Physical Chemistry
Unit-5	<b>Chemical Kinetics:</b> Introduction – differential and integrated rate equations for
	second order kinetics, derivation of second order rate equation when a=b and
	$a\neq b$ , unit of rate constant, half- life period, experimental verification of second
	order reactions - study of kinetics of saponificaiton of an ester, determination
	of the order of reaction – differential, time for half-change method and isolation
	method.
	Experimental methods of chemical kinetics, conductometric – example -
	saponification of esters.
Unit-6	Potentiometric - example - kinetics of bromination of N,N-di-methyl aniline
	and spectrophotometric - example - colorimetric study of kinetics of oxidation
	of Indigocarmine by chloramine-T.
	Application of kinetic studies: Arriving at the mechanism of urea formation
	from ammonium cyanate.
Linit 7	<b>Phase equilibrie:</b> Gibb's phase rule definition of the terms with examples
Unit-7	<b>rhase equinoria:</b> Glob s phase fulle – definition of the terms with examples,
	application to one component system (water system), reduced phase rule –
	statement, reduced systems, two component system - simple eutectic type KI-
	water system, freezing mixtures, Pb-Ag system (desilverization of

	argentiferrous lead)
Unit-8	Radiation Chemistry: Definition, primary and secondary stages in
	radiochemical reactions, ionic yield, energy yield, comparison with
	photochemistry, units of radiation – rad, gray and roentgen, Dosimeter – Fricke
	dosimeter, theories of radiolysis - Lind's and EHT theories. Radiolysis of
	water vapour, benzene and
	acetic acid

Block-6B.3	Organic Chemistry
Unit-9	Substitution reactions: Nucleophilic substitution reaction, SN1 and SN2 with
	energy profile diagram. Stereochemistry and mechanism of SN1 and SN2
	reaction, Walden inversion, Factors affecting the rate of SN1 and SN2
	reactions- nature of alkyl groups, nature of leaving groups, nucleophiles and
	solvents.
<b>TI I I I</b>	
Unit-10	Elimination reactions: E1 and E2 reactions, mechanisms of E1 and E2
	reactions, Stereochemistry of elimination reactions- Anti and Syn, Factors
	affecting the rate of E1 and E2 reactions- nature of alkyl groups, nature of
	leaving groups, nucleophiles and solvents, Substitution v/s Elimintion
	reactions. EICB reactions,
Unit-11	Additions reactions: Additions to Alkenes and Alkynes, Syn Additions, Anti
	Additions, Additions to Carbonyls- Diastereoselectivity in Acyclic Systems:
	Cram's Rule, Felkin-Ahn Model, Chelation Control by Neighboring Groups,
	Addition to Cyclohexanones, Additions to Enolates- Formation of (E) and (Z)
	Enolates.
Unit-12	Synthesis of cyclic compounds: Synthesis of Cyclopropanes, Synthesis of
	Cyclobutanes, Synthesis of Five-Membered Rings (Radical Cyclization
	Reactions), Baldwin's Rules, Synthesis of Six-Membered Rings (Diels-Alder
	Reaction)- The Dienophile (E <sup>+</sup> ), The Diene (Nu:) Regiochemistry of the Diels–

Alder:	1,2-Disubstituted	Product	Is	Preferred	Over	1,3,	1,4-Disubstituted
Produc	t Is Preferred Over	1,3. Robi	nso	on annulatio	on.		

### Paper- 6C

Block-	Inorganic Chemistry
6C.1	
Unit_1	Introduction Components of Environment Biosphere Lithosphere
Umt-1	Introduction, Components of Environment, Biosphere, Entiosphere,
	Hydrosphere and Atmosphere, Ecological principles- aspects of ecology,
	classification, types of ecosystems. Environmental Pollution and
	Environmental Pollutants, Some Commonly used terms in Environmental
	Pollution, Types of Pollution, Smog, Greenhouse Effect and Global Warming,
	Ozone Layer and its Depletion (Stratospheric Pollution), Soil or Land
	Pollution, Strategies to Control Environmental Pollution, Green Chemistry as
	an Alternative Tool for Reducing Pollution
Unit-2	Water pollution and analysis: Sources of water pollution, composition of
	potable water, importance of water analysis, sampling and sample preservation,
	physico-chemical analysis ofwater. Mineral analysis (temperature, pH,
	conductivity, turbidity, solids, alkalinity, chloride, fluoride, sulphates,
	hardness), Demand analysis (DO, BOD, COD, TOC), nutrients (nitrogen-
	total, nitrate, nitrite, phosphate) and heavy metals (As, Cd, Cr, Hg and Pb). A
	brief idea of coagulation and flocculation. Water treatment plants: Sand filters
	and other types of filters.
Unit-3	Air pollution and analysis: Air pollution and analysis-classification of air
	pollutants, sources of air pollution and methods of control, sampling of aerosols
	and gaseous pollutants and their effects, SO <sub>2</sub> , NO <sub>2</sub> , CO, CO <sub>2</sub> , particulates-SPM,
	RSPM, High Volume Sampler, Fabric Filters, Cyclones (direct and Reverse),
	ESP,
	<b>Thermal pollution</b> —sources, harmful effects and prevention of thermal

	pollution.
	Noise pollution sources, effects and control of noise pollution
Unit-4	<b>Bio-inorganic chemistry:</b> Essential and trace elements in biological process,
	metalloporphyrins with special reference to haemoglobin and myoglobin,
	oxygen uptake, structure and functions of haemoglobin, myoglobin,
	Oxygenation and deoxygenation, biological role of alkali and alkaline earth
	metal ions with respect to $Na^+$ and $Ca^{2+}$ ions, Photosynthesis and nitrogen
	fixation reactions.
Block-	Physical Chemistry
6C 2	i nyskai Chemistry
00.2	
Unit-5	Molecular Spectroscopy: Regions of spectra, types of spectra, microwave
	spectra - rotational spectra of diatomic molecules, moment of inertia
	(expression to be derived). Expression for rotational energy, selection rule and
	transition, calculation of bond length, Isotopic effect.
Unit-6	<b>IR Spectra</b> – vibrational spectra of diatomic molecules – forceconstant (no
	derivation), expression for vibrational energy, zero point energy. Selection rule
	and transitions. Vibrational modes of polyatomic molecules taking $H_2O$ and
	CO <sub>2</sub> molecules as examples. Applications of IR spectroscopy (mention).
Unit-7	Raman Spectra: Concept of polarizability, pure rotation, vibration (qualitative
	study) stoke's and antistoke's lines, selection rule, applications (mention)
	Electronic Spectra: Potential energy curves for bonding and antibonding
	molecular orbitals, band theory, electronic transitions, qualitative description of
	non-bonding orbitals and transition between them. Selection rule and Franck
	Condon principle.
Unit-8	Lattice Defects: Per fect &Imperfect crystals, point defects, Interstitial,
	Schottky defect, Frenkel defect, line defect & other entities, thermodynamics of
	Schottky & Frankel defects. Dissociation. theory of dislocation. plane defects-
	Lineage boundary, grain boundary, stacking fault, 3D defects. Defects & their

concentrations, ionic conductivity in solids, Non stoichiometric compounds.
Electronicproperties of Non-stoichiometric oxides.

Block-	Organic Chemistry
6C.3	
Unit-9	<b>Green Chemistry:</b> Purpose, principles to be followed for green chemistry.
	Synthesis of acetamide, ibuprofen, benzoin, benzylic acid and para-bromo
	acetanilide.
	Natural Pigments: Introduction to antho cyanines, structural formulae and
	their importance of antho cyanins, $\beta$ -carotene and haemoglobin.
Unit-10	Organic Polymers: Monomer and repeating units, Condensation polymers,
	addition polymers, natural polymer- rubber, vulcanization of rubber, silk, hair,
	synthetic polymer- poly styrene, PVC, PEG, polyethelen, Nylon66, terylene,
	synthesis and their applications, gals transition temperature.
Unit-11	<b>Dyes:</b> Colour and constitution, chromophore - oxochrome theory, classification
	of dyes based on applications with examples, synthesis of indigo and malachite
	green, structural elucidation of alizarin and its synthesis.
	Terpenes: Definition, isoprene rule, classification, isolation (solvent extraction
	and steam distillation) structural elucidation of citral and its synthesis,
	structural formulae of $\alpha$ -terpeniols, camphor and menthol.
Unit-12	Drugs: Chemotherapy and chemotherapeutic agents, definition of drugs, types
	of drugs, antipyretics, analgesics, anesthetics, sedatives, narcotics, antiseptics,
	antibacterials, antibiotics, antimalarials and sulpha drugs with examples.
	Synthesis of paracetamol, sulphanilamide, sulphaguanidine

### **Chemistry Syllabus for Practical for B.Sc. Course**

Note: Students should be trained to use electronic balances

72hr per semester

#### <u>I Semester: Practical – I</u>

- 1. Calibration of: (i) Pipette (ii) Burette (iii) Volumetric flask
- 2. Preparation of 2N solutions of H<sub>2</sub>SO<sub>4</sub>, HCl, HNO<sub>3</sub>, CH<sub>3</sub>COOH and NH<sub>3</sub>
- Preparation of standard sodium carbonate solution and standardization of hydrochloric acid solution (methyl orange indicator). Estimation of sodium hydroxide present in the solution using phenolphthalein indicator.
- 4. Preparation of standard oxalic acid solution and standardization of sodium hydroxide solution. Estimation of sulphuric acid present in the solution
- 5. Preparation of standard potassium biphthalate solution and standardization of sodium hydroxide solution. Estimation of oxalic acid present in the solution.
- 6. Preparation of standard oxalic acid solution and standardization of potassium permanganate solution. Estimation of ferrous ammonium sulphate present in the solution
- 7. Preparation of standard oxalic acid solution and standardization of potassium permanganate solution. Estimation of hydrogen peroxide present in the solution.
- 8. Estimation of sulphuric acid and oxalic acid in a mixture using standard sodium hydroxide and standard potassium permanganate solutions.
- Determination of the percentage of available chlorine in the given sample of bleaching powder.
- 10. Estimation of ferrous and ferric iron in a given mixture using standard potassium dichromate solution.
- Preparation of standard zinc sulphate solution and standardization of EDTA.
   Estimation of total hardness of water.
- 12. Estimation of ammonium chloride using standard sodium hydroxide and standard hydrochloric acid solutions (back titration).

### **II Semester: Practical – II**

**Part 1:** Qualitative analysis of mono functional organic compounds through functional group analysis. Determination of physical constant and preparation of suitable derivative of the following class

- 1. Acids
- 2. Alcohols
- 3. Aldehydes
- 4. Amides
- 5. Amines
- 6. Halogenated hydrocarbons
- 7. Hydrocarbons
- 8. Ketones
- 9. Nitro compounds
- 10. Phenols

**Part 2:** Organic preparations: Recrystallization and determination of melting point and its importance may be mentioned

- 1. Acetylation: Preparation of acetanilide from aniline
- 2. Oxidation: Preparation of benzoin acid from benzaldehyde
- 3. Reduction: Preparation m-nitrobenzylacohol from m-nitrobenzaldehyde
- 4. Hydrolysis: preparation of benzoic acid from ethyl benzoate

#### **III Semester: Practical – III**

Systematic semi-micro qualitative analysis of a mixture of two simple salts (with no interfering radicals) including ionic reactions

The constituent ions in the mixture to be restricted to the following

Anions: HCO<sub>3</sub><sup>-</sup>, CO<sub>3</sub><sup>2-</sup>, SO<sub>3</sub><sup>-</sup>, Cl<sup>-</sup>, Br<sup>-</sup>, NO<sub>3</sub><sup>-</sup>, BO<sub>3</sub><sup>3-</sup>, SO<sub>4</sub><sup>2-</sup> and PO<sub>4</sub><sup>3-</sup>

Cations:  $Pb^{2+}$ ,  $Bi^{3+}$ ,  $Cd^{2+}$ ,  $Al^{3+}$ ,  $Fe^{3+}$ ,  $Fe^{2+}$ ,  $Mn^{2+}$ ,  $Zn^{2+}$ ,  $Ba^{2+}$ ,  $Sr^{2+}$ ,  $Ca^{2+}$ ,  $Mg^{2+}$ ,  $K^+$ ,  $Na^+$  and  $NH_4^+$ 

#### Note:

- 1. Mixtures requiring elimination of phosphate and borate should not be given.
- 2. Combination of anions in  $2^{nd}$  group shall be avoided.
- 3. Salts that yield double decomposition shall be avoided (like BaSO<sub>4</sub>).
- 4. The combination of two cations in the mixture should belong to different groups. However combinations like  $Mg^{2+}$  and  $NH_4^+$  and  $Na^+$  and  $NH_4^+$  can be given.

#### **IV Semester: Practical – IV**

- 1. Determination of the density using specific gravity bottle and viscosity of a liquid using Ostwald's viscometer.
- 2. Determination of the density using specific gravity bottle and surface tension of a liquid using stalagmometer.
- 3. Determination of molecular mass of a non-volatile solute by Walker-Lumsden method.
- 4. Determination of rate constant of the decomposition of hydrogen peroxide catalyzed by FeCl<sub>3</sub>.
- 5. Determination of transition temperature of the salt hydrates.
- 6. Determination of rate constant of saponification of ethyl acetate titrimetrically.
- 7. Determination of percentage composition of sodium chloride solution by determining the miscibility temperature of phenol water system.
- 8. Determination of the mass present in the given solution of a strong acid using strong base by thermometric titration method.

- 9. Determination of molecular weight of a polymer material by viscosity measurements (cellulose acetate/methyl acrylate).
- 10. Study of kinetics of reaction between K<sub>2</sub>S<sub>2</sub>O<sub>8</sub> and KI, second order, determination of rate constant.
- 11. Determination of distribution coefficient of iodine in water and carbon tetra chloride.

### V Semester: Practical – V and VI

#### **Practical - V:**

Gravimetric Estimations:

- 1. Gravimetric estimation of barium as barium sulphate.
- 2. Gravimetric estimation of iron as iron (III) oxide.
- 3. Gravimetric estimation of copper as copper (I) thiocyanate.
- 4. Gravimetric estimation of nickel as nickel dimethylglyoximate.
- 5. Gravimetric estimation of magnesium as magnesium -8-hydroxy oxinate.
- 6. Gravimetric estimation of sulphate as barium sulphate.
- 7. Gravimetric estimation of aluminum as aluminum oxide.
- 8. Gravimetric estimation of zinc as zinc oxide.
- 9. Gravimetric estimation of calcium as calcium oxide.
- 10. Paper chromatographic separation of  $Fe^{3+}$  and  $Ni^{2+}$  ions.
- 11. Paper chromatographic separation of  $Na^+$  and  $K^+$  ions

#### **PRACTICAL - VI:**

Ore and Alloy Estimations:

- 1. Preparation of standard potassium dichromate solution and estimation of iron in the given sample of hematite by dichromate method.
- 2. Estimation of percentage of calcium in limestone by oxalate method.
- 3. Estimation of manganese in the given sample of pyrolusite.
- 4. Estimation of magnesium in the given sample of dolomite by EDTA method.
- 5. Estimation of copper in bronze by iodometric method.
- 6. Estimation of tin in solder using EDTA.

#### Preparation of Inorganic Complexes

- 1. Preparation of mercurytetrathiocyanatocobaltate(II).
- 2. Prparation of potassiumtrisoxalatoferrate(III).
- 3. Preparation of ferrousoxalate.
- 4. Preparation of potassiumbisoxalatodiaquachromate(III).

- 5. Preparation of chloropentaminecobalt(III)chloride.
- 6. Preparation of manganese (III)acetylacetonate.

### VI Semester – Practical VII and VIII

#### **Practical VII:**

- Determination of equivalent conductance of the given electrolyte (strong and weak) by using Meter Bridge.
- 2. Determination of solubility of sparingly soluble salt (like BaSO<sub>4</sub>) by conductometric method.
- 3. Determination of Ka (dissociation constant of a weak acid) by conductometric method.
- 4. Determination of rate constant of saponification of ethyl acetate by conductivity measurements.
- 5. Conductometric titration of strong acid and strong base and weak acid and strong base.
- 6. Determination of percentage composition of a given mixture containing two miscible liquids by Abbe's refractometer.
- 7. Potentiometric titration of ferrous ammonium sulphate against potassium dichromate.
- 8. pH titration of strong acid against strong base ( by observing change in pH).
- 9. Potentiometric titration of mixture of HCl and CH<sub>3</sub>COOH using NaOH solution.
- 10. Colorimeteric estimation of Fe<sup>3+</sup> ion using ammonium thiocyanate as complexing agent.
- 11. Colorimeteric estimation of Cu<sup>2+</sup> ion using NH<sub>4</sub>OH as complexing agent.
- 12. Colorimeteric study of kinetics of oxidation of indigocarmine by chloramine-T.

#### **Practical-VIII**

Organic Estimations:

- 1. Separation of p- and o- nitroaniline by TLC method (Solvent extraction).
- 2. Separation of p- and o- nitroaniline by column chromatography.
- 3. Estimation of glucose by Fehling solution method.
- 4. Estimation of Phenol by acetylation method.

- 5. Estimation of ascorbic acid by iodometric method.
- 6. Determination of Iodine value of oils by chloromine-T.
- 7. Isolation of Caffeine from tea powder.
- 8. Isolation of Castor oil from Castor seeds.
- 9. Estimation of neutral amino acids by titrametric method.
- 10. Estimation of carboxylic acid by titrametric method.
- 11. Estimation of -NH2 group by acetylation method.
- 12. Determination of saponification value of oils.

## **Reference books**

#### **Inorganic chemistry**

- 1. A Text book of Inorganic Chemistry; P. L. Soni, Sultan Chand & Sons
- 2. A Text book of Inorganic Chemistry; B. R. Puri & L. Sharma, *Shobhanlal Nagin Chand Co.*
- 3. Principles of Inorganic Chemistry; Puri, Sharma & Kalia Shobhanlal Nagin, *Chand Co.*
- 4. A Text book of Inorganic Chemistry; Gurudeep Raj, Krishna Prakashan Media (P) Ltd
- 5. Concise Inorganic Chemistry; J. D. Lee, Well Science Ltd.
- 6. A Text book of Inorganic Chemistry; Sathya Prakash & others, S Chand & Co Ltd.
- 7. Basic concepts of Analytical Chemistry; S. M. Khopkar, New Age International
- 8. Selected Topics in Inorganic Chemistry; Madan, Malik & Tuli S. Chand & Company
- 9. A Text book of Inorganic Chemistry; A. K. De, New Age International
- 10. Comprehensive Inorganic Chemistry; O. P. Agarwal; Disha Publication.
- 11. Inorganic Chemistry; Kapoor & Chopra, R. Chand & Co
- 12. Engineering Chemistry; B. K. Sharma, Krishna Prakashan Media P. Ltd.
- 13. Industrial Chemistry; B. K. Sharma, Krishna Prakashan Media P. Ltd.
- 14. Engineering Chemistry; Jayaprakash & Venugopal,
- 15. Engineering Chemistry; Jain and Jain, Dhanpal & Sons, New Delhi
- 16. Hand book of Industrial Chemistry; Riegel's James A. Kent B. S. Publishers & Distributors
- 17. Instrumental methods of Chemical analysis; B. K. Sharma, Goel Publishing House

- 18. Elements of Nuclear Chemistry R. Gopalan Vikas Publishing House
- 19. Industrial Chemistry B. N. Chakarbathy Oxford & IBH Publishers
- 20. Instrumental methods of Chemical analysis; Gurdeep R. Chatwal & Anand Sham, *Himalaya Publishing House*
- 21. A Textbook Quantitative analysis; A. I. Vogel, ELBS
- 22. A Textbook Quantitative analysis; A. I. Vogel, ELBS
- 23. Management of Water Resources in Agriculture; V. S. Shreramulu,
- 24. Inorganic Polymers; C. R. Chatwal, Himalaya Publishing House
- 25. Theoretical Principles of Inorganic Chemistry; Manku, Tata McGraw Hills
- 26. Advanced Practical Inorganic Chemistry; Gurudeep Raj, Goel Publishing House
- 27. Experimental Inorganic/Physical Chemistry; Mounir A. Malati Horward Series in Chemical science
- 28. University Chemistry; C. N. R. Rao, Mac Millan Company
- 29. A Text book of Inorganic Chemistry; Robinson & Heslop, New Age Publications
- 30. A Text book of Inorganic Chemistry; Emeleus & Anderson, New Age Publications
- 31. A Text book of Inorganic Chemistry; F. A. Cotton & G. Wilkinson, Wiley Interscience
- 32. Analytical Chemistry; Willard, Meritind & Dean, New Age Publications
- 33. Advanced Chemistry; Philip Mathews, Cambridge University Press
- 34. Instrumental methods of Chemical analysis; H. H.Willard, L. L. Merrite, K. A. Dean & F. A. Skettle, *CBS Publishers*
- 35. A Text book of Inorganic Chemistry; Emelius H. J., Sharpe A. G., University Book Stall New Delhi
- 36. Theoretical Inorganic Chemistry; Dey & Selbin, University Book Stall New Delhi
- 37. Analytical Chemistry; John. H. Chenady, Saunders College, Publishing New York
- 38. Introduction to nanoscience & nanotechnology; Chattopadhyay, PHI
- 39. Nanotechnology fundamentals & applications; Manasi Karkare, IKI NTPC
- 40. Nanotechnology; Richard Brooker, Earl boyson, Wiley Dream Tech India
- 41. Advances in nanoscience & nanotechnology; Dr. Shuthosh Sharma & Dr. Bellari, *CSIR Publications*

#### **Organic chemistry**

1 A Text book of Organic Chemistry; M. K. Jain, S. Chand & Company

2 A Text book of Organic Chemistry; Bhal & Bhal., S. Chand & Company

3 A Text book of Organic Chemistry; P. L. Soni., S. Chand & Company

4 Laboratory Manual of Organic Chemistry; Raj K. Bansal., New Age Publications

5 Laboratory Manual of Organic Chemistry; Jayaraman., S. Chand & Company

6 Chemistry of Natural products; Aggarwal., Goel Publishing House Meerut

7 Organic Chemistry; K. K. Sharma., Shobhanlal & Nagan Company

8 Organic Chemistry; Puri & Sharma., Shobhanlal & Nagan Company

9 Medicinal Chemistry; Ashuthosh Kar., Tata Mcgraw Hill Publications

10 Organic Chemistry; Handrickson., Tata Mcgraw Hill Publications

11 Organic Synthesis special techniques V. K. Ahluwalia & Renu Aggarwal Narosa publishing House

12 Organic Chemistry Vol. I & II I. L. Finar ELBS

13 Stereo Chemistry Eliel John Wiley Eastern Publications

14 Text Book of Qualitative & Quantitative Organic Analysis; Arthur Vogel, ELBS

15 Heterocyclic Chemistry; Raj K. Bansal, Tata Mcgraw Hill, Publications

16 Laboratory Manual of Organic Chemistry; Skoog & West, Prentice-Hall of India Pvt. India

17 Manual of organic Chemistry; Dey & Seetharaman, Allied Publishers.

18 A text book of practical organic chemistry (Volume-III); A. I. Vogel

19 Practical Organic chemistry; Mann & Saunders,

#### **Physical Chemistry**

1 Physical Chemistry; R. P. Verma, Pradeep Publication

2 Kinetics of Chemical Reactions; S. K. Jain, Vishal publications, Jalandhar New Delhi

3 Physical Chemistry; M. Kundan & S. K. Jain, S. Chand & Company

4 Text book of Physical Chemistry; K. K. Sharma & C. K. Sharma, Vani Educational Books

5 Biophysical Chemistry; Upadhyaya & Upadhyaya, Himalaya Publishing Homes

6 Principles of physical chemistry; Puri, Sharma & Pathania

7 Essentials of physical chemistry; B. S. Bahl, Arun Bahl & G. D. Tuli

8 Polymer Science; V. R. Gowriker, N. V. Vishwanathan & J. Sreedhar

9 Quantum Chemistry (2<sup>nd</sup> edition); A. K. Chandra,

10 Quantum Chemistry; R. K. Prasad,

11 Colloidal Chemistry; D. K. Sharma, Goel Prakashan. Meerut

12 Physical Chemistry; R. L. Madan & G. D. Tuli S., Chand & Company

- 13 Text book of advanced Physical Chemistry; Gurudeep Raj, Goel Prakashan. Meerut
- 14 Principles and Applications of Catalysis; B. Vishwanath, Narosa Publishing House
- 15 Engineering Chemistry; Jain & Jain; Dhanpal & Sons, New Delhi
- 16 Text Book of Physical Chemistry; B. D. Khosla, R. Chand & Publications

17 Fundamentals of Molecular Spectroscopy; Colin N. Banwell & Elleine M. Meeash, Himalaya Publishing Group

- 18 Physical Chemistry; Colin N. Banwell, Himalaya Publishing Group
- 19 Physical Chemistry; Glasstone, ELBS
- 20 Text book of Chemical Kinetics; Laidier, New Age Publication
- 21 Text book of Photochemistry; W. Bansal, S. Chand & Company
- 22 Text book of Thermodynamics; Glasstone, East-West Press Pvt. Ltd.
- 23 Text book of Electrochemistry; Glasstone, East-West Press Pvt. Ltd.
- 24 Physical Chemistry; Rakshit,
- 25 Physical Chemistry; Pathania & Sharma, Vishal Publications Jalandhar &, Delhi
## Annexure I

## **INTER- DISCIPLINARY COURSE**

(Open Elective) for First Semester

## ವಿಭಾಗ– ಕನ್ನಡ

ಪತ್ರಿಕೆ–೬: ಆಧುನಿಕ ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಇತಿಹಾಸ EL 1.1 (ಕ್ರೆಡಿಟ್–೩) ಬ್ಲಾಕ್–೧೯: ಆಧುನಿಕ ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಮುಖ್ಯ ಘಟ್ಟಗಳು

ಘಟಕ-೭೩: ಆಧುನಿಕ ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಹಿನ್ನೆಲೆ ಮತ್ತು ಪ್ರೇರಣೆಗಳು.

**ಘಟಕ–೭೪:** ನವೋದಯ ಪೂರ್ವ, ನವೋದಯ– ಬಿ.ಎಂ.ಶ್ರೀ., ಕುವೆಂಪು, ದ.ರಾ.ಬೇಂದ್ರೆ, ಶಿವರಾಮಕಾರಂತ, ಮಾಸ್ಕಿವೆಂಕಟೇಶ್ ಅಯ್ಯಂಗಾರ್, ಕೆ.ಎಸ್. ನರಸಿಂಹಸ್ವಾಮಿ.

ಘಟಕ-2೫: ಪ್ರಗತಿಶೀಲ ಮತ್ತು ನವ್ಯ: ಅನಕೃ, ಕಟ್ಟೀಮನಿ, ನಿರಂಜನ, ಚದುರಂಗ, ವಿ.ಕೃ. ಗೋಕಾಕ, ಅಡಿಗ, ಜಿ.ಎಸ್. ಶಿವರುದ್ರಪ್ಪ, ಶಾಂತಿನಾಥ ದೇಸಾಯಿ, ಅನಂತಮೂರ್ತಿ, ಯಶವಂತ ಚಿತ್ತಾಲ, ಲಂಕೇಶ್, ತೇಜಸ್ವಿ, ವೈದೇಹಿ, ವೀಣಾ ಶಾಂತೇಶ್ವರ, ವಿಜಯಾದಬ್ಲೆ.

ಘಟಕ-೭೬: ಬಂಡಾಯ ಮತ್ತು ದಲಿತ:

ಬರಗೂರು ರಾಮಚಂದ್ರಪ್ಪ, ಬಿ.ಟಿ. ಲಲಿತಾನಾಯಕ, ಸಾರಾ ಅಬೂಬಕ್ಕರ್, ದೇವನೂರು ಮಹಾದೇವ, ಸಿದ್ದಲಿಂಗಯ್ಯ, ಅರವಿಂದ ಮಾಲಗತ್ತಿ, ಮೊಗಳ್ಳಿ ಗಣೇಶ.

ಬ್ಲಾಕ್ – ೨೦: ಆಧುನಿಕ ಕನ್ನಡ ಕಾವ್ಯ ಮತ್ತು ಸಾಹಿತ್ಯ ಪ್ರಕಾರಗಳು

ಘಟಕ-22: ಕಾವ್ಯ ಪ್ರಕಾರಗಳು: ಭಾವಗೀತೆ, ಸುನೀತ, ಶೋಕಗೀತೆ, ಪ್ರಗಾಥ.

ಘಟಕ-೭೮: ಕಥನ ಕಾವ್ಯ, ಖಂಡ ಕಾವ್ಯ, ಮಹಾಕಾವ್ಯ.

ಘಟಕ-೭೯: ಸಾಹಿತ್ಯ ಪ್ರಕಾರಗಳು: ಕಥೆ, ಕಾದಂಬರಿ, ನಾಟಕ ಜೀವನ ಚರಿತ್ರೆ.

ಘಟಕ-೮೦: ಲಲಿತ ಪ್ರಬಂಧ, ಆತ್ಮಕತೆ, ಪ್ರವಾಸ ಸಾಹಿತ್ಯ, ಸಂಪಾದನೆ, ವಿಚಾರ ಸಾಹಿತ್ಯ, ವಿಜ್ಞಾನ ಸಾಹಿತ್ಯ

#### ಪರಾಮರ್ಶನ ಗಂಥಗಳು

೧. ಹೊಸಗನ್ನಡ ಸಾಹಿತ್ಯ: ಎಲ್.ಎಸ್. ಶೇಷಗಿರಿರಾವ್, ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್, ಬೆಂಗಳೂರು, ೧೯೯೨

೨. ಯುಗಧರ್ಮ ಮತ್ತು ಸಾಹಿತ್ಯ ದರ್ಶನ: ಕೀರ್ತಿನಾಥ ಕುರ್ತಕೋಟಿ, ಮನೋಹರ ಗ್ರಂಥ ಮಾಲೆ, ಧಾರವಾಡ, ೧೯೯೧

೩. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಇತಿಹಾಸ: ರಂ.ಶ್ರೀ. ಮಗುಳಿ, ಗೀತಾ ಬುಕ್ ಹೌಸ್, ಮೈಸೂರು, ೨೦೧೮

೪. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಸಂಗಾತಿ: ಕೀರ್ತಿನಾಥ ಕುರ್ತಕೋಟಿ, ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ, ಹಂಪಿ, ಹೊಸಪೇಟೆ, ೧೯೯೫

೫. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಸಂಗಾತಿ: (ಪ್ರ.ಸಂ) ಬರಗೂರು ರಾಮಚಂದ್ರಪ್ಪ, ಕರ್ನಾಟಕ ಸಾಹಿತ್ಯ ಅಕಾಡೆಮಿ, ೨೦೧೮

೬. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ: ತ.ಸು. ಶಾಮರಾಯ, ತಳುಕಿನ ವೆಂಕಣ್ಣಯ್ಯ ಸ್ಮಾರಕ ಗ್ರಂಥಮಾಲೆ, ಮೈಸೂರು, ೨೦೧೪

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 ಜೊಸಗನ್ನಡ ಕಾವ್ಯ ಪ್ರಕಾರಗಳು: ಪ್ರಧಾನ ಸಂಪಾದಕರು, ಎ.ರಂಗಸ್ವಾಮಿ, ಲೇ. ಮ. ರಾಮಕೃಷ್ಣ, ಪ್ರಸಾರಂಗ, ಕರಾಮುವಿ, ಮೈಸೂರು, ೨೦೧೦
 ೮. ಆಧುನಿಕ ಸಾಹಿತ್ಯ ಪ್ರಕಾರಗಳು: ಪ್ರಧಾನ ಸಂಪಾದಕರು, ಎ. ರಂಗಸ್ವಾಮಿ, ಲೇ. ಡಾ. ಜಿ.ಆರ್. ತಿಪ್ಪೇಸ್ವಾಮಿ, ಪ್ರಸಾರಂಗ, ಕರಾಮುವಿ, ಮೈಸೂರು, ೨೦೧೦

## **DEPARTMENT - ENGLISH**

## EL-1.1: INTER- DISCIPLINARY COURSE-I (OPEN ELECTIVE)

## **INDIAN LITERATURE-I**

## **OBJECTIVES**

- To help to understand the contribution of Kalidasa to Sanskrit drama as a playwright
- To create an awareness of the importance of Shakuntala and Mrichhakatika as classical Indian texts
- To evaluate Lord Macaulay and Raja Ram Mohan Roy writers of English Prose.
- To introduce the role of Autobiographies in Indian writing in English

## BLOCK –I

Kalidasa: Shakuntala Shudraka: Mrichhakatika

## **BLOCK -II**

Jawaharlal Nehru: An Autobiography Ram Mohan Roy: Letter to Lord Amherst Macaulay: Minutes on Indian Education Vivekananda: Address to the Parliament of Religions

## **Suggested Reading:**

- M.K.Naik: Critical Essays on Indian Writing in English. Sahitya Akademi, 1969.
- Narasimhaiah. C.D: The Swan and the Eagle. Indian Institute of Advanced Study, 1987.
- Meenakshi Mukherjee: The Twice Born Fiction. Heinemann Educational Publishers, 1972.

• Chirantan Kulshrestha. Contemporary Indian English Verse: An Evaluation. Arnold-Heinemann, 1981.

## **DEPARTMENT - HINDI**

## व्यावहारिक हिंदी एवं व्याकरण

## वर्ण विचार

- वर्ण
- स्वर और उसका वर्गीकरण
- व्यंजन और उसका वर्गीकरण
- वर्णों का उच्चारण स्थान
- संधि
- समास

## शब्द विचार

- शब्द के भेद
- अर्थ के आधार पर शब्द भेद
- व्युत्पत्ति के आधार पर शब्द भेद
- रचना के आधार पर शब्द भेद
- प्रयोग के आधार पर शब्द भेद
- विकारी और अविकारी शब्द भेद
- अव्यय
- संज्ञा और उसके भेद
- वचन- उसके भेद, वचन परिवर्तन के नियम
- लिंग- उसके भेद, लिंग परिवर्तन के नियम
- काल और उसके भेद
- कारक और विभक्ति- उसके प्रकार,
- सर्वनाम और उसके भेद
- विशेषण और उसके भेद
- क्रिया और उसके भेद
- क्रिया विशेषण और उसके भेद
- समुच्च्य बोधक और उसके भेद

- संबंधबोधक और उसके भेद
- विस्मयादिबोधक और उसके भेद
- परसर्ग और उपसर्ग
- वाच्य और उसके प्रकार

## वाक्य विचार

- वाक्य का अर्थ और परिभाषा
- वाक्य के प्रकार .... आदि

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## **DEPARTMENT - TELUGU**

## E. L. 1.1 Thilak Prathyeka Adhyayanam

## Block - 1:Thilak Kavithvam - 1

- Unit 1: Amrutham Kurisina Raathri
- Unit 2:Thilak Padhya Kavithaa Vaibhavam
- Unit 3:Thilak Abhiruchulu Alavaatlu
- Unit 4: Thapala bantrothu

## **Block - 2: Thilak Kavithvam**

Unit - 1:Thilak Sahithya Parichayam - 1

Unit - 2: Thilak Sahithya Parichayam - 2

Unit - 3:Thilak vachana kavithaa Vaibhavam - 1

Unit - 4: Thilak Vachana Kavithaa Vaibhavam - 2

## **DEPARTMENT - HISTORY**

## ANCIENT WORLD CIVILIZATIONS

(Egypt, Mesopotamia, Greek, Roman, Inca, Chinese)

**Objective:** The course is aims to understand major world civilizations. It is to provide a global historical perspective of ancient world which special reference to Egypt, china, Greek, Roman, Inca civilizations.

## **Pedagogy:** personal contact programmes, audio video programmes, online lectures Assignments, etc

Credits: 2.

Examination Duration: 11/2 hours and Maximum Marks:40

## **Course outcomes:**

After completing this course the students should be able to

- > Discuss the Egyptian and Mesopotamian civilizations.
- Analyse the political socio economic conditions of Greek Roman civilizations.
- > Evaluate the Chinese contributions to ancient world.

## Block – I

## Unit-1

Egyptian Civilization: Importance of the Nile, Geographical importance, Gift of Nile, Political conditions.

## Unit-2

Social, Economic and religious conditions, Literature and learning, arts and architecture.

## Unit-3

Mesopotamian Civilization, Sumer and Babylonian, Hammurabi's code, Society and Culture, Economic conditions, art and literature, Assyrian Empire.

## Unit - 4

Greek Civilization, Political Organizations, the city, State, Alexander the Great, Greek political theory, Religion, Philosophy, art and architecture, Characteristic of Hellenistic Civilization.

Block – II Unit - 5 Roman Civilization, The Land and the people, the Government, Roman Republic, Roman Empire, Roman Republic, The Empire, The Patricians and Plebeians, Punic wars.

## Unit – 6

Julius Caesar, his wars, fall Augustus Caesar, Social Economic Conditions, Roman art and architecture.

## Unit - 7

Painting, Sculpture, Roman Law, Roman Religion, Philosophy, Roman literature, Decline of the Roman Empire.

## Unit - 8

Inca Civilisation, Socio – economic Political conditions, Chinese Civilisation, Socio – economic Political conditions.

## Suggested readings:

- 1. Breasted, J.H. : Ancient Times, A History of the early world.
- 2. Rostovzeff, M.S. : History of Ancient World
- 3. Schvider.H : The History of Civilization
- 4. Swain.J.E. : A History of World Civilization
- 5. Breasted.J.H. : History of Egypt
- 6. Jastorow.M : The Civilization of Babylonia and Austria
- 7. Bury.J.E. & OTHERS: The Hellenistic Age
- 8. Bailey.C : The Legacy of Rome and others
- 9. Abot.F.F.: Society and Politics of Ancient Rome

## **DEPARTMENT – ECONOMICS**

## EL1.1: Economic Policies of India Since 1991.

- **Objective:** To enable the Students to understand the economic policies of India in the era of new economic policy.
- Pedagogy: A Combination of Lectures, Group Discussion, Assignments.
- Credits: 2 ; Examination Duration: 1<sup>1</sup>/<sub>2</sub>and Maximum Marks: 50 (Internal Assessment Marks = 10 and Semester-end Examination =40)

## **Course Inputs**

## BLOCK – I: India's Economic Policies

- UNIT: 1 Economic Policies in India Since 1991
   Economic reforms in India Economic Scenario in India during 1990-91 Domestic Financial Crisis Balance of Payment Crisis Extent of External debt and debt Trap Problem.
- UNIT: 2 Need for Reforms

Measures Taken – Devaluation – Privatization – Liberalization – Globalization.

# UNIT : 3 Monetary Policy and Fiscal Policy Narasimhan Committee on Banking and Financial Sector Reforms Since 1998 – Fiscal Reforms: Raja Chellaiah Committee and Tax Reform Policies – Fiscal Prudence and Policies.

# UNIT : 4 Structural Adjustments and External Sector in India Foreign Trade: Trends in Exports and Imports – Balance of Payment and its Crisis – Export Import Policy – In Defence of Import Substitution – Foreign Exchange Policy.

## BLOCK : II FDI and the Role of State

## UNIT : 5 Foreign Direct Investment (FDI)

Trends in FDI – FDI Policy – Its Impact on the Domestic Economy – Labour Migration: causes and Consequences on Indian Economy – Information and Communication Revolution and India.

UNIT : 6 Challenges to Development in India
 Poverty – Unemployment – Poverty alleviation Programmes - urban Poverty and Problems – Income Inequality – Employment Generating Schemes.

#### UNIT: 7 The Role of State

Parallel Economy in India – Black Money – Corruption – Slams – Redefining the Role of the State and the Markets – Balance between Economic and Socio - Political Goals.

## UNIT : 8 Administrative Reforms

Rights to Information – Measures Towards Good Governance – NITI Ayoga and aftermath – Digitalized India – Demonetization – GST – Make in India.

## **References:**

- 1. Acharya Shankar, (2003) India's Economy: Some Issues and Answers, Academic Foundation, New Delhi.
- 2. Byres J Terence (Ed.,) (1999) The Indian Economy, Major Debates since Independence, OUP,New Delhi.
- 3. Datt Ruddar, (2002) Economic Reforms in India A Critique, S.Chand and Co, New Delhi.
- 4. Kapila Uma (Ed) (2015) Indian Economy since Independence, Academic Foundations, New Delhi.
- 5. Kapila Uma, (2005) Understanding the Problem of Indian Economy, Academic Foundation, New Delhi.
- 6. Misra S.K. & V.K. Puri, (2011) Indian Economy-Its Development Experience, Himalaya Pub., House, Mumbai.
- 7. NCAER, Economic and Policy Reforms in India, NCAER, New Delhi.
- 8. Rangarajan C, (1998) Indian Economy- Essays on Money and Finance, UBSPD, New Delhi.
- 9. Sachs D.Jeffrey, A.Varshney & N Bajpai (Ed)(1999) India in the Era of Economic Reforms, OUP, New Delhi.

10. Vaidyanathan A, India's Economic Reforms and Development, OUP, New Delhi

## **DEPARTMENT - POLITICAL SCIENCE**

## (OEL-I) Local Government in India

## **Block-I**

Unit:1	Meaning, Nature and Scope of Local Governments.		
Unit:2	Evolution of Panchayat Raj Institution in India.		
	a) Constitute Assembly and Village Panchayat.		
	b) Balavanth Roy Mehta Committee Report		
	c) Ashok Mehta Committee Report.		
	d) G.V.K. Rao Committee Report.		
Unit:3	Constitutional Amendments and Panchayat Raj Institutions:		
	a) Basis of Constitutional Amendment.		
	b) 73 <sup>rd</sup> and 74 <sup>th</sup> Constitutional Amendment.		
	c) Karnataka Panchayat Raj At of 1983.		
	d) Karnataka Panchayat Raj Act of 1993.		
Unit:4	Zilla Panchayat: Structure, Functions and Sources of Revenue.		

## **Block-II**

- Unit:5 Taluk Panchayat : Structure, Functions, Executive Officer, Powers and Functions.
- Unit:6 Gram Panchayat: Gram Sabha, Ward Sabha: Structure, Functions and Sources of Revenue.
- Unit:7 Panchayat Development Officer and Secretary: Powers and Functions.
- Unit:8 Role of Panchayat Raj Institutions in Development (with Reference to Karnataka)
  - a) Panchayat Raj in Rural Development.
  - b) Social Change: Empowerment of the Weaker Sections.

## **References:**

- 1. Verma B. M, Social justice and Panchayath Raj
- 2. Mutarib-M.A. and Others, Theory of Local Government,
- 3. Dr. Arjun darshankar, Panchayath Raj aani Nagari.
- 4. V. B. Patil, Pancayath Raj.
- 5. A.N. Kulkarni, Bharatiya Sthanik Swashasan,
- 6. Shantaram Bhosale, Bharatiya Sthanik Shasan,
- 7. Kikherji. S, Essays on Rural Development.
- 8. Balaramu. C. H. Administration of Anty Poverty Programmes.
- 9. 73<sup>rd</sup> Constitutional Amendment Act, Government of India, 1993.
- 10. Karnataka Panchayatraj Acts, 1985, 1995.

## **DEPARTMENT - SOCIOLOGY**

## **Invitation to Sociology**

(02 Credits)

#### **Course Description**

This course introduces learners to the basic concepts of sociology. It is particularly designed to orient the learners from interdisciplinary background about the essence of sociology and intends to inculcate sociological imagination.

#### **Course Objectives**

- To introduce the learner to the basic concepts and processes of sociology
- to comprehend the structural and organizational aspects of society
- to examine the process of social change

#### **Learning Outcomes and Competencies**

After successfully completing the course, following outcomes and competencies are possible among the learners. Learner will have/can

- Conceptual precision and clarity about the basic sociological concepts
- Develop sociological imagination and apply to analyze the contemporary events
- explain major social processes of society
- analytical view about Indian social structure
- explicate major process of social change and can conceptualize the changing aspects of Indian society

#### **Course Contents**

#### **Block-1** Basic Concepts and Processes

- Unit-1 Emergence of Sociology-Factors and Early Thinkers-Sociological Imagination
- Unit-2 Society, Community-Associations and Institutions- Culture and Socialization
- Unit-3 Social System, Structure and Function
- Unit-4 Social Processes-Cooperation, Competition, Conflict, Accommodation and Assimilation

## Block-2 Social Organization and Social Change

Unit-5 Caste and Class System-Changes in Caste

- Unit-6 Social Mobility and Types
- Unit-7 Factors of Social Change

Unit-8 Process of Social Change in India (Sanskritization, Westernization,

Modernization and Globalization)

#### **References**

- 1. Berger, Peter L. 1978. An Invitation to Sociology, Allen and Unwin, London. Davis, Kingsley. Human Society, Macmilan, New Delhi.
- 2. Dumont, Louis, 1988, Homo Hierarchicus. Oxford University Press. Giddens, Anthony. 2009. Sociology. Politi Press, Malden.
- 3. Inkles, Alex. 2002. What is Sociology, Prentice Hall India, New Delhi. Jayaram, N, 1990, Introductory Sociology, Macmilan, New Delhi.
- 4. Johnson Harry M., 2011: Sociology: A Systematic Introduction: Allied Publishers, New Delhi.
- 5. MacIver, R.M and C.H. Page. Society Introduction to Sociology, Macmilan, New Delhi
- 6. Samuel, Koenig. 1957. Sociology: An Introduction to Science of Society, Barnes & Nobel Books, London.
- 7. Singh, Yogendra. 1993: Social Change in India: Crisis and Resilience, Har-Anand, New Delhi.

## DEPARTMENT – ANCIENT HISTORY AND ARCHEOLOGY

AHA OE 1.1	World Heritage Sites of India
Block - 1	Introduction
Unit - 1	Nature - Scope - Criteria for incorporation of World Heritage sites
Unit - 2	Types of World Heritage sites in India
Block - 2	Archaeological and Cave Heritage sites
Unit - 3	Bimbetka - Sanchi- Nalanda – Champaner - Dholavira
Unit – 4	Ajanta – Ellora - Elephant
Block - 3	North Indian World Heritage Sites
Unit – 5	Bodh Gaya — Kajuraho–Konarak–Rani kivav– Jaipur,
Unit – 6	Agra Fort – Red Fort - FathepurSikri–Taj Mahal – Humayun's Tomb

Ahamadabad, Qutub Minar

Block - 4	South Indian World Heritages Sites
Unit – 7	Mahabalipuram – Pattadakallu – Chola temples
Unit - 8	Monuments of Hampi – Churches and Convents of Old Goa – Ramappa Temple

## References:

- 1. Marco Canneo, Jasmina: The world heritage sites of UNESCO TheTreasure of Art
- 2. ASI: World Heritage Sites Series
- 3. Individual guide: Books on respective city Individual

## **DEPARTMENT - EDUCATION**

## **IDC – 1 FOUNDATIONS OF EDUCATION**

## **BLOCK-1 FOUNDATIONS OF EDUCATION – I**

Unit-1 Philosophical Foundations Unit-2 Basic Concepts of Philosophy Unit-3 Psychology as a Science Unit-4 Basic Concept in Psychology related to Education

## **BLOCK-2 FOUNDATIONS OF LEARNING – II**

Unit-5 Sociological bases of Education Unit-6 Educational Issues in Indian Society Unit-7 Cultural and Historical Foundations Unit-8 Political and Economic bases of Education

## **References**:

- 1. Harison and Myers (1970), Education, Manpower and Economic Growth, McGrothill, Oxfords, IBH Publishing Co., New Delhi.
- 2. Kamala Bhatia & Baldev Bhatia, (1974) The Philosophical and Sociological Foundations of Education, Doaba House, New Delhi.
- 3. Bhatia B.D, (1974), 'Theory and Principles of Education, Doaba House, Delhi'.
- 4. Sorokim .P, (1947) 'Society, Culture and Personality', Harper and Brothers Publishers, New York.

## **DEPARTMENT – COMMERCE**

## **EL1.1: Personal Financial Planning**

**Objective**: To enable the Students to understand about the different Investment Avenues, Saving Schemes designed by various agencies particularly for the individuals.

**Pedagogy:** A Combination of Lectures, Group Discussion, Assignments.

Credits: 2

**Examination Duration**:  $1^{1}/_{2}$  and Maximum Marks: 50

(Internal Assessment Marks = 10 and Semester-end Examination = 40)

## **Course Inputs**

**Block I** 

- Unit -1: Introduction to Financial Planning: Introduction The Process Financial Planning – Client Interactions – Time Value of Money Applications – Personal Financial Statements – Cash Flow ad Debt Management – Planning to Finance Education.
- Unit -2: Financial Planning Process: Introduction Setting Goals Informal Budget Preparation Investment Opportunities Financial Vs Physical Investments Role of a Financial Planner.
- Unit -3: Savings Plans: Introduction Setting Goals Savings Instruments Savings Plan Tax Savings Schemes.
- Unit -4: Investment Planning: Introduction Risk Return Analysis Mutual Fund Derivatives Asset Allocation Investment Strategies and Portfolio Construction and Management.

**Block II** 

- Unit -5: Risk Analysis and Insurance Planning: Introduction Risk Management and Insurance Decision in Personal Financial Planning – Various Insurance Policies and Strategies for General Insurance – Life Insurance – Motor Insurance – Medical Insurance.
- Unit -6: Retirement Planning and Benefits: Introduction Retirement Need Analysis Techniques – Savings and Investment Plans for Retirement – Employee Provident Fund – Public Provident Fund – Superannuation Fund – Gratuity – Annuity Plans.
- Unit -7: Tax Planning: Introduction Income-tax Computation for Individuals

   Companies Trust and other bodies Statutory Provisions Pertaining to
   Capital Gains and Indexation House Property Deduction and Allowances.
- Unit -8:Health Financing: Introduction Health Financing Models Financing of Health in India – National Rural Health Mission – Challenges of

Access to Health Care and Service Quality – Health Insurance Mechanism & Financial Protection.

## **Books Recommended for Reference**

- 01. Khan M.Y, Financial Services, Tata MacGraw Hill.
- 02. Singhanar V.K, Students' Guide to Income Tax, Taxmann.
- 03. Ranganathan and Madhuamathi, Investment Analysis and Portfolio Management, Pearson Publications.
- 04. Gordon and Natarajan, Emerging Scenario of Financial Services, Himalaya Publishing House.
- 05. George Rejda, Principles of Risk Management and Insurance, Pearson.

## **DEPARTMENT - MANAGEMENT**

## COURSE: OE-1 : Disaster Management - Credit: 2 MBAS 459: DISASTER MANAGEMENT

Objectives	: The course aims at familiarizing the students with the concepts of disaster						
	managemer	it, need for disa	ster manage	ement a	nd its	relevance.	
Pedagogy	: Lectures,	assignments,	Industrial	visits	and	practical	exercises,
	discussions						

- 1. Understanding Disasters · Meaning, nature, characteristics and types of Disasters, Causes and effects, Disaster: A Global View, Disaster Profile of India, The Disaster Management cycle.
- Geological and Mountain Area Disasters · Earthquakes · Volcanic Eruption · Landslides Snow Avalanches, Wind and Water Related Natural Disaster · Floods and Flash Floods · Droughts · Cyclones · Tsunamis, Man Made Disasters · Understanding Man-Made Disasters · Fires and Forest Fires · Nuclear, Biological and Chemical disaster · Road Accidents
- 3. Introduction to disaster Preparedness · Disaster Management: Prevention, Preparedness and Mitigation · Disaster Preparedness: Concept & Nature · Disaster Preparedness Plan · Disaster Preparedness for People and Infrastructure · Community based Disaster Preparedness Plan
- 4. Roles & Responsibilities of Different Agencies and Govt. · Roll of Information, Education, Communication & Training · Role and Responsibilities of Central, State, District and local administration. · Role and Responsibilities of Armed Forces, Police, Para Military Forces. Role and Responsibilities of International Agencies, NGO's, Community Based Org. (CBO's)
- 5. Technologies for Disaster Management · Role of IT in Disaster Preparedness · Remote Sensing, GIS and GPS · Use and Application of Emerging Technologies · Application of Modern Technologies for the Emergency communication. · Application and use of ICST for different disasters.

- 6. Disaster Mitigation · Disaster Mitigation: meaning and concept · Disaster Mitigation Strategies · Emerging Trends in Disaster Mitigation · Mitigation management · Role of Team and Coordination
- Disaster Management in India Disaster Profile of India Mega Disasters of India and Lessons Learnt Disaster Management Act 2005 – Institutional and Financial Mechanism National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national),Non-Government and Inter-Governmental Agencies. National Disaster management Authority.

#### References

- 1. Bryant Edwards (2005): Natural Hazards, Cambridge University Press, U.K.
- 2. Carter, W. Nick, 1991: Disaster Management, Asian Development Bank, Manila.
- 3. Central Water Commission, 1987, Flood Atlas of India, CWC, New Delhi.
- 4. Central Water Commission, 1989, Manual of Flood Forecasting, New Delhi.
- 5. Government of India, 1997, Vulnerability Atlas of India, New Delhi.
- 6. Sahni, Pardeep et.al. (eds.) 2002, Disaster Mitigation Experiences and Reflections, Prentice Hall of India, New Delhi.

## **DEPARTMENT - BIO CHEMISTRY**

#### Basics of Bioinorganic and Biophysical chemistry for Biology graduates.

#### **Bioinorganic chemistry**

Coordination Compounds: Transition metals, properties (Colour, Oxidation states, Magnetic properties) Coordinate bond, double and complex salts– differences with examples.

Postulates of Warner's theory. Types of ligands: For examples: uni, bi, polydentate ligands. Coordination number, examples.

Porphyrin nucleus and their classification. Important metallo-porphyrins occurring in nature. Structure and biological importance of Heme, cytochrome, chlorophyll,Vitamin  $B_{12}$ .

Nitrogen, Fixation of atmospheric nitrogen – Symbiotic and non-symbiotic. Nitrogen cycle. Environmental pollution by nitrogen compounds. Phosphorous: Importance of

Phosphorous compounds in biological system, phosphorous cycle

Oxygen, Formation of ozone in atmosphere. Role of ozone in maintenance of life on earth. Effect of environmental pollutants on ozone layer.

Sulphur and Selenium, Importance of compounds of Sulphur and Selenium in biological systems. Effect of sulphur compounds on environmental pollution.

#### **Biophysical chemistry**.

Units in chemistry, Avogadro's number, Mole, Mole fraction, Molarity, Equivalent weight, Normality, Molality. Colligative Properties, Osmotic pressure and its measurements. Hypo-, Hyper- and isotonic solutions. Effect of osmotic pressure on living cells.

Donnan membrane equilibrium. Relative lowering of vapour pressure, Raoult's law. Elevation of boiling point, depression in freezing point.

Adsorption: Freundlich and Langmuir's adsorption isotherm. Applications of adsorption.

Viscosity: Definition, determination of viscosity of liquids & solutions by Ostwald's viscometer (solutions of gum and protein to be taken as examples).

Distribution law, Distribution law, partition coefficient, application of distribution law.

Acids, bases and buffers- Lewis concept of acids and bases. Ionic product of water. pH scale, buffers, Henderson- Hasselbach equation, buffer capacity Choice of buffers. Theory of acid base indicators. pH titration curve and iso-electric pH of amino acids.

#### **Selected References:**

- 1. Basic Principles of Organic Chemistry, Roberts and Caserio, W. A. Benjamin, Inc. (1964).
- 2. Organic Chemistry, Morrison and Boyd, Allyn and Bacon Inc (1992).
- 3. Principles of Inorganic chemistry by Cotton & Wilkinson, Wiley (1999).
- 4. Textbook of Organic chemistry by Ahluwalia V K & Madhuri G Narosa publications (2001).
- 5. Physical chemistry by Castellan G W, Narosa Publications (2004).
- 6. Physical chemistry by Chakraborthy D K, Narosa Publications (2004).

## **DEPARTMENT - BIOTECHNOLOGY**

## MBT EL –I- Biotechnology and its Applications

Introduction to biotechnology. Principles of biotechnology, classification. **Recombinant DNA Technology** 

Introduction, outline of genetic engineering procedure, restriction endonucleases, cloning & expression vectors- plasmids, cloning in plasmid, transformation and detection of transformants- lacZ, genomic and cDNA libraries, gene analysis techniques-hybridization: Southern, Northern, Western, in situ, Polymerase chain reaction.

## Microbial and food and environmental Biotechnology

Basics of fermentation technology: Types of microbial culture- batch, continuous and fedbatch. Microbial production: Use of microbes in production of vitamins, enzymes, organic acids, amino acids, polysaccharides, flavors, sweeteners, proteins and antibiotics.

Fermented food products- yogurt, cheese, tempeh, sauerkraut; beverages- wine and beer. Preand Pro-biotics, single cell proteins, Genetically modified foods, designer foods.

Current status of biotechnology in environment. Bioconservation, biofuels, gasohol, biogas.Bioremediation: Concepts and principles, bioremediation using microbes, in situ and ex situ bioremediation, biosorption and bioaccumulation of heavy metals.

#### **Plant Biotechnology**

Landmarks in Plant tissue culture. Types of cultures- embryo, organ, callus and cell cultures, Somatic embryogenesis, Haploid Production, Androgenesis, Protoplast culture and somatic hybridization. Micropropagation- Methods and stages, applications. Synthetic seeds, somaclonal variation. Production of secondary metabolites by plant cells, Biotransformation.

Plant transformation techniques: Direct and indirect methods of gene transfer in plants. Transgenic plants and crop improvement- herbicide tolerance, disease resistance, abiotic stress tolerance, delayed ripening, improvement of nutritional quality, molecular pharming.

#### **Animal Biotechnology**

Basics of animal cell culture techniques, cell lines, physical conditions for culturing animal cells, equipments required, scale-up of culture methods.

Application of animal cell culture- Hybridomas, production of therapeutic antibodies, stem cell technology, cell and tissue engineering.

Genetic engineering of animals: Methods for gene transfer in animals, microinjection, nuclear transplantation, retrovirus-mediated gene transfer, gene knockdown techniques. Transgenic-animals- sheep, pigs, cattle, chickens; applications of transgenic animals.

Block-1	Title: Periodic Table and chemical Periodicity
Unit-1	Elements, atomic structure, atomic number, atomic mass, quantum numbers,
	electronic configuration,
Unit-2	Periodic properties of elements, State of Matter, their resources. Important
	periodic properties of the elements, covalent radii, ionic radii, ionization
	potential, electron affinity and electronegativity
Unit-3	Concepts of Acids and Bases: Review of acid base concepts. Lux-Flood and
	solvent system concepts. Hard-soft acids and bases. Applications.
Unit-4	Solutions: Concentration units, solutions of liquids in liquids, Raoult's law,
	ideal and non-ideal solutions.

## **DEPARTMENT - CHEMISTRY**

Block-2	Title: Bonding and molecular structure
Unit-5	Calcification of matter: (elements, compounds, substance and mixture), The
	three states of matter, physical and chemical properties of matter, fundamental
	particles of atoms, atomic number, atomic mass, atomic structure of atom
	molecular formula, empirical formula, molecular mass.
Unit-6	Ions and ionic compounds, properties of ionic compounds, formation of ionic
	compounds, covalent compounds, properties of covalent compounds, properties

	of covalent compounds		
Unit-7	Metals, properties of metals, theory of metallic bond formation, types of meta		
	conductor, semiconductor and insulators, n-type semiconductors and p-type		
	semiconductors, alloys and superconducting materials.		
Unit-8	Acids and bases, general properties of acid and bases, Acid base reactions,		
	oxidation reduction reactions, oxidation number, types of redox reactions,		
	balancing oxidation-reduction equation, exothermic and endothermic reactions		
	energy change in chemical reactions.		

## **DEPARTMENT : CLINICAL NUTRITION AND DIETETICS**

#### **OEL-1: HEALTHY LIFESTYLES AND NUTRITION** 3 Credits

## **BLOCK 1: INTRODUCTION TO FOOD AND NUTRITION**

Unit 1.- Factors affecting food habits, choices and dietary patterns – Definition of Food, Nutrition, Health, Fitness. Interrelationship between nutrition and health, concept of a desirable dietfor optimum nutrition, health and fitness.

- Unit 2-. A brief review of nutrients in general
  - Energy and macronutrients Carbohydrates, Protein, Fat functions, sources deficiency disorders and recommended intakes.
  - Micronutrients: Minerals calcium, Iron, Iodine, and other elements, • Vitamins – FatSoluble & Water Soluble.

Unit 3: Nutritional assessment- Anthropometric, biochemical, clinical, dietary and

**Biochemical assessments** 

Unit 4: Basic principles of planning diet –, RDA for Indians, Food groups, Dietary guidesand balanced diets.

## **BLOCK 2: PLANNING OF DIET**

Unit 5: Principles of planning a normal diet: characteristics of a normal diet, meeting nutrientrequirements of individuals and family. Use of Dietary guidelines for Indians.

Unit 6: Objectives of diet therapy- Regular diet and rationale for modifications in energy

and other nutrients, texture, fluid, soft diets etc.

Unit 7: Role of dietician in hospital- specific functions, team approach in patient care, psychological consideration, interpersonal relationship with patients. Nutrition and medicalethics. Hospital dietary- scope and importance, types of food service, quality

management.

**Unit 8:** Nutrition counseling: definition, concept, role of clinical dietician, the recipient and counseling environment and goals of counseling. An overview of systems approach to nutritionalcare and its components (planning, implementation and evaluation).

## REFERENCES

- Srilakshmi B (2004) Nutrition Science. New Age International (P) Ltd, Publishers.
- Kango M (2005) Normal Nutrition, Curing diseases through diet. First Edition CBS Publications.Paul S (2003) Text Book of Bio-Nutrition, Fundamental and Management. RBSA Publishers.
- Williams SR (2000) Nutrition and Diet Therapy. Sixth Edition C.V. Melskey Co.
- Mudambi SR and Rajagopal MV (1997) Fundamentals of Foods and Nutrition. New AgeInternational (P) Ltd, Publishers.
- Swaminathan M (1999) Essential of Food and Nutrition. Vol I and II, Bappco publications, Madras.
- Corinne, H. Robinson 2010– "Normal and Therapeutic nutrition", Oxford and IBH publishingcompany, Bombay.
- •

Srilakshmi – 2012"Dietetics", 4th edition, New age international publisher, Chennai

## **DEPARTMENT - COMPUTER SCIENCE**

## ELMCS-01 Mobile App Development: Credit 2

## Block – I

Unit-1: Introduction to Mobile Computing: applications, a simplified reference model, Wireless

Transmission:

Unit-2: Frequencies of radio transmission, signals, antennas, signal propagation, multiplexing,

modulation, spread spectrum, cellular system.

- **Unit-3** Media Access Control: motivation for a specialized MAC, SDMA, FDMA, TDMA, CDMA ,and Comparisons.
- Unit-4: GSM, DECT, Wireless LAN: Infrared vs. radio transmission, Infrastructure and adhoc networks,

IEEE 802.11, HPERLAN, Bluetooth.

## Block – II

Unit-5: Mobile Network Layer: mobile IP, dynamic host configuration protocol,

- Unit-6: ad-hoc networks. Mobile Transport Layer: Traditional TCP, classical TCP improvements,
- Unit-7: TCP over 2.5/3G wireless networks. File Systems, World Wide Web,

Β.

Unit-8: Wireless Application Protocol (WAP) and WAP 2.0.

## Text book:

1. Jochen H. Schiller, Mobile Communications(2e)

## Reference

- 1. Raj Kamal, Mobile Computing
- 2. Asoke K. Talukder, Roopa R. Yavagal, Mobile Computing
- 3. Mazliza Othman, Principles of Mobile Computing and Communications
- 4. Prasant Kumar Pattnaik, Rajib Mall, Fundamentals of Mobile Computing
- 5. Ivan Stojmenovic, Handbook of Wireless Networks and Mobile Computer
- 6. David Taniar, Mobile Computing Concepts, Methodologies, Tools, and Applications

## **DEPARTMENT - ENVIRONMENTAL SCIENCE**

## **ESOEL-1: Basics of Environmental Science**

## **Block I: Ecology and Environment**

- **Unit 1:** Definition, Principles and Scope. Biotic and abiotic factors of environment. Ecosystems: pond, forest, river, grassland and estuary ecosystems
- **Unit 2:** Ecosystem trophic structure, energy flow, food chain, food web, Ecological pyramids.
- **Unit 3:** Population dynamics: Definition, population density, Natality, Mortality, Age structure, Growth pattern, population dispersion.
- **Unit 4:** Biogeochemical cycle types, sedimentary and gaseous cycles, N, C, S, P, O cycles. Rock and hydrological cycles.

## **Block II: Biodiversity and Conservation**

Unit 5: Biodiversity, Definition, Types of Biodiversity, importance and roles.

- **Unit 6:** Needs and benefits of biodiversity, Loss of biodiversity- causes and consequences, Need for conservation of biodiversity
- **Unit 7:** Conservation strategies, endemic and exotic species, Red Data book, National parks, wildlife sanctuaries, biosphere reserves, biodiversity hotspots, wildlife protection act, biodiversity act, wetland conservation and management, Hotspots of biodiversity.
- **Unit 8:** Project Tiger, Project elephant, Ramsar site and other conservation projects. Experts Committee Reports on Environmental conservation

## **DEPARTMENT - GEOGRAPHY**

## ELMG -01, Introduction to Physical Geography (Credit-2)

Block-1

Origin, Shape and Size of the Earth, Movement of the Earth- Rotation and Revolution, Effects of the movement of Earth, Coordinates -Latitude, Longitude and Time; Structure of the Earth, Rocks - types, significance, Weathering –types; Agents of Denudation - River, Glacier, Wind and Under Ground water; Structure and Composition of Atmosphere, Weather and Climate

## Block-2

Atmospheric Pressure, Winds and Precipitation; Distribution of Land and Sea, Submarine Relief of the Ocean, Temperature and Salinity of Sea Water; Ocean Tides and Oceanic Currents- Atlantic, Pacific and Indian Oceans; Biosphere- Elements, Ecology, Ecosystem, World's Biomes, Biodiversity – Importance, Types and Conservation

## References

- 1. B.S. Negi (1993) Physical Geography. S.J. Publication, Meerut
- 2. D.S.Lal (1998) Climatology.Chaitnya publishing house, Allahabad
- 3. K. Siddhartha (2001) Atmosphere, Weather and Climate.Kisalaya publication, New Delhi
- 4. R.N.Tikka (2002) Physical Geography. KedarnathRamnath&co, Meerut
- 5. Willian D. Thornbury (1997) Principle of Geomorphology. New Age Internatinal (Pvt Ltd.)New Delhi.

## **DEPARTMENT - MATHEMATICS**

## ELMM --01 - FUNDAMENTALS OF MATHEMATICS (2 Credits)

**Block-I:** Number Theory: Natural numbers, integers, Real numbers, GCD, LCM, Prime numbers. Surds, Indices, Logarithms, Progressions, Arithmetic Progression, Geometric Progression, Harmonic Progression,

**Block-II:** Set Theory: Operations of Union, Intersection, Complementation. Relations & Functions: Types of relations One-one, onto, Many-one functions, graphs of functions. Mathematical Logic: Propositions, logical connectives, Methods of proofs.

## **Books for Reference:**

- 1. Kolman and Busby: Discrete Mathematics, PHI.
- 2. S. L. Loney: The Elements of Coordinate Geometry, London Macmillan & Co.
- 3. B. S. Grewal: Higher Engineering Mathematics, 36th Ed., Khanna Pub.
- 4. S. Lipschutz and M. Lipson: Theory and Problems of Discrete Mathematics. Schaum Series. 2nd Ed. Tata McGraw Hill.

## **DEPARTMENT - MICRO BIOLOGY**

## **Microbial World and Microbial Diversity**

- i. Introduction to microbial world, Physiochemical and biological characteristics; Characteristics of Acellular microorganisms (Viruses); Baltimore classification, general structure with special reference to viroids and prions.
- ii. Binomial Nomenclature, Whittaker's five kingdom and Carl Woese's three kingdom classification systems and their utility.
- iii. Difference between prokaryotic and eukaryotic microorganisms
- General characteristics of Cellular microorganisms, types archaebacteria, eubacteria, wall-less forms - MLO (mycoplasma and spheroplasts) with emphasis on distribution and occurrence, morphology, mode of reproduction and economic importance.
- ii. Structure, reproduction and economic importance of Mycoplasma.
- i. General concept of Phytoplanktons and Zooplanktons. Characteristics, occurrence, thallus organization and classification of Algae.
- ii. Cyanobacteria occurrence, thallus organization, cell ultra structure, reproduction and economic importance. Applications of algae in agriculture, industry, environment and food.
- i. Historical developments in the field of Mycology including significant contributions of eminent mycologists.
- ii. General characteristics of fungi including habitat, distribution, nutritional requirements, fungal cell ultra- structure, thallus organization and aggregation, mode of reproduction and
- iii. Economic importance of fungi with examples in agriculture, environment, Industry, medicine and food.
- i. General characteristics, structure, mode of reproduction and economic importance of Actinomycetes with special reference to its application in medicine and industry.
- ii. General characteristics, occurrence, classification structure, reproduction and economic importance of Protozoa.

## **References:**

1. Singh, R.P. General Microbiology. Kalyani Publishers, New Delhi (2007).

2. Aneja, K.R. Experiments in Microbiology, Plant pathology and Biotechnology, Fourth edition, NewAge International publishers.

3. Dubey, R.C. and Maheshwary, D.K. Text book of Microbiology. S.chand and company (1999).

4. Powar, C.B. and Daginawal, H.F. General Microbiology. Vol-I and Vol- II, Himalaya Publishing House.

5. Chakraborty P. A Textbook Of Microbiology. New central book Agency (2005).

6. Prescott, M.J., Harley, J.P. and Klein, D.A. Microbiology. 5th Edition WCB Mc Graw Hill, New York, (2002).

7. Tortora, G.J., Funke, B.R. and Case, C.L. Microbiology: An Introduction. Pearson Education, Singapore, (2004).

8. Alcomo, I.E. Fundamentals of Microbiology. VI Edition, Jonesand Bartlett Publishers. Sudbury. Massachusetts, (2001).

9. Black J.G. Microbiology-Principles and Explorations. JohnWiley &Sons Inc. New York, (2002).

10. Pelczar, MJ Chan ECS and Krieg NR, Microbiology McGraw-Hill.

11. Willey, Sherwood, Woolverton. Prescott, Harley, and Klein's Microbiology McGraw-Hill publication

12. Tortora, Funke, Case. Microbiology. Pearson Benjamin Cummings.

13. JACQUELYN G. BLACK. Microbiology Principles and explorations. JOHN WILEY & SONS, INC.

14. Madigan, Martinko, Bender, Buckley, Stahl. Brock Biology of Microorganisms. Pearson

15. Tom Besty, D.C Jim Koegh. Microbiology Demystified Mc GRAW-HILL.

## **DEPARTMENT - PHYSICS**

## **MP-EL1:** Mechanics

BLOCK-A

- **Unit-1: Laws of Motion:** Frames of reference, Newton's Laws of motion, Dynamics of a system of particles, Centre of Mass.
- Unit-2: Momentum and Energy: Conservation of momentum, Work and energy, Conservation of energy, Motion of rockets.
- Unit-3: Rotational Motion: Angular velocity and angular momentum, Torque, Conservation of angular momentum.
- **Unit-4: Gravitation:** Kepler's Laws (statement only), Newton's Law of gravitation, motion of a particle in a central force field, satellite in circular orbit and applications, geosynchronous orbits, weightlessness, basic idea of global positioning system (GPS).

BLOCK-B:

- **Unit-5: Oscillations:** Simple harmonic motion, differential equation of SHM and its solutions, kinetic and potential energy, total energy and their time averages, damped oscillations.
- **Unit-6: Elasticity-1:** Hooke's law, stress-strain diagram, elastic moduli-relation between elastic constants, Poisson's ratio, expression for Poisson's ratio in terms of elastic constants, work done in stretching and work done in twisting a wire.
- **Unit-7: Elasticity-2:** Twisting couple on a cylinder determination of rigidity modulus by static torsion, torsional pendulum-determination of rigidity modulus and moment of inertia  $q,\eta$  and  $\Box$  by Searles method.
- **Unit-8: Special Theory of Relativity:** constancy of speed of light, postulates of special theory of relativity, length contraction, time dilation.

## **DEPARTMENT - PSYCHOLOGY**

## EL-1 Introduction to Psychology 2 Credits

## **Block 1: Introduction to Psychology-I**

Unit 1: Introducing Psychology -Definition, Scope, and goals

Unit 2: Branches of Psychology

Unit 3: Motivation

Unit 4: Emotions

## **Block 2: Introduction to Psychology-II**

Unit 5: Sensation, Attention and Perception

- Unit 6: Learning, Memory and Forgetting
- Unit 7: Intelligence

Unit 8: Personality

## **References:**

- 1. Charles G.Morris. Albert A. Maisto Psychology an Introduction , Prentice Hall. New Jersy.
- 2. Feldman, A. R., Understanding Psychology IV th Ed, 1996, McGraw Hill, New Delhi.
- 3. Morgan, King, Weisz &Schopler, Introduction to Psychology-V11 Ed,1993, Tata McGraw Hill, New Delhi.
- 4. Ernest R Hilgard, Richard C Atkinson ,Rita L Atkinson Introduction to Psychology Oxford Publication, New Delhi.

## **DEPARTMENT : INFORMATION TECHNOLOGY**

## ELMIT -01: Green Computing

## (2 Credits)

**Course Objective:** Study the concepts related to Green IT, Green devices and hardware along with software methods, green enterprise activities, managing the green IT and various laws, standards, protocols along with outlook of green IT.

## **BLOCK 1: Overview of Green Computing**

- Unit 1:Green IT Introduction, Overview and issues, Initiatives and standards, Pathways of Green computing, Benefits of Green IT, Environmental Impacts of IT
- Unit 2: Green devices and hardware Environmental issues arising from electronic devices, life cycle of electronic devices, Hazards and E-waste Ecycling, Going paperless, Hardware considerations, Greening information systems, Managing Green IT, 3Rs of Green IT, Thinking About Money-Saving Efforts

- Unit 3: Green Data Centres and Associated Energy Challenges, Data Centre IT Infrastructure, Data Centre Facility Infrastructure: Implications for Energy Efficiency, IT Infrastructure Management, Green Data Storage, Storage Media Power Characteristics,
- **Unit 4:** Green network and communications, objectives and challenges of green networking, Enterprise Green IT strategy, Approaching Green IT strategies, Business drivers and dimensions for Green IT strategies, Steps in Developing a Green IT Strategy, Metrics and Measurements in Green Strategies

## **BLOCK 2: Management of Green Computing**

**Unit 5:** Sustainable Information Systems and Green Metrics, Sustainable IT Services, Sustainable IT Roadmap, Enterprise, Green IT Readiness, Readiness and Capability

Green Enterprises and the Role of IT, Organizational and Enterprise Greening, Information Systems in Greening Enterprises, Greening the Enterprise: IT Usage and Hardware,

**Unit 6:** Managing Green IT, Strategizing Green Initiatives, Implementation of Green IT, Regulating Green IT: Laws, Standards and Protocols,

**Unit 7:** Green Cloud Computing and Environmental Sustainability, Cloud Computing and Energy Usage Model: A Typical Example, Features of Clouds Enabling Green Computing, Green Cloud Architecture

**Unit 8:** Green IT: An Outlook, Awareness to Implementation, Green IT Trends, Greening by IT, A Seven-Step Approach to Creating Green IT Strategy

## **Text Books:**

- 1. Gangadharan, G. R., & Murugesan, S. (2012). Harnessing Green IT: Principles and practices. Wiley Publication, ISBN: 9788126539680.
- 2. Smith, B. E. (2013). Green Computing: Tools and Techniques for Saving Energy, Money, and Resources. CRC Press.

## **DEPARTMENT -BOTANY**

## **Plant-Microbe Interactions**

Overview of plant microbes interactions,

Introduction, beneficial microbes, Rhizobium bacterium and nitrogen fixation, mycorrhizal fungi.

Plant pathogens, Agrobacterium tumefaciens and crown gall disease,

Mechanisms of plant disease mechanism, some bacterial plant diseases,

Plant viruses and mechanism of plant against viruses attacks.

Fungal pathogen- mechanism of plant disease,

Omycete pathogens, Fungal mediated plant.

General concept of plant immunity,

PAMP-triggered immunity (PTI) and effectors-triggered immunity (ETI).

Transcription activator like effector and their role in virulence and disease resistance.

#### References

1. Lautenberg, B. (2015). Principles of Plant-Microbes Interactions: Microbes for sustainable Agriculture, Springer.

2. Stacey, G. and Keen, N. T. (1997). Plant-Microbes Interactions, Vol 4, . Springer.

3. Ramasamy, K, (2015). Plant Microbes Interactions, New India Publishing Agency.

4. Martin, F. and Kamoun, S. (2014). Effectors in Plant-Microbes Interactions 1st Edition, Wiley Blackwell.

## **DEPARTMENT -ZOOLOGY**

## MZO-IE-1: Parasites, Vectors & Communicable Diseases

#### Introduction to parasites.

Distribution, types, origin and evolution of parasites. Parasitism.

Types: Ecto-parasites, Endo-parasites and their adaptations.

Pathogenic micro-organisms, brief outline and classification of parasitic protozoan's: Entamoeba, Balantidium, Giardia, Trichomonus, Plasmodium, Leishmania and Trypanosoma and their diseases.

Control measures, diagnosis and therapy. **Pathogenic helminthes and vectors.** 

Etiology, epidemiology, pathogenesis, diagnosis, prevention and control of disease due to *Trichinella spiralis, Ancylostoma duodenale, Fasciola hepatica*, Schistosoma species.

Pathogenic Cestodes: Life cycle, treatment of diseases caused by Echinococcus, Hymenolepis and Diphyllobothrium. Scope and importance of vectors. Origin and evolution of vectors. Habitat, life cycle, pathogenicity of fleas, mites, ticks, lice's and mosquitoes.

Historical perspectives and scientists involved in the discovery of vectors and communicable Diseases.

Epidemiology, bio-ecology, life cycle of biological and mechanical Vectors. Vector-hostparasites interactions, Host-pathogen interaction, insects transmitting Bacteria and viruses.

#### Control and management of vectors and vector borne diseases

Control measures: cultural, chemical, biological, genetic and environmental Methods of vectors. Management of biological and mechanical vectors during Different seasons. Integrated Vector Control and Management.

Insecticide resistance in vectors, Drug resistance in pathogens.

Importance of education, awareness among public on communicable diseases and community participation. Covid-19 pandemics. Epidemiology of corona virus and its mutants. Vaccination against corona virus in India and other parts of the world.

## DEPARTMENT –FOOD AND NUTRITION SCIENCE

## ELMFNS-01 FOOD PSYCHOLOGY

Credits: 2

## **BLOCK 1: FOOD: PREFERENCES AND CHOICES**

**Unit 1: Food:** Physiological definition and significance, meaning of food, food classification, Food as statement of self-identity, Social interaction, Cultural identity

Unit 2: The Role of Food and Eating on Personality and Social Development: Psychology of eating, Food and emotion regulation, Food in daily living, Food Socialization, Food and control of others

Unit 3: Food Preferences and Fluctuations: Developmental Models, Cognitive Models & Psychophysiological Models, Physiology of food choice, Likes and Dislikes, acquired food preferences, Attitudes towards change, Food and sensory stimulus, Factors influencing eating behavior – (biological, environmental, individual, food characteristics, culture etc., Effect of eating on food selection and preferences, Understanding of the body and self – selection of the diet.

Unit 4: Food choices across lifespan and influence of society: The changing role of the senses in food choice and food intake across lifespan, Food in security and health across lifespan, Influence of media and advertisements, Digital platform and influence on food choices

#### **BLOCK 2: EATING DISORDERS AND TREATMENTS**

 Unit 5: Mood, Emotions, food cravings and addictions: relation with food preferences, Connection between mood and eating, Biological and physiological aspects of food cravings, Stress and eating behavior, Food addiction - description, neurobiology of food addiction

- Unit 6: Eating disorders and treatment: Anorexia nervosa, Bulimia nervosa and binge eating Disorder-Definition, Symptoms, believed causes, Classification, Risk factors, Common myths of eating disorders, Treatment & dietary management
- Unit 7: Overeating, Obesity and Weight management: Definition, Prevalence, Classification of Body Mass Index, Types & patterns, Etiology, Physiological component, Fad diets, Risk factors, Treatment Weight management (Behavior & Cognitive), Lifestyle modifications, Dietary modification (calorie restricted diet)

Unit 8: You are what you eat- Approaches to change the dietary behavior: Multidisciplinary approach, Strategies to support healthy dietary behavior: Encouraging healthy eating, Selection of food, Meal & portion size, developing education materials, Motivation & economics, Benefits of exercise, Stage classification for change, Barriers affecting the clinical outcome

## **REFERENCES:**

 <u>Smith John L.</u> (2002 ), The Psychology of Food and Eating (English, Hardcover, Smith John , Publisher: Palgrave MacmillanL.), ISBN: 9780333800201, 0333800206.

Alexandra W. LogueOct 2017, The Psychology of Eating and Drinking Fourth Edition.

## **Annexure II INTER- DISCIPLINARY COURSE**

(Open Elective) for Second Semester

## ವಿಭಾಗ– ಕನ್ನಡ

ಪತ್ರಿಕೆ-೬: ಪ್ರಾಚೀನ ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಇತಿಹಾಸ EL-2.1 (ಕ್ರೆಡಿಟ್-೨)

ಬ್ಲಾಕ್-೩೮: ಸಾಹಿತ್ಯ ಚರಿತ್ರೆಯ ಉಗಮ ಮತ್ತು ವಿಕಾಸ

ಘಟಕ-೧೪೯: ಸಾಹಿತ್ಯದ ಉಗಮ, ಬೆಳವಣಿಗೆ, ಉದ್ದೇಶ.

ಘಟಕ-೧೫೦: ಪ್ರಾಚೀನ ಮೂರ್ವ ಶಾಸನಸಾಹಿತ್ಯ.

ಘಟಕ-೧೫೧: ಪಂಪ ಪೂರ್ವ ಯುಗದ ಸಾಹಿತ್ಯ.

ಘಟಕ-೧೫೨: ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆಯ ವಿಭಾಗಕ್ರಮ.

ಬ್ಲಾಕ್-೩೯: ಪ್ರಾಚೀನ ಕನ್ನಡ ಸಾಹಿತ್ಯ

ಘಟಕ-೧೫೩: ಪ್ರಾಚೀನ ಕನ್ನಡ ಸಾಹಿತ್ಯ ರೂಪಗಳು; ಚಂಪೂ, ವಚನ, ರಗಳೆ, ಷಟ್ಟದಿ, ಸಾಂಗತ್ಯ ಇತ್ಯಾದಿ.

- ಘಟಕ-೧೫೪: ಪ್ರಾಚೀನ ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಪರಿಕಲ್ಪನೆಗಳು; ಚರಿತ್ರೆ-ಮರಾಣ, ಧರ್ಮ-ಕಾವ್ಯಧರ್ಮ, ಹಿಂಸೆ-ಅಹಿಂಸೆ, ಮಾರ್ಗ-ದೇಶಿ, ಲೌಕಿಕ-ಆಗಮಿಕ, ವಸ್ತುಕ-ವರ್ಣಕ, ಪ್ರಭುತ್ವ-ಪ್ರತಿರೋಧ.
- ಘಟಕ-೧೫೫: ಪ್ರಾಚೀನ ಕನ್ನಡ ಕವಿ-ಕೃತಿ-ಕಾಲ-ದೇಶ-ಭಾಗ ೧.

ಪಂಪ, ರನ್ನ, ಪೊನೃ, ೧ನೆ ಚಾವುಂಡರಾಯ, ನಾಗವರ್ಮ ೨ನೆಯ ಚಾವುಂಟರಾಯ, ನಾಗಚಂದ್ರ, ನಯಸೇನ, ದುರ್ಗಸಿಂಹ, ಬ್ರಹ್ಮಶಿವ, ಕರ್ಣಪಾರ್ಯ, ಜನ್ನ.

ಘಟಕ-೧೫೬: ಪ್ರಾಚೀನ ಕನ್ನಡ ಕವಿ-ಕೃತಿ-ಕಾಲ-ದೇಶ-ಭಾಗ ೨.

ಆಂಡಯ್ಯ, ನೇಮಿಚಂದ್ರ, ರುದ್ರಭಟ್ಟ ಪ್ರಮುಖ ವಚನಕಾರರು – ಜೇಡರ ದಾಸಿಮಯ್ಯ, ಬಸವಣ್ಣ, ಅಕ್ಕ ಮಹಾದೇವಿ, ಅಲ್ಲಮಪ್ರಭು, ಚನ್ನಬಸವಣ್ಣ, ಹರಿಹರ, ರಾಘವಾಂಕ, ಕುಮಾರವ್ಯಾಸ, ಲಕ್ಷ್ಮೀಶ, ಪ್ರಮುಖ ಕೀರ್ತನಕಾರರು, ಚಾಮರಸ, ಕುಮಾರವಾಲ್ಮೀಕಿ, ಸರ್ವಜ್ಞ, ಷಡಕ್ಷರಿ, ಸಂಚಿ ಹೊನ್ನಮ್ಮ, ನಂಜುಂಡ, ರತ್ನಾಕರವರ್ಣಿ, ಮುದ್ದಣ, ಕೆಂಪುನಾರಾಯಣ.

## ಪರಾಮರ್ಶನ ಗಂಥಗಳು

೧. ಗತಿಬಿಂಬ : ಜಿ.ಎಸ್. ಶಿವರುದ್ರಪ್ಪ, ಬೆಂಗಳೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ, ಬೆಂಗಳೂರು

- ೨. ಕಾವ್ಯ ವಿಹಾರ : ಕುವೆಂಪು, ಉದಯರವಿ ಪ್ರಕಾಶನ, ಮೈಸೂರು, ೧೯೬೯
- ೩. ಸಮಗ್ರ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ : ಬೆಂಗಳೂರು, ವಿಶ್ವವಿದ್ಯಾನಿಲಯ ಬೆಂಗಳೂರು, ೨೦೦೨
- ೪. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ : ಕೆ. ವೆಂಕಟರಾಮಪ್ಪ, ಪ್ರಸಾರಾಂಗ, ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ, ಮೈಸೂರು
- ೫. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ: ದೇವುಡು, ಶಾರದಾ ಪ್ರಕಾಶನ, ಮೈಸೂರು, ೧೯೩೫
- ೬. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಸಂಗಾತಿ : ಕೀರ್ತಿನಾಥ ಕುರ್ತಕೋಟಿ, ಮನೋಹರ ಗ್ರಂಥಮಾಲೆ, ಧಾರವಾಡ
- 2. ಶೈಲಿ : ಎಸ್.ವಿ.ರಂಗಣ್ಣ, ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ, ಮೈಸೂರು, ೧೯೭೬
- ೮. ಶತಮಾನದ ಕನ್ನಡ ಸಾಹಿತ್ಯ : ಸಂಪಾದಕರು, ಜಿ.ಎಸ್. ನಾಯಕ, ಕನ್ನಡ ಸಾಹಿತ್ಯ ಅಕಾಡೆಮಿ, ಬೆಂಗಳೂರು
- ೯. ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಇತಿಹಾಸ : ರಂ. ಶ್ರೀ. ಮುಗಳಿ, ಕೇಂದ್ರ ಸಾಹಿತ್ಯ 🛛 ಅಕಾಡೆಮಿ, ನವದೆಹಲಿ, ೧೯೬೩

೧೦. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ : ರಂ.ಶ್ರೀ. ಮುಗಳಿ, ಉಷಾ ಸಾಹಿತ್ಯ ಮಾಲೆ, ಮೈಸೂರು, ೧೯೭೧

೧೧. ಬಿಂಬ: ಚದುರಂಗ, ಸಂವಹನ ಪ್ರಕಾಶನ, ಮೈಸೂರು

೧೨. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ ಸಂಪುಟಗಳು : ಕುವೆಂಪು ಕನ್ನಡ ಅಧ್ಯಯನ ಸಂಸ್ಥೆ, ಮೈಸೂರು. ವಿಶ್ವವಿದ್ಯಾನಿಲಯ, ಮೈಸೂರು, ೧೯೮೨

- ೧೩. ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಪ್ರಾಚೀನತೆ: ಪ್ರಧಾನ ಸಂಪಾದಕರು, ಎ. ರಂಗಸ್ವಾಮಿ, ಲೇ. ಎಚ್.ಪಿ. ಗೀತಾ, ಜನಪ್ರಿಯ ಕನ್ನಡ ಮಾಲೆ, ಕನ್ನಡ ಅಧ್ಯಯನ ಮತ್ತು ಸಂಶೋಧನಾ ವಿಭಾಗ, ಕರಾಮುವಿ, ಮೈಸೂರು, ೨೦೧೧
- ೧೪. ಪ್ರಾಚೀನ ಕನ್ನಡ ಕಾವ್ಯ ಸ್ಥಿರತೆ ಮತ್ತು ಚಲನ ಶೀಲತೆ : ಪ್ರಧಾನ ಸಂಪಾದಕರು, ಎ. ರಂಗಸ್ವಾಮಿ, ಲೇ. ಶಿವರಾಮಯ್ಯ, ಜನಪ್ರಿಯ ಕನ್ನಡ ಮಾಲೆ, ಕನ್ನಡ ಅಧ್ಯಯನ ಮತ್ತು ಸಂಶೋಧನಾ ವಿಭಾಗ, ಕರಾಮುವಿ, ಮೈಸೂರು, ೨೦೧೨

೧೫. ಕನ್ನಡ ಕೈಪಿಡಿ: ಸಂಪುಟ ೨, ಪ್ರಸಾರಂಗ, ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ, ಮೈಸೂರು, ೨೦೦೭

## **DEPARTMENT - ENGLISH**

## EL-2.1: INDIAN LITERATURE-II

## **OBJECTIVES**

- To appreciate artistic values in Hayavadana and the use of myth
- To know the importance of Indian English historical plays
- To appreciate Sri Aurobindo as a poet and critic
- To comprehend the different theories of aesthetic experience of art

## BLOCK -I

Girish Karnad: Hayavadana Gurucharan Das: Larin Sahib

## **BLOCK –II**

M. Hiriyanna: Art Experience

**Sri Aurobindo**: Selections: The Poets of the Dawn and The Poets of the Dawn 3 (The Future Poetry)

## **Suggested Reading:**

- K.R.Srinivas Iyengar: Indian Writing in English .Macmillan, 1979.
- M.K.Naik: Critical Essays on Indian Writing in English.Sahitya Akademi, 1969.

- Narasimhaiah C.D: The Swan and the Eagle. Indian Institute of Advanced Study, 1987.
- Meenakshi Mukherjee: The Twice Born Fiction. Heinemann Educational Publishers, 1972.

## **DEPARTMENT - HINDI**

## <u>हिंदी सिनेमा</u>

- सिनेमा का उद्भव और विकास
- मूक चलचित्र और दादा साहब फाल्के युग
- दूसरा पढाव, सवाक चलचित्र अथवा आलमआरा
- रंगीन सिनेमा का युग
- सामाजिक सिनेमा एक विवेचन
- धर्म एवं सांस्कृतिक सिनेमा एक विवेचन
- राजनैतिक सिनेमा एक विवेचन
- आर्थिक सिनिमा एक विवेचन
- हास्य एवं व्यंग्य सिनेमा एक विवेचन
- बाल सिनेमा
- सिनेमा एवं संवेदना
- सिनेमा एव भाषा-शिल्प सिनेमा एवं गायन
- सिनेमा एवं पात्र संयोजना
- सिनेमा एवं नैतिक मूल्य
- अनूदित सिनेमा
- सिनेमा का तुलनात्मक अध्ययन
- फिल्म समीक्षा......आदि

## 

- सिनेमा साहित्य और समाज- प्रहलाद अग्रवाल, अनामिका प्रकाशन, नई दिल्ली
- कथाकार कमलेश्वर और हिंदी सिनेमा- उज्ज्वल अग्रवाल, राजकमल प्रकाशन, नई दिल्ली
- बॉलिवुड पाठ विमर्श के संदर्भ- ललित जोशी, वाणी प्रकाशन, नई दिल्ली
- फ्लैशबैक, प्रभ्नाथ आज़मी, शिल्पायन, नई दिल्ली
- नाटक के सौ बरस, हरिश्चंद्र अग्रवाल और अजित पुष्कल, शिल्पायन, नई दिल्ली

## **DEPARTMENT - TELUGU**

## E. L. 2.1 TELUGU SAMSKRUTHI - SAMAJAM

## Block - 1: ANDHRULA CHARITHRA - SAMSKRUTHI

Unit - 1:Samskruthi Vaisistyam Unit - 2:Andhrula Charithra - Samskruthi Paraspara Prabhavam Unit - 3:Andhrula kalalu Unit - 4: Andhrula basha - samajam

## Block - 2: ANDHRULA AACHARALU -SAMPRADHAYALU

- Unit 1: Andhrula Pandugalu
- Unit 2: Sthrela Nomulu Vrathalu
- Unit 3: Andhrula Sangikaacharalu
- Unit 4: Andhrula Sampradhayalu

## **DEPARTMENT - HISTORY**

## **OEL2.1 Social Reform Movements in Modern India**

**Objective:** The course is aims to trace the causes for the division of society in various sections and need for reformation. Further it explains age old social evils which crippled Indian society.

Pedagogy: personal contact programmes, audio video programmes, online lectures Assignments, etc

## Credits: 2. Examination Duration: 1 1/2 hours and Maximum Marks: 40

## **Course outcomes**

After completing this course the students should be able to

- Understanding the contributions of the Raja ram Mohan Roy Dayananda Sarawathi towards the Indian modernity
- Analyse the Jyothibai pule Savithribai Pule Ambedkar's contributions to Indian social reform movements
- Evalute the works of Sahu Maharaj and Krishna raja wadiyar IV patronage to social Justice.

## Block-I

## Unit:1

Colonial Discovery of India : Orientalism, Anglicism, Evangelism-Understanding Indian Society, Meaning of Social Reform. The Concept of Modernity : Western Impact – Indian Response.

## **Unit : 2**

Rajaram Mohan Roy and Brahmo Samaj, Dayananda Sarawathi and Arya Samaj-Nationalism and Society – Prarthana Samaj.

## Unit:3

Jyothi Ba- Phle and Savithri Ba Pule, Social and education reforms.

## Unit:4

Communalism, Eradication of Communalism, Muslim League, Wahhabi and Pan Islamism-Syed Ahmed and Aligarh Movement.

## **Block-II**

## Unit : 5

The debate over the interpretation of Shastras – Ishwar Chandra Vidya Sagar - B.M.Malabari – Vivekananda – M.G. Ranade — Bal Gangadhar Tilak.

#### Unit :6

Dr. B.R.Ambedkar-, His views on Society, A caste and its annihilation, Religion and Economy, M.K.Gandhi- E.V.Ramswamy Periyar and Sri.Narayanguru, Ayyan kali.

## Unit:7

The reformers – Kandukuri Veereshalingam – Pandit Shivanatha Shastry – Gopal Ganesh Agarkar-K.T.Telang-Maharma.

#### Unit :8

D.K.Karve, Maharaj Saiyyaji Rao Gaekwad of Baroda – Chatrapathi Shahu Maharaj of Kolhapur and Maharaja Krishnaraja Wodeyar IV of Mysore.

## **Suggested readings:**

- 1. Nararajan : A Century of Social Reform in Indian.
- 2. Seetharam Singh : Nationalism and Social Reform in India
- 3. Dhananjaya Keer : Ambedkar, Life and Mission
- 4. Dhananjaya Keer :Mahatma Jyoti Rao Phule : Father of Social Revolution in India
- 5. Charless Heimsath R : Indian Nationalism and Hindu social Reform
- 6. A.S.Altekar : Position of Women In Hindu Civilization.
- 7. Gail Omvedt : Cultural Revolt in a Colonial Society The Non Brahmin Movements in Western India.
- 8. Gail Omvedt : Dalits and Democratic Revolution.
- 9. Ravindrakumar : Selected Documents of B.G.Tilak.
- 10. S. Ramkrishna : Social Reform Movements in Andhra
- 11. M.K.Gandhi : Women and Social Injustice.

ವಿಜಯ ಪೊಣಚ್ಚು ತಂಬಂಡ (ಸಂ), ಭಾರತ ಉಪಖಂಡದ ಆಧುನಿಕ ಪೂರ್ವ ಚರಿತ್ರೆ ವಿವಿಧ ಆಯಾಮಗಳು – ಸಂಪುಟ–03, ಪ್ರಸಾರಾಂಗ, ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ, ಹಂಪಿ.

## **DEPARTMENT - ECONOMICS**

## **EL2.1: Institutions for International Development**

- **Objective:** To enable the Students to understand the need and importance of various International Institutions.
- Pedagogy: A Combination of Lectures, Group Discussion, Assignments.
- Credits: 2 ; Examination Duration: 1<sup>1</sup>/<sub>2</sub> and Maximum Marks: 50 (Internal Assessment Marks = 10 and Semester-end Examination =40)

## **Course Inputs**

#### Block – I Economic Issues at Global and National Level

#### Unit – 1 Globalisation

Globalisation – Forces Driving Globalisation – Income Inequality – National Integrity – Impact on Labour – Multinational corporations – Global Business Environment – National Business Environment.

## Unit - 2Legal Issues of Business at Global and National LevelPolitical Risks - Legal System - Business Ethics - Centrally PlannedEconomy - Mixed Economy - Market Economy - Human Development

#### Unit – 3 International Trade

Importance – Volume – Direction – Composition – Trends – Theories of Trade - Mercantilism – Absolute Advantage – Comparative Advantage – International Product Life Cycle – Political, Economic and Cultural Motives behind Government Intervention.

#### Unit – 4 GATT and WTO

Importance – objectives – Functions - GATT and W.T.O – India and WTO.

#### Block – II Economic Integration and International Business Issues

#### Unit – 5 Regional Economic Integration

Meaning – Effects – Integration in Europe: European Union – Integration in Americans : North American Free Trade Agreement (NAFTA) – Latin American Integration Association (LAIA) – Free Trade Area of Americans (FTAA) and Transatlantic Economic Partnership.

#### Unit – 6 Integration in Asia

Association of Southern East Asian Nations (ASEAN) - Asia Pacific Economic Cooperation (APEC) – Integration in middle East : Gulf Cooperation Council (GCC) – BRICS – SAARC.

#### Unit – 7 International Financial Markets

International capital markets – Foreign Exchange markets – Currency Convertibility – International Monetary System.

# Unit – 8 Issues in International Business Trade War – Balance of Payment – Terrorism – Oil Crisis – Smuggling – Dumping – Environmental Degradation – Exhibit of Nuclear power – Covid 19 and other pandemics.

#### **References:**

- 01. Apte A.N. (2011) International Financial Management, Tata McGraw Hill Pub., Co. Ltd., New Delhi.
- 02. Bhambari C.P, (1980) The World Bank and India, Vikas Publishing House, New Delhi.
- 03. International Development Association, Annual Reports.
- 04. International Finance Corporation, Annual Reports.
- 05. International Monetary Fund, Annual Reports.
- 06. World Bank, (1995) The Evolving Role of the World Bank in the First Half Century, Washington D.C.
- 07. World Bank, World Bank in India, Washington, D.C. USA
- 08. World Bank, World Development Reports, and Annual Reports. Palle Krishna Rao, (2005) WTO, Text and Cases, PSG Excel Series, New Delhi.

## **DEPARTMENT - POLITICAL SCIENCE**

## (OEL-I) Indian Constitution

## **Block-I**

- Unit:1 Framing of the Indian Constitution.
- Unit:2 Preamble and Salient Features of the Indian Constitution.
- Unit:3 Fundamental Rights and Duties.
- Unit:4 Directive Principles of the State Policy.

## Block-II

Unit:5	Union Legislature : Composition, Powers and Functions.
Unit:6	Union Executive : President and Vice-President - Election, Powers and
	Functions, Prime ministers and Council of Minister - Powers and
	Functions.
Unit:7	State Legislature : Composition, Powers and Functions, State
	Executive -Governor and Chief Minister.
Unit:8	The Judiciary : Supreme Court and High Court - Composition,
	Jurisdiction and Functions.

## **References:**

- 1. Andre Beteille, 1965. Caste, class, and Power. Berkley: University of California Press.
- 2. Appadorai, A 1968. india: Studies In Social And Political Development 1947-1967. New Delhi: Aisa Publishing House.
- 3. Desai, A R. 2016. Social Background of Indian Nationalism. Los Angeles: Papular Prakashan.
- 4. Granville Austin, 2000. The Indian Constitution: Cornerstone of a Nation. Melbourne: Oxford University Press.
- 5. Hanson and Douglas, 1972. India's Democracy. New York city: W W Norton & Co Inc.
- 6. Johari J C 1974. Indian Government and Politics. New Delhi: Vishal Publications.
- 7. Karunakaran, K.P 1964. Continuity and Change in Indian Politics. New Delhi: People's Pub. House.
- 8. Kochanek. A. 1968. The Congress Party of India: the Dynamics of a One-Party Democracy. New Jersey: Princeton University Press.

- 9. Morris Jones, 1967. The Government and Politics of India. London: Hutchinson University Library.
- 10. Myron Weiner, 1957. Party Politics in India. New Jersey: Princeton University Press.
- 11. Myron Weiner, 1967. Party Building in New Nation. Chicago: University of Chicago Press.
- 12. Palmer, N D 1971. The Indian Political System. Boston: Houghton Mifflin.
- 13. Partha Chatterjee, 1998. State and Politics in India. University of Michigan: Oxford University Press.
- 14. Pylee, M V 1960. Constitutional government in India. Bombay: Asia Pub. House.
- 15. Rajni Kothari, 1970. Politics in india. The University Of Michigan: Little Brown
- 16. Rajni Kothari, 1995. Caste in Indian Politics. Telangana: Orient Blackswan.
- 17. Venkatarangaiya: M Shiviah, 1975. Indian Federalism. New Delhi: Arnoldheinemann Publishers.
- 18. Zoya Hasan, 2000. The State in Indian Politics. Landon: Sage publication.

## **19. DEPARTMENT – PUBLIC ADMINISTRATION**

## **20. INDIAN POLITY – I**

#### 21. BLOCK – 1

22. UNIT – 1 23.	Indian Constitution.
24.UNIT – 2 25.	Preamble - Meaning and Importance.
26. UNIT – 3 27.	Fundamental Rights and Duties.
28.UNIT – 4	Directive Principles of State Policy and Relation with
Fundamenta	l Rights.
29.	
<b>30. BLOCK – 2</b>	
31.	
32. UNIT – 5 33.	Indian Federalism and Parliamentary system of Government.
34.UNIT – 6 Financial	Centre - State Relations. Legislative Administrative and
35.	
36. UNIT – 7 Positions.	Union Executive - President Elections, Powers and .
37.	
38. UNIT – 8 Functions	Council of Ministers and Prime Ministers - Powers and

## **DEPARTMENT - SOCIOLOGY**

Study of Indian Society -02 Credits

## **Course Description**

Every science has its own classical theories, which stand as eternal in their explanatory power and prowess to transcend the time and region. This course intends to introduce the learners to the classical period of sociology which is not just a bundle of theories but a consistent tradition and formative period, even contemporary theories cannot eschew from being inspired. After studying this course, following learning outcomes can be expected.

## **Course Objectives**

- 1. To appreciate the organizational framework of Indian society
- 2. To appreciate the aspects unity and diversity of Indian society
- 3. Examine the social issues in contemporary India

## Learning Outcomes

Following outcomes are expected from the learners after successfully completing the course. Learner can/has

LOC-1: sociological insights about the social structural and organizational aspects of Indian society

LOC-2: present the changes in institutional framework of Indian society

LOC-3: recognize the causes for major social issues and present realistic remedies

## **Course Content**

## **Block-1 Social Organizations**

Unit-1 Unity and Diversity-Problem of Integration

Unit-2 Caste-Characteristics and Recent Changes

Unit-3 Marginalization-SC, ST, OBC and Minorities

Unit-4 Changes in Family and Concerns of the Aged

## **Block-2 Social Issues in Contemporary India**

Unit-5 Environmental Sanitation and Ecological Degradation

Unit-6 Educated Unemployment and Employability

Unit-7 Social Unrest-Terrorism, Naxalism, Communalism and Corruption

Unit-8 Child Rights and Right to Education (RTE)

## **References**

- Ahuja, Ram. 2002. Study of Social Problems. Jaipur & New Delhi: Rawat Publications
- Atal, Yogesh. 1979. The Changing Frontiers of Caste. National Publishing House: Delhi
- Beteille, Andre. 1971. Caste, Class and power. Berkeley: University of California.
- Betteille, Andre. 1974. Social Inequality, New Delhi: Oxford University Press.
- Betteille, Andre. 1992. Backward Classes in Contemporary India. New Delhi: Oxford University Press.
- Berreman, G.D. 1979. Caste and Other Inequalities: Essays in Inequality. Meerut: Folklore Institute.
- Dube, Leela. 1997. Women and Kinship, Comparative Perspectives on Gender
- Southern South Asia.
- Das, Veena. 2006. Oxford Handbook of Indian Sociology. New Delhi: Sage
- Dube, S C. 1990. Study of Indian Society. New Delhi: National Book Trust
- Jha, Hetukar. 2015. Sanitation in India. Delhi: Gyan Books.
- Karve, Iravathi. 1990. Kinship Organization in India.
- Pais, Richard. 2015. Sociology of Sanitation. Delhi: Kalpaz Publications.
- Pathak, Bindeshwar. 2015. Sociology of Sanitation. Delhi: Kalpaz Publications.
- Singer, Milton & Cohen, Bernards. 1996. Structure and change in Indian Society. Jaipur: Rawat
- Singh, Yogendra, Modernization of Indian Tradition. Jaipur & New Delhi: Rawat
- Srinivas, M N. 1995. Social Change in Modern India: Orient Blackswan
- Srinivas, M. N. 1962. Caste in Modern India and Other Essays. Asia Publishing House: Delhi

## DEPARTMENT – ANCIENT HISTORY AND ARCHEOLOGY

AHA OE 2.1	Cultural History of Hoysalas (OE)						
Block - 1	Early Kings						
Unit - 1	Archeological and Literary Sources						
Unit - 2	Theories of Origin of Hoysalas – Sala – Nripakama – Ereyanga						
Block - 2	Important Rulers						
Unit - 3	Vishnuvardhana - VeeraNarasimha – I						
Unit - 4	Ballala – II - Narasimha – II - Narasimha III and Ballala – III						
Block - 3	Cultural Contributions						
Unit - 5	Hoysala polity - Economy						
Unit –6	Hoysala Society – Religion – Education - literature						
Block - 4	Art and Architecture						
Unit - 7	Hoysala Architecture						
Unit – 8	Hoysala Art						

References:

- 1. Epigraphia Carnatica: Relevant Volumes
- 2. Derrett Duncan, M.J: The Hoysalas, 1957
- 3. Dhakey M.A: Encyclopedia of Indian Temple Architecture
- 4. Desai P.B: History of Karnataka
- 5. Foekema Gerard: A Complete Guide to Hoysala Temples

6. Gopinatha Rao T.A: Elements of Hindu Iconography, Vols

- 7. Kelleson Collyer: The Hoysala Artists Their Identity Style
- 8. Krishna Murthy M.S: The Hoysala Art, Kuppam, 2007
- 9. Padmnabha K: Hoysala Sculptures : A cultural Study

10.Sheik Ali B (Ed): The Hoysala Dynasty , 1972 11.William Cohelo: The HoysalaVamsha, 1950

12. Annual Reports of the Department of Archaeology, Mysore 1939 – 46

13.Settar S: Hoysala Temples

14. Marg: In Praise of Hoysala Art

15. Narasimhachar R; Lakshmidevi Temple at Doddagaddhavalli

16. Shastri KAN: The Cholas, 17. Shastri KAN: History of South India

## **DEPARTMENT - EDUCATION**

## **IDC - 2 HIGHER EDUCATION**

**BLOCK - 1 HIGHER EDUCATION – ORGANIZATION AND TEACHING – LEARNING** 

Unit-1 Higher Education

Unit-2 Teaching Learning in Higher Education – I

Unit-3 Teaching-Learning in Higher Education – II

Unit-4 Problems and Innovations in Higher Education

# **BLOCK - 2 HIGHER EDUCATION – SOCIO-PSYCHOLOGICAL AND MANAGEMENT DIMENSIONS**

Unit-5 Socio-Psychological Background of College Students

Unit-6 Problems of College Students

Unit-7 Higher Education – Management Dimensions

Unit-8 Higher Education Teacher

## **References**:

- 1. Shills Edward (1989) 'The modern university Liberal Democracy'.
- 2. Abraham, Abu (1988) The Penguin, Book of Indian cartoons, New Delhi.
- 3. Chandra, Bipan (1984) Communalism Modern India, New Delhi.
- 4. Chauhan S.S (1989) Innovations in Teaching Learning Process, New Delhi, Vikas.
- 5. Srivastva A.B and Sharma K.K (1985) Elementary Statistics in Psychology and Education, New Delhi, Sterling Publishers Pvt. Ltd.,

## **DEPARTMENT - COMMERCE**

## **Elective Course – EL2.1: Entrepreneurship Development**

- **Objective:** To enable the Students to understand about the different aspects of Entrepreneurship Development.
- **Pedagogy:** A Combination of Lectures, Group Discussion, Assignments.

• Credits: 2 ; Examination Duration: 1<sup>1</sup>/<sub>2</sub>and Maximum Marks: 50 (Internal Assessment Marks = 10 and Semester-end Examination =40)

### **Course Inputs**

### Block I

- Unit -1: Entrepreneur and Entrepreneurship: Introduction Evolution Characteristics Distinction between Entrepreneur and Manager Functions Types Entrepreneur Concept of Entrepreneurship Growth of Entrepreneurship in India Role of Entrepreneurship in Economic Development
- Unit 2: Women Entrepreneurship: Introduction Concept Statistical Evidence New Age Women Functions Growth Problems Recent trends in Development of Women Entrepreneurship.
- Unit -3: Rural Entrepreneurship: Introduction Meaning Need Rural Industrialisation in Retrospect Problems Development of Rural Entrepreneurship NGOs and Rural Entrepreneurship.
- Unit -4: Conceptual Models of Entrepreneurship: Introduction Models of John Kao Udai Pareek and Nadakarni– NISIET.

### Block II

- Unit 5: Factors Affecting Entrepreneurial Growth And Competencies: Introduction - Economic Factors – Non-Economic Factor – Government Actions -Entrepreneurial Competencies: Meaning – Major Entrepreneurial Competencies – Developing Competencies.
- Unit -6: Entrepreneurial Motivation and Mobility: Introduction Motivation Motivation Theories Motivating Factors Achievement Motivation Factors Influencing Mobility Occupational Mobility Locational Mobility.
- Unit 7: Entrepreneurship Development Programes: Introduction Need for EDPs Objectives of EDPs Course Contents and Curriculum of EDPs Phases of EDPs Evaluation of EDPs.
- Unit -8: Institutional Support System for Entrepreneurship: Introduction DICs SISIs SIDCOs NISIET EDIT NIESBU TCOs- A Broad Overview of Central and State Level Financing Institutions.

#### **Books Recommended for Reference**

- **a.** Vasanth Desai, The Dynamics of Entrepreneurial Development and Management, Himalaya Publishing House.
- b. A. N Desai, Entrepreneurship Management, Ashish Publishing House.
- c. Chandra Prasanna, Project Preparation, Appraisal and Implementation, Tata McGraw Hill.
- d. Khanka, S.S, Entrepreneurial Development, S. Chand Publications.
- e. Prasanna Chandra, Projects: Planning, Analysis, Selection, Implementation and Review, Tata McGraw Hill.

## **DEPARTMENT - MANAGEMENT**

## **E-COMMERCE**

### Credits: 2

#### Module 1: E-commerce and its Technological Aspects:

Overview of developments in Information Technology and Defining E-Commerce: The scope of E commerce, Electronic Market, Electronic Data Interchange, Internet Commerce, Benefits and limitations of E-Commerce, Produce a generic framework for E-Commerce, Architectural framework of Electronic Commerce, Web based E Commerce Architecture.

**Module 2: Electronic Data Interchange:** Benefits of EDI, EDI technology, EDI standards, EDI communications, EDI Implementation, EDI Agreements, EDI Security. Electronic Payment Systems, Need of Electronic Payment System: Study and examine the use of Electronic Payment system and the protocols used, Study Electronic Fund Transfer and secure electronic transaction protocol for credit card payment. Digital economy: Identify the methods of payments on the net – Electronic Cash, cheques and credit cards on the Internet.

### **References:**

1. Elias. M. Awad, " Electronic Commerce", Prentice-Hall of India Pvt Ltd.

2. Ravi Kalakota, Andrew B. Whinston, "Electronic Commerce-A Manager's guide", Addison-Wesley.

3. Efraim Turban, Jae Lee, David King, H.Michael Chung, "Electronic Commerce–A Managerial Perspective", Addison-Wesley.

4. Elias M Award, "Electronic Commerce from Vision to Fulfilment", 3rd Edition, PHI, Judy Strauss, Adel El-Ansary, Raymond Frost, "E-Marketing", 3RDEdition, Pearson Education

## **DEPARTMENT - BIO CHEMISTRY**

## **Basics of Bioorganic chemistry for Biology graduates.**

- Introduction to Organic chemistry: Classification of organic compounds, unique characteristics, IUPAC nomenclature of organic compounds (including bifunctional).
- Reaction mechanisms: Classification of organic reactions: substitution, addition, elimination and rearrangement with one example for each. Concepts of the following carbon anions, carbon cations, free radicals, carbenes, nucleophiles and electrophiles.
- Cycloalkanes: Reactivities and relative stability, Bayer's strain theory. Sachse-Mohr theory. Boat and chair form of cycloalkanes. Axial and equatorial bonds.
- Arenes: Structue of Benzene–resonance and molecular orbital theories. Aromaticity. Mechanism of Nitration and Friedel-Craft's reaction. Electronic interpretation of the orienting influence of substituents in the electrophilic substitution of Toluene, Chlorobenzene, Nitrobenzene and Phenol. Polynuclear hydrocarbons–Resonance structures of Naphthalene, Anthracene and phenanthrene.
- $S_{\rm N}1$  and  $S_{\rm N}2$  reactions, mechanism with an example for each. Concept of elimination reactions. Example –n-butyl chloride.
- Alcohols: Classification, monohydric, alcohols-distinguishing reactions for primary, secondary and tertiary alcohols.

Trihydric alcohols: Glycerol, Properties, (KHSO<sub>4</sub>, HNO<sub>3</sub>, Oxalic acid and HI)

Phenols: Acidity of phenols, Effect of substitution on acidity

Stereochemistry: Stereoisomerism, types, Fischer-projection formulae, asymmetric carbon atom, molecular dissymmetry, chirality, optical isomerism: ex. Glyceraldehyde, Lactic acid, Tartaric acid. Nomenclature of enantiomers. D- and L- system, Recemisation and resolution.

Heterogeneous and Homogenous hydrogenation of oils.

### **Selected References:**

- 1. Basic Principles of Organic Chemistry, Roberts and Caserio, W. A. Benjamin, Inc. (1964).
- 2. Organic Chemistry, Morrison and Boyd, Allyn and Bacon Inc (1992).
- 3. Principles of Inorganic chemistry by Cotton & Wilkinson, Wiley (1999).
- 4. Textbook of Organic chemistry by Ahluwalia V K & Madhuri G Narosa publications (2001).
- 5. Physical chemistry by Castellan G W, Narosa Publications (2004).
- 6. Physical chemistry by Chakraborthy D K, Narosa Publications (2004).

## **DEPARTMENT - BIOTECHNOLOGY**

## MBT EL-2 FUNDAMENTAL OF BIOTECHNOLOGY

Scope and Introduction to Biotechnology History & Introduction to Biotechnology What is Biotechnology? Definition of Biotechnology, Traditional and Modern Biotechnology, Branches of Biotechnology

Plant, Animal Biotechnology, Marine Biotechnology, Agriculture, Healthcare, Industrial Biotechnology, Pharmaceutical Biotechnology, Environmental Biotechnology.

Applications Biotechnology Applications of Biotechnology in Agriculture : GM Food, GM Papaya, GM Tomato, Fungal and Insect Resistant Plants BT Crops, BT Cotton and BT Brinjal Pros and Cons Biotechnological applications in Crop and Livestock Improvements Modifications in Plant Quality Golden Rice, Molecular Pharming, Plant Based Vaccines Ethics in Biotechnology and IPR 15 lectures

Food and Fermentation Biotechnology Food Biotechnology Biotechnological applications in enhancement of Food Quality Unit Operation in Food Processing Quality Factors in Pre processed Food Deterioration and its Control Rheology of Food Products Microbial role in food products Yeast, Bacterial and other Microorganisms based process and products Fermentation Technology Definition, Applications of Fermentation Technology Microbial Fermentations Overview of Industrial Production of Chemicals (Acetic Acid, Citric Acid and Ethanol), Antibiotics, Enzymes and Beverages Molecular Biology - Replication DNA Replication in Prokaryotes and Eukaryotes Semiconservative DNA replication, DNA Polymerases and its role, E.coli Chromosome Replication, Bidirectional Replication of Circular DNA molecules. Rolling Circle Replication, DNA Replication in Eukaryotes DNA Recombination – Holliday Model for Recombination Transformation

Mutation and DNA Repair Definition and Types of Mutations. Mutagenesis and Mutagens. (Examples of Physical, Chemical and Biological Mutagens) Types of Point Mutations, DNA REPAIR Photo reversal, Base Excision Repair, Nucleotide Excision Repair, Mismatch Repair, SOS Repair and Recombination Repair.

Genetic Engineering Experimental evidences for DNA and RNA as Genetic Material. Genetic Engineering in Ecoli and other Prokaryotes, Yeast, Fungi and Mammalian Cells Cloning Vectors-Plasmids ( pBR 322, pUC) Vectors for Plant and Animal Cells, Shuttle Vectors, YAC Vectors, Expression Vectors Enzymes- DNA Polymerases, Restriction Endonucleases, Ligases, Reverse Transcriptase's, Nucleases, Terminal Transferees, Phosphatases Isolation and Purification of DNA (Genomic, Plasmid) and RNA,, Identification of Recombinant Clones

Block-1	Title: Physical parameters of molecules							
Unit-1	Thermodynamics: First and second laws of thermodynamics. Concept							
	entropy and free energy, entropy as a measure of unavailable energy. Entropy							
	and free energy changes and spontaneity of process.							
Unit-2	Chemical kinetics: Rate and order of reaction. Factor affecting the rate							
	reaction. And determination Order of reaction. Energy of activation and its							
	determination. Brief account of collision and activated complex theories.							
Unit-3	Ionic equilibria: pH scale, buffer solutions, calculation of pH of buffer							
	solutions, buffer capacity and buffer index, buffer mixtures.							
Unit-4	Electrochemistry: Electrolytic conductance, specific, equivalent and molar							
	conductance, ionic mobility and transference number, factors affecting the							
	electrolytic conductance, Arrhenius theory of strong and weak electrolytes,							
	assumptions of DebyeHuckel theory of strong electrolytes.							
Block-2	Title: Organic molecules							
Unit-5	Introduction to organic chemistry, atomic orbitals, sigma and pi bond							
	formation-molecular orbital (MO) method, sp, sp2 and sp3							
	hybridization, bond length, bond dissociation energies and bond angles							
Unit-6	Electronegativity and polarity of the bonds. Classifications and							
	reactions of organic compounds (with examples).							

## **DEPARTMENT - CHEMISTRY**

Unit-7	Biological in	nportance	of	natural	products:	Amino	acids,	proteins,	
	carbohydrates (cellulose, starch, glycogen), lipids (fats and oils, phospholipids),								
	nucleic acids, steroids, alkaloids, vitamins, flavonoids.								
Unit-8	Applications of synthetic products: Dyes, drugs, polymers (plastics), soaps and								
	detergents, per	sticides and	pher	omones.					

## DEPARTMENT – CLINICAL NUTRITION AND DIETETICS

## OEL - 2: NUTRACEUTICALS AND HEALTH FOODS 2 Credits

### **BLOCK 1. NUTRACEUTICALS:**

Unit - 1: Introduction to Nutraceutical

- Unit 2: Use of Nutraceuticals in Traditional Health Sciences
- Unit 3: Functional Foods
- Unit 4: Development of Nutraceutical and Functional Foods

## BLOCK 2: FUNCTIONAL FOODS AND NUTRACEUTICALS OF PLANT, ANIMAL AND MIRCIBIAL ORIGIN

Unit - 5: Prebiotics and Probiotics

Unit - 6: Bio Active Peptides and Phyto- Chemicals

Unit - 7: Fats and Oils- Omega 3 Fatty Acids:

Unit - 8: Sugar Substitutes / Sweeteners

## **REFERENCES:**

- Tai Hu Guan, (2018), text book of Nutraceuticals and Health, Scitus Academics Publisher, Wilmington DE 19804, United States of America.
- Wildman REC, (2016), Handbook of Nutraceuticals and Functional Foods, 2nd edition, CRC Press publishers, Boca Raton, Florida (USA).
- Athapol Noomhorm, Imran Ahmad, Anil Kumar Anal (2014), Functional Foods and Dietary Supplements Processing, Effects and Health Benefits, first edition, published by John Wiley & Sons, Ltd. UK 111 River Street, Hoboken, NJ 07030-5774, USA
- Wildman REC, (2001) Handbook of Nutraceutical and Functional Foods, CRC Press,

USA.Ghosh D et al, (2012) Innovations in Healthy and Functional Foods, CRC Press, USA. Pathak YV (2011) Handbook of nutraceuticals Volume 2, CRC Press, USA.

## **DEPARTMENT - COMPUTER SCIENCE**

## ELMCS- 02: E -Commerce

#### **BLOCK-1**

**UNIT-1:** Overview of developments in Information Technology and Defining E-Commerce: The scope of E commerce, Electronic Market, Electronic Data Interchange, Internet Commerce, Benefits and limitations of E-Commerce, Produce a generic framework for E-Commerce,

**UNIT-2:** Architectural framework of Electronic Commerce, Web based E Commerce Architecture. Consumer Oriented E Commerce E-Retailing: Traditional retailing and e retailing, Benefits of e retailing,

**UNIT-3:** Key success factors, Models of e retailing, Features of e retailing. E services: Categories of e-services, Web-enabled services, matchmaking services,

**UNIT-4:** Information-selling on the web, e entertainment, Auctions and other specialized services. Business to Business Electronic Commerce

### **BLOCK-2**

**UNIT-5: Electronic Data Interchange**: Benefits of EDI, EDI technology, EDI standards, EDI communications, EDI Implementation, EDI Agreements, EDI Security. Electronic Payment Systems, Need of Electronic Payment System:

**UNIT-6:** Study and examine the use of Electronic Payment system and the protocols used, Study Electronic Fund Transfer and secure electronic transaction protocol for credit card payment. Digital economy: Identify the methods of payments on the net – Electronic Cash, cheques and credit cards on the Internet.

**UNIT-7: Security in E Commerce** Threats in Computer Systems: Virus, Cyber Crime Network Security: Encryption, Protecting Web server with a Firewall, Firewall and the Security Policy, Network Firewalls and Application Firewalls, Proxy Server. Issues in E Commerce Understanding Ethical,

**UNIT-8:** Social and Political **issues in E-Commerce**: A model for Organizing the issues, Basic Ethical Concepts, Analyzing Ethical Dilemmas, Candidate Ethical Principles Privacy and Information Rights: Information collected at E-Commerce Websites, The Concept of Privacy, Legal protections Intellectual Property Rights: Types of Intellectual Property protection, Governance.

#### **References:**

- 1. Elias. M. Awad, " Electronic Commerce", Prentice-Hall of India Pvt Ltd.
- 2. RaviKalakota, Andrew B. Whinston, "Electronic Commerce-A Manager's guide", Addison-Wesley.
- 3. Efraim Turban, Jae Lee, David King, H.Michael Chung, "Electronic Commerce–A ManagerialPerspective", Addison-Wesley.

- 4. Elias M Award, "Electronic Commerce from Vision to Fulfilment", 3rd Edition, PHI, Judy Strauss, Adel
- 5. El-Ansary, Raymond Frost, "E-Marketing", 3RDEdition, Pearson Education.

## **DEPARTMENT - GEOGRAPHY**

### ELMG -02 Regional Geography of Karnataka (Credits - 2)

## Block-1

Physical setting - Location, Administrative divisions, Geology, Physiographic divisions of the Karnataka; Climate and Rivers; Soils and Vegetation; Irrigation in Karnataka, Major Multipurpose River Valley Projects, Major water problems and Issues - Yetthinahole, Linganamakki, Mekedatu, Krishna-Cauvery valley-linking Rivers.

## Block-2

Agriculture - Major of Crops: Rice, Jowar, Ragi, Wheat, Oil seeds, Sugarcane, Cotton, Tobacco and Coffee; Minerals Resources - Iron ore, Manganese, Bauxite, Copper, Gold; Major Power Projects - Hydel, Thermal and Atomic Energy power plants; Industries -Cotton Textile, Silk Textile, Sugar, Iron and Steel, Cement and Paper industries, Industrial Regions of Karnataka; Transportation - Roads, Railway, Water way, Ports/Harbors and Airways; Population - growth, distribution and density

## **References:**

- 1. Directorate of Information and Tourism, Government of KarnatakaKarnataka State Gazetteer
- 2. Mallappa, P., (2014) Geography of Karnataka, Chethana book publishers, Mysuru
- 3. N.B.K Reddy & G.S. Murthy, (1967) Regional Geography of Mysore State
- 4. R.P. Misra, (1973) Geography of Mysore
- 5. Ranganath, (2018) Geography of Karnataka, Mysore Book House, Mysuru

## **DEPARTMENT - MATHEMATICES**

Combinatorics and Graph Theory (ELMM –02)

2 Credits

Block-I: Permutations and Combinations, Pigeon-hole principle, Principle of inclusion and exclusion.

**Block-II:** Graphs, Vertices of graphs, Walks and connectedness, Degrees, Operations on graphs, Blocks – Cutpoints, bridges, Block graphs and Cutpoint graphs. Trees - Elementary properties of trees,

### **Books for Reference:**

- 1. C. L. Liu Elements of Discrete Mathematics, McGraw-Hill, 1986.
- 2. Kenneth H. Rosen Discrete Mathematics and its Applications, McGraw-Hill, 2002.
- 3. F. Harary Graph Theory, Addition Wesley Reading Mass, 1969.
- 4. N. Deo Graph Theory With Applications to Engineering and Computer Science, Prentice Hall of India, 1987.
- 5. K. R. Parthasarathy Basic Graph Theory, Tata McGraw-Hill, New Delhi, 1994.
- 6. G. Chartand and L. Lesniak Graphs and Diagraphs, wadsworth and Brooks, 2nd Ed.,
- 7. Clark and D. A. Holton A First Look at Graph Theory, Allied publishers.
- 8. D. B. West Introduction to Graph Theory, Pearson Education Inc., 2001, 2nd Ed.,
- 9. J. A. Bondy and U. S. R. Murthy Graph Theory with applications, Elsevier, 1976.

## **DEPARTMENT - MICROBIOLOGY**

### Microbes in Sustainable Agriculture and Development

- i. Soil Microbiology: Soil as Microbial Habitat, Soil profile and properties,
- ii. Soil formation, Diversity and distribution of microorganisms in soil.
- iii. Microbial Activity in Soil and Green House Gases- Carbon dioxide, methane, nitrous oxide, nitric oxide production and control
- i. Mineralization of Organic & Inorganic Matter in Soil: Mineralization of cellulose, hemicelluloses, lignocelluloses, lignin and humus, phosphate, nitrate, silica, potassium.
- Microbial Control of Soil Borne Plant Pathogens: Biocontrol mechanisms and ways, Microorganisms used as biocontrol agents against Microbial plant pathogens, Insects, Weeds.
- iii. Biofertilization, Phytostimulation,
- iv. Bioinsecticides: Plant growth promoting bateria, biofertilizers symbiotic (Bradyrhizobium, Rhizobium, Frankia),
- v. Non Symbiotic (Azospirillum, Azotobacter, Mycorrhizae, MHBs, Phosphatesolubilizers,algae),
- vi. Novel combination of microbes as biofertilizers, PGPRs
- i. Secondary Agriculture Biotechnology: Biotech feed, Silage, Biomanure, biogas, biofuels advantages and processing parameters.
- ii. GM crops: Advantages, social and environmental aspects, Bt crops, golden rice, transgenic animals.

### **References:**

1. EldorA.Paul. SoilMicrobiology. EcologyandBiochemistry.VIEdition:Academic Press, (2007).

2. EugeneL. Madsen. Environmental Microbiology:FromGenomestoBiogeochemistry. IEdition,Wiley-BlackwellPublishing. (2008).

3. Agrios, G.N. Plant pathology. Harcourt Asia Pvt. Ltd. (2000).

4. Buchanan. B.B., Gruissem, W. and Jones, R.L Biochemistry and Molecular Biology of Plants. I.K. International Pvt. Ltd. (2000).

5. Mehrotra R S and Ashok Agrawal. Plant Pathology. Tata Mc Graw Hill ,6th reprint (2006).

6. K. S. Bilgrami, H. C. Dube. A textbook of modern pathology. 6th Edition, Vani Educational Books, a division of Vikas, (1984).

7. K.R. Aneja .Experiments in Microbiology, Plant Pathology and Biotechnology . New Age

Publications.2017

## **DEPARTMENT - PHYSICS**

## **MP-EL2: Waves and Optics**

BLOCK-A:

- **Unit-1: Superposition of Two Collinear Harmonic oscillations**: linearity & superposition principle. (i) Oscillations having equal frequencies and (ii) oscillations having different frequencies (Beats).
- **Unit-2: Waves Motion- General**: Transverse waves on a string, travelling and standing waves on a string, normal modes of a string, group velocity, phase velocity, plane waves, Spherical waves, wave intensity.
- **Unit-3: Fluids:** Surface tension: synclastic and anticlastic surface excess of pressure application to spherical and cylindrical drops and bubbles. viscosity rate flow of liquid in a capillary tube Poiseuille's formula determination of coefficient of viscosity of a liquid.
- **Unit-4: Sound:** Simple harmonic motion forced vibrations and resonance intensity and loudness of sound, intensity levels, musical notes, musical scale, acoustics of buildings: reverberation and time of reverberation, absorption coefficient, Sabine's formula measurement of reverberation time.

BLOCK-B:

- **Unit-5: Wave Optics:** electromagnetic nature of light, definition and properties of wave front, Huygen's Principle.
- **Unit-6: Interference:** Interference: division of amplitude and division of wavefront. Young's double slit experiment, interference in thin films: parallel and wedge-shaped films, Newton's Rings: measurement of wavelength and refractive index.
- **Unit-7: Diffraction:** Fraunhofer diffraction- single slit and double Slit, multiple slits and diffraction grating, Fresnel diffraction: half-period zones, zone plate, Fresnel diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis.
- **Unit-8: Polarization:** Transverse nature of light waves, plane polarized light production and analysis, circular and elliptical polarization.

## **DEPARTMENT - PSYCHOLOGY**

## EL-2 Psychology in Everyday Life 2 Credits

## **Block 1: Applications of Psychology-I**

Unit 1: Psychology as a Profession

**Unit 2:** Memory Improving Techinques

Unit 3: Stress and Emotional Management

Unit 4: Personality Development

## **Block 2: Applications of Psychology-II**

Unit 5: Psychology in Educational Settings

Unit 6: Psychology in Health Setting

Unit 7: Psychology in Organizational Setting

Unit 8: Adjustment to Family and Work Place

## **References:**

- 1. Charles G.Morris. Albert A. Maisto Psychology an Introduction , Prentice Hall. New Jersy.
- 2. Feldman, A. R., Understanding Psychology IV th Ed, 1996, McGraw Hill, New Delhi.
- 3. Morgan, King, Weisz &Schopler, Introduction to Psychology-V11 Ed,1993, Tata McGraw Hill, New Delhi.
- 4. Ernest R Hilgard, Richard C Atkinson ,Rita L Atkinson Introduction to Psychology Oxford Publication, New Delhi.

## **DEPARTMENT -INFORMATION TECHNOLOGY**

## ELMIT -02 E-Commerce (2 Credits)

## **Block 1:Fundamentals of E-commerce**

## **Unit 1 : Introduction to E-commerce**

What Is E-commerce? The Difference Between E-commerce and E-business, Technological Building Blocks Underlying E-commerce: the Internet, Web, and Mobile Platform, Major Trends in E-commerce, Unique Features of E-commerce Technology

## **Unit 2 : Types of E-commerce:**

Business-to-Consumer (B2C) E-commerce, Business-to-Business (B2B) E-commerce. Consumer-to-Consumer (C2C) E-commerce, Mobile E-commerce (M-commerce), Social Ecommerce, Local E-commerce E-commerce: A Brief History, Understanding E-commerce: Organizing Themes, Academic Disciplines Concerned with E-commerce

## **Unit 3 : E-Commerce Infrastructure**

The Internet, Technology Background , Internet – Key Technology concepts, TCP/IP, IP addresses, Domain names, DNS and URLs, Client Server Computing, Cloud computing model, Mobile platform

### Unit 4 : Internet and Web

Hypertext, HTML, XML, Web servers and clients, Web browsers, Communication tools – E mail, messaging apps, online message boards, Internet Telephony

### **Block 2: Construction of E-commerce presence**

**Unit 5: E-commerce presence** – Building an e-commerce idea, Systematic approach, Choosing software and hardware, E-commerce site tools

**Unit 6: E-commerce security** E-commerce System environment, Security threats, Technology solutions

**Unit 7**: **E-commerce payment systems** : Management policies, E-commerce payment systems, Electronic billing presentment and payment

**Unit 8: E-commerce Business Strategies** : E-commerce business models, Major B2C Business models, B2B Business models,

### **References:**

- 1. Laudon, Kenneth C., and Carol Guercio Traver. *E-Commerce 2020-2021*. Pearson, 2020.
- 2. Laudon, Kenneth C., and Carol Guercio Traver. *E-commerce Essentials*. Pearson, 2014

## **DEPARTMENT - BOTANY**

#### Plant Diversity and Human Welfare

Plant Diversity and its Scope Levels of biodiversity: Genetic, Species and Ecosystem; Agrobiodiversity and cultivated plant taxa and related wild taxa.

Values and uses of Biodiversity, Methodologies for valuation, Ethical and aesthetic values, Uses of plants; Ecosystem services.

Loss of Biodiversity Loss of biodiversity- causes and implications, Hot spots of biodiversity, extinction of species, projected scenario for biodiversity loss.

Management of Plant Biodiversity Organizations associated with biodiversity management, IUCN, UNEP, WWF, UNESCO, NBPGR; Methodology for execution;

Biodiversity legislation; Information management and communication.

Conservation of Biodiversity, Role of Plants in Relation to Human Welfare Conservation of genetic, species and ecosystem diversity,

In situ and ex situ conservation strategies, India's biodiversity and its conservation Social approaches to conservation,

Biodiversity awareness programmes, Sustainable development.

Importance of forestry their utilization and commercial aspects; Avenue trees; Ornamental plants of India; Alcoholic beverages; Fruits and nuts; Wood and its uses; their commercial importance.

#### References

1. Krishnamurthy, K.V. (2004). An Advanced Text Book of Biodiversity - Principles and Practices.Oxford and IBH Publications Co. Pvt. Ltd. New Delhi

2. Singh, J.S., Singh, S.P. and Gupta, S. (2006). Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi, India.

3. Reddy, K.V. and Veeraiah, S. (2010). Biodiversity and Plant Resources. Aavishkar publication, New Delhi.

4. Heywood, V. H. and Watson, R. T. (1995). Global biodiversity and Assessment. Cambridge University Press.

## DEPARTMENT –FOOD AND NUTRITION SCIENCE

### **OEL-2: NUTRITIONAL MANAGEMENT IN DISASTER CONDITIONS**

### **BLOCK- I: NATURAL / MANMADE DISASTERS**

- Unit-1: Emergency Situations-Famine, Drought, Flood, Earthquake, Cyclone, War, Civil and Political Emergencies.
- Unit-2: Nutrition in Emergencies, Nutritional Problems and Communicable Diseases.
- Unit-3: Feeding Programs during Emergencies.
- Unit-4: Assessment and monitoring of Nutritional Status and relief measures during emergencies.

#### **BLOCK- I: NUTRITIONAL RELIEF AND REHABILITATION**

- Unit-5: Assessment of Food needs in emergency situations, Food Distribution Strategy, Local food rehabilitation.
- Unit-6: Special Foods/ Rations for Nutritional Relief, Organizations for Mass Feeding/ Food Distribution, and Supplementary Feeding.
- Unit-7: Transportation, Storage, Feeding Centres, Sanitation, Hygiene and Identifying Reaching the Vulnerable Group.
- Unit-8: Public Nutrition Approach to Tackle Nutritional and Health Problems in Emergencies, food security.

#### **REFERENCES:**

Jaspars, S. & Young, H. (1996), General Food Distribution in Emergencies: from Nutritional Needs to Political Priorities. Good Practice Review 3. 1996. Relief and Rehabilitation Network, Overseas Development Institute. London. Young H., Jaspars S., Brown R., Frize J. & Khogali H (2001), Food Security and Assessments in Emergencies: A Livelihoods Approach. Humanitarian Practice Network, Overseas Development Institute. London